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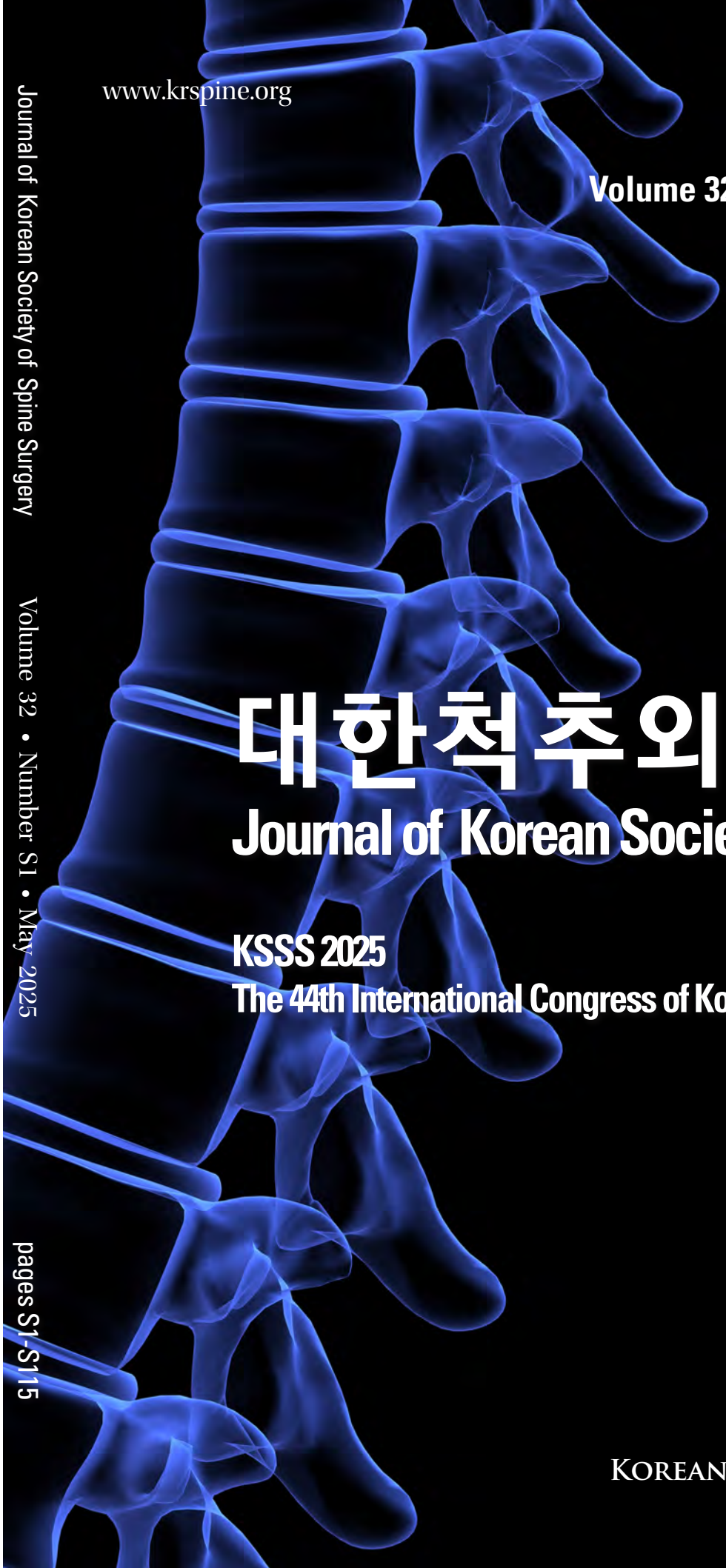

대한척추외과학회지

Journal of Korean Society of Spine Surgery

KSSS 2025
The 44th International Congress of Korean Society of Spine Surgery

May 21(Wed)~23(Fri), 2025
Lotte Hotel Seoul, Seoul, Korea

KOREAN SOCIETY OF SPINE SURGERY

Journal of Korean Society of Spine Surgery
Volume 32 • Number S1 • May 2025
pages S1-S115

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Actonel® 35mg 150mg (risedronate sodium tablets)

Actonel® EC 35mg (risedronate sodium enteric-coated tablet)

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악토넬EC정 35mg

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	악토넬® EC정 35mg[3]	악토넬® 정 35mg[4]	악토넬® 정 150mg[5]
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효능·효과	폐경 후 여성의 골다공증 치료	1. 폐경 후 여성의 골다공증 치료와 예방 2. 남성의 골다공증 치료	폐경 후 여성의 골다공증 치료와 예방
용법·용량	**주 1회 식사와 관계없이 경구투여**	주 1회 경구투여 (아침식사 최소 30분 전에 복용하거나 또는 하루 중에 어떤 때라도 음식물이나 음료수의 섭취 전후로 최소 2시간 떨어져서 복용한다)	월 1회 경구투여 (충분한 흡수를 위해 하루 중 처음으로 음식물 또는 물 이외의 음료수를 섭취하기 최소 30분 전에 복용한다)
제품코드	644503330	644503310	644503320

ATT-23L018

Reference

1. 악토넬EC정 허가사항 (23.06월 기준, 의약품안전나라 의약품 정보- 용법용량(성인) : 리세드론산나트륨으로서 1회 35 mg을 주 1회 식사와 관계없이 아침에 경구 투여한다.) **2.** McClung MR et al. Efficacy and safety of a novel delayed-release risedronate 35 mg once-a-week tablet. Osteoporos Int. 2012 Jan;23(1):267-76. **3.** 악토넬EC정 35mg 허가사항 (23년 11월 기준) **4.** 악토넬정 35mg 허가사항 (23년 11월 기준) **5.** 악토넬정 150mg 허가사항 (23년 11월 기준)

Journal of Korean Society of Spine Surgery

About the Journal

Journal of Korean Society of Spine Surgery is the official journal of Korean Society of Spine Surgery and is published four times year on March 31, June 30, September 30, and December 31. Supplementary abstracts will be published for annual Spring and Fall congress. The Journal is devoted to research and treatment related to the spine surgery and high-quality, ethical, evidence-based spine care, including basic science and clinical investigations. Read the full text of the first ever issue of Journal of Korean Society of Spine Surgery, published on 1 April 1994.

Aims and Scope

Journal of Korean Society of Spine Surgery (J Korean Soc Spine Surg, JKSSS) is an international journal in all fields of basic spine science and spine surgery, including anatomy of the spine, biology, biomechanics and pathophysiology, diagnostic procedures, and neuroscience. The aim of "Journal of Korean Society of Spine Surgery" is to provide an integrated, ethical and balanced view of diagnostic, research and treatment procedures affecting spine specialists worldwide.

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회 장	박종범
차기회장	석경수
명예회장	석세일
총 무	양재준
부 총 무	박세준
감 사	김영배, 김정환
평 의 원	강창남, 김상범, 김석우, 김용찬, 김진환, 김태균, 남우동, 박융, 박종범, 서보건, 석경수, 이동호, 이정섭, 이재철, 이제협, 임수택, 안동기, 최용수
편집위원회 (위원장 박시영)	3년: 박예수, 서형연, 송광섭, 신동은, 양재혁(총무), 정남수, 최병완
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	1년: 강창남, 강태욱, 고상봉, 김성규, 김윤혁, 김형민, 문성환, 박문수, 박형열, 서준영, 어재형, 이강식, 이준석(총무), 하정기
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척추통증연구학회 (회장 선승덕)	2년: 고광표, 권지원, 김영태, 김용찬, 김태훈, 김현수, 서승표, 신원식, 양승진, 이근우, 이석중, 이재욱, 차재룡, 최용기
	1년: 김남후, 김대희, 김도연, 김영배, 김정환, 김창수, 김환정, 박대현(총무), 박수안, 박종범, 백승일, 선승덕, 송광섭, 심대무, 안동기, 안영준, 안태근, 이승환, 이창욱, 이한솔, 이호진, 전창훈, 정기웅, 정승기, 조재환, 최진만
역 대 회 장	
서광윤, 안병훈, 주정빈, 김광회, 석세일, 박병문, 문명상, 윤승호, 김기용, 김남현, 김홍태, 왕진만, 이영구, 김기수, 정영기, 조재림, 박승림, 김영태, 박병철, 이준규 정재윤, 박희전, 안면환, 하기용, 이춘기, 유재원, 신병준, 이춘성, 이환모, 이종서, 김기택, 이규열, 김환정, 전창훈, 김동준, 김학선, 조규정, 장봉순, 최용수, 김태균	

대한척추외과학회지 편집위원회

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대한척추외과학회지

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<May 21 (Wed) Belle-Vue Suite (36F)>

Basic Research Symposium: Session 1

Basic Research Symposium: Session 2

<May 22 (Thu) Crystal ballroom A (2F)>

Free Paper: Cervical (1)

Free Paper: Cervical (2)

Free Paper: Cervical (3)

Invited Lecture I

Plenary Lecture I

Asian Spine Society Session I

Symposium (I) Cervical: Current Trends in Degenerative Cervical Myelopathy

Invited Lecture III

Free Paper: Lumbar (1)

Free Paper: Lumbar (2)

Free Paper: Lumbar (3)

<May 23 (Fri) Crystal ballroom A (2F)>

Best Paper Candidates Presentation I (Domestic)

Best Paper Candidates Presentation II (Domestic)

Best Paper Candidates Presentation III (Domestic)

Best Paper Candidates Presentation IV (International)

Plenary Lecture II

Invited Lecture V

Best Paper Candidates Presentation V (International)

Best Paper Candidates Presentation VI (International)

Symposium (III) Lumbar: Lumbo-Pelvic-Hip Complex

Invited Lecture VII

Free Paper: Deformity (5)

Free Paper: Infection

Asian Spine Society Traveling Fellowship & Visiting Reports (Crystal Ballroom A)

<May 22 (Thu) Crystal ballroom B (2F)>

Free Paper: Basic Research (1)

Free Paper: Basic Research (2)

Free Paper: Deformity (1)

Invited Lecture II

Asian Spine Society Session II

Symposium (II) Deformity: Updates for Adult Spine Deformity (ASD) Decision Making

Invited Lecture IV

Free Paper: Deformity (2)

Free Paper: Deformity (3)

Free Paper: Deformity (4)

<May 23 (Fri) Crystal ballroom B (2F)>

Free Paper: Lumbar (4)

Free Paper: MIS (1)

Free Paper: MIS (2)

Free Paper: MIS (3)

Invited Lecture VI

Free Paper: MIS (4)

Free Paper: Tumor

Symposium (IV) MIS: Practice-Based Session 1: Present and Future of Endoscopic Spinal Surgery

Symposium (IV) MIS: Practice-Based Session 2: Advance MIS-Spine Surgery

Invited Lecture VIII

Free Paper: Trauma

Free Paper: Miscellaneous

<Vidio Session>

Cervical

Lumbar

MIS

Deformity

Tumor

<e-Poster Session>

e-Poster

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Basic Research Symposium: Session 1

S001

Replicative Lifespan and Senescence of Disc Cells, and Directions of Regeneration Research

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Background and Introduction: The intervertebral disc (IVD) is a critical structure that provides flexibility and mechanical support to the spine. However, its cells, primarily nucleus pulposus (NP) and annulus fibrosus (AF) cells, exhibit limited replicative lifespan and are prone to senescence, leading to disc degeneration. Cellular senescence in disc cells is driven by a combination of intrinsic and extrinsic factors, including telomere attrition, oxidative stress, inflammation, and mechanical loading. Understanding these mechanisms is essential for developing strategies to mitigate disc degeneration and promote regeneration.

Replicative Lifespan of Disc Cells

Replicative lifespan in disc cells is often linked to the gradual loss of cellular proliferation capacity. This is due to the accumulation of cellular damage, including DNA damage, oxidative stress, and changes in mitochondrial function. As the cells approach their replicative limit, they enter a state known as cellular senescence, which is characterized by a permanent cell cycle arrest. This is a defense mechanism that prevents damaged cells from proliferating but can also lead to a loss of tissue homeostasis and function. Disc cells have a limited capacity for proliferation, largely due to their avascular nature and hypoxic microenvironment. The NP cells, which are derived from the notochord during early development, undergo phenotypic changes and decrease in number with aging. Similarly, AF cells experience reduced mitotic activity over time. Telomere shortening is a key factor contributing to their limited replicative lifespan, triggering cellular senescence.

Senescence of Disc Cells

Senescence in disc cells plays a significant role in the degenerative process of the IVD. As cells enter senescence, they cease to divide, but they remain metabolically active, secreting pro-inflammatory cytokines, matrix-degrading enzymes, and other factors that contribute to tissue breakdown. Senescent disc cells exhibit altered gene expression, characterized by increased production of pro-inflammatory cytokines (e.g., IL-1β, IL-6, TNF-α) and matrix-degrading enzymes (e.g., MMPs, ADAMTS). This pro-inflammatory state, known as the senescence-associated secretory phenotype (SASP), exacerbates extracellular matrix degradation and contributes to the progression of disc degeneration. Additionally, oxidative stress and mitochondrial dysfunction further accelerate the accumulation of senescent cells.

Directions for Regeneration Research

Given the critical role of disc cell senescence in IVD degeneration, future research is focused on finding ways to regenerate or rejuvenate these cells. Strategies to address replicative lifespan limitations including promoting cellular reprogramming, enhancing autophagy to clear cellular damage, and using stem cell therapy to replace senescent cells. Additionally, gene editing technologies, such as CRISPR-Cas9, offer promise in reversing senescence or enhancing the regenerative potential of disc cells. Another promising direction is the use of biomaterial scaffolds and tissue engineering to create environments that support the growth and function of healthy disc cells. Moreover, research into the molecular pathways that regulate senescence and cell survival could lead to therapeutic interventions that delay or reverse IVD degeneration, ultimately restoring disc function and preventing further degeneration.

Conclusions: Understanding the replicative lifespan and senescence of disc cells is key to developing effective regenerative therapies for IVD regeneration. Advances in cellular reprogramming, stem cell therapy, and tissue engineering are likely to offer promising solutions for the treatment of this debilitating condition.

Keywords: Disc cells, Replicative lifespan, Senescence, Regeneration research

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S002

Biomechanical Effects of Cement Augmentation and Prophylactic Vertebroplasty Adjacent Segment Stability in Multilevel Spinal Fusion Finite Element Analysis

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Background and Introduction: Multilevel spinal fusion is a frequently performed procedure for managing spinal deformities and degenerative diseases. When the upper proximal fusion level extends to T10, complications such as screw loosening, adjacent segment degeneration, proximal junctional kyphosis, and, in severe cases, proximal junctional failure frequently occur. Cement augmentation and prophylactic vertebroplasty are often employed to prevent these issues; however, their efficacy remains unclear. This study aimed to evaluate the biomechanical effects of cement augmentation and prophylactic vertebroplasty in multilevel posterior spinal fusion from T10 to the ilium using finite element modeling (FEM).

Main Body: A validated FEM of T8–pelvis was constructed using computed tomography data of a healthy 57-year-old male. The biomechanical parameters range of motion (ROM), intradiscal pressure (IDP), and peak von Mises stress (PVMS) in the posterior ligament complex (PLC) and facet joints and stress distribution at the cement–bone interface were evaluated. Five surgical models were simulated: Type 1 (fusion with pedicle screws only), Type 2 (fusion with T10 cement augmentation), Type 3 (fusion with T10 and T11 cement augmentation), Type 4 (fusion with T10 and T11 cement augmentation and T9 vertebroplasty), and Type 5 (fusion with T10 and T11 cement augmentation and T8 and T9 vertebroplasty). Cement augmentation and prophylactic vertebroplasty were modeled with polymethylmethacrylate material properties. ROM, IDP, PVMS in the PLC and facet joints, as well as stress distribution on the cement–bone interface and posterior structures were analyzed. Cement augmentation and prophylactic vertebroplasty did not significantly affect structural stability, as the differences in ROM, IDP, and PVMS in the PLC and facet joints across models were less than 5%. However, stress analysis revealed abnormal distributions at the cement–cancellous bone interface in Type 4 and Type 5. Stress increased in the T8 lower and T9 upper regions in Type 5 and in the T9 upper region in Type 4, suggesting potential fracture initiation points. Vertebroplasty resulted in uneven stress distribution at the cement–bone interface, with Type 5 demonstrating the highest PVMS at T9, particularly during lateral bending. Notably, stress values were also elevated in extension and axial rotation. Cement screw augmentation at the upper instrumented vertebra showed negligible effects on adjacent segments.

Conclusions: While cement augmentation and prophylactic vertebroplasty provide immediate stability, they can lead to abnormal stress distributions at the cement–bone interface, increasing the risk of fractures over time. These effects may be exacerbated in patients with osteoporosis or older adults, highlighting the need for further studies in at-risk populations.

Keywords: Multilevel spinal fusion, Cement augmentation, Finite element modeling, Stress distribution, Vertebroplasty, Biomechanical effects

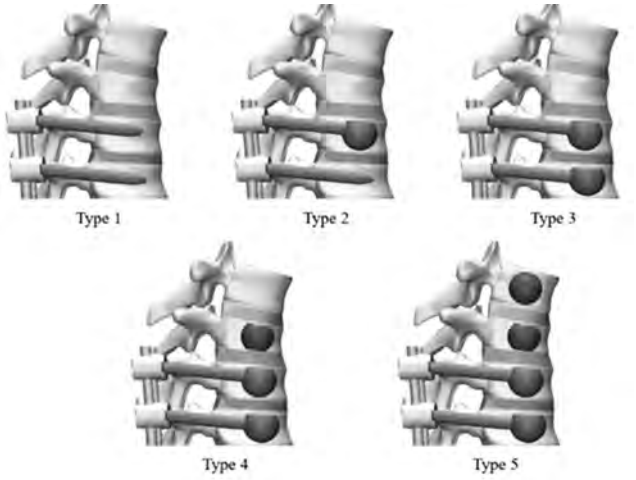

Fig. 1. Construction of five different surgical model types (T8 to Pelvis model): Type 1, no cement; Type 2, T10 cement augmentation; Type 3, T10–T11 cement augmentation; Type 4, T10–T11 cement augmentation with T9 vertebroplasty; and Type 5, T10–T11 cement augmentation with T8–T9 vertebroplasty [16].

S003

Introduction of AI in Spine and CT-Based AI for Detection of Spinal Fractures

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Background and Introduction: Artificial intelligence (AI) has recently played a crucial role in the diagnosis and treatment of spinal disorders, particularly in the field of medical imaging analysis, where rapid advancements are being made. AI is a technology that mimics human cognition and decision-making abilities, evolving from simple rule-based systems to machine learning (ML) and deep learning (DL). Machine learning learns patterns from data to make predictions, while deep learning utilizes artificial neural networks (ANNs) with multi-layer structures to automatically extract and learn features. In particular, convolutional neural networks (CNNs) play a key role in medical imaging analysis.

Main Body: Accurate diagnosis of spinal fractures significantly impacts patient prognosis. However, due to the vast volume of CT images and the complexity of subtle fractures, there is a high likelihood of missed diagnoses. Studies have shown that the missed diagnosis rate for spinal fractures is approximately 10%, which is attributed to the limitations of radiologists in interpreting CT images. To address this issue, AI-based computer-aided diagnosis (CAD) systems have been developed, and research is being conducted to automatically detect spinal fractures in CT images. Early studies developed machine learning-based spinal fracture detection models, but their accuracy was insufficient for practical use as an assistive tool for medical professionals. Subsequent studies applied deep learning techniques, particularly CNNs, to automatically learn and detect fracture patterns in CT images. However, there is still room for improvement in research methods and performance, especially in cervical spine fracture detection, which has lower accuracy due to the complexity of cervical spine structures. In our study, the authors developed and evaluated an AI model for detecting lumbar spine fractures. MRI data was used as the ground truth, and the model was trained using CT images in three different planes: axial, coronal, and sagittal. Unlike previous studies that primarily relied on axial plane CT images, this study adopted a multi-plane approach to improve accuracy. Additionally, a cervical spine fracture detection model was developed, and with the inclusion of additional patient data, it outperformed previous studies. Notably, integrating the cervical spine fracture detection model with lumbar and thoracic spine detection models maintained accuracy without degrading performance.

Conclusions: CT-based AI technology can help reduce errors in conventional image interpretation and enable faster and more accurate diagnosis of spinal fractures. However, to further enhance model performance, it is necessary to improve the diversity and quality of data, and additional validation in clinical settings is essential.

Keywords: Spinal fracture, Computer-aided diagnosis, Artificial intelligence, Deep learning

S004

Recent Biological Studies in Osteoporosis Treatment

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Abstract: Osteoporosis is a prevalent skeletal disorder characterized by reduced bone mass and microarchitectural deterioration, leading to increased fracture risk. Current pharmacological treatments primarily target extracellular signaling pathways to inhibit bone resorption or stimulate bone formation, including bisphosphonates, denosumab, and romosozumab. However, despite these advancements, there remains an unmet need for therapies that provide greater bone mineral density (BMD) improvement, faster fracture risk reduction, better perioperative bone health, and improved patient compliance. Recent research has identified several novel therapeutic targets beyond conventional agents. Intracellular signaling pathways, particularly sirtuins (SIRT 1, 3, 7), have shown potential in promoting osteoblastic activity

and reducing oxidative stress, with sirtuin activators such as resveratrol and anthocyanins demonstrating promising preclinical results. Post-translational modifications, specifically the NEDD4 family of ubiquitin ligases, have been implicated in osteoblastic function regulation. Inhibition of Smurf1 and modulation of WWP proteins have been proposed as potential strategies to enhance bone formation, though clinical applicability remains uncertain. Emerging evidence also suggests that gut microbiota composition influences bone metabolism. Studies have identified specific bacterial species, such as Bacteroides and Roseburia, that contribute to bone homeostasis by mediating insulin-like growth factor-1 (IGF-1) expression and hydrolyzing serine dipeptide lipids. Gut microbiome-based interventions, including probiotics or microbiota transplantation, may represent a novel therapeutic avenue for osteoporosis management. Stem cell therapy, particularly mesenchymal stem cell (MSC) transplantation, has shown potential in preclinical studies to restore bone homeostasis and improve BMD. However, challenges such as low transplantation efficiency, potential tumorigenicity, and thrombotic risks limit its clinical translation. Similarly, exosome-based therapies, which facilitate intercellular communication and enhance osteoblast proliferation while inhibiting osteoclastogenesis, are being explored for their therapeutic potential, though further studies are needed to optimize bone-targeting specificity. In summary, recent advancements in osteoporosis research have expanded the potential treatment landscape beyond denosumab and romosozumab. Intracellular signaling modulators, post-translational modification regulators, microbiome interventions, stem cell therapies, and exosome-based strategies offer promising new directions. However, translating these novel findings into clinical practice requires further validation through rigorous preclinical and clinical trials to ensure safety, efficacy, and feasibility.

Basic Research Symposium: Session 2

S005

Osteobiologics – The Need for Evidence!

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Throughout the evolution of orthopedic and spine surgery, significant insights have been gained regarding the application of osteobiologics in bone healing and spinal fusion. This presentation will examine key concepts derived from our collective clinical experience and scientific research on osteobiologics. It will address the desirable properties of these agents and explore their relationship to fundamental tissue engineering principles—specifically the roles of cells, scaffolds, and signaling factors. In addition, the discussion will cover dosing strategies, highlighting the interplay between concentration and total dose, as well as the balance between efficacy and toxicity. The complexity of selecting among the myriad osteobiologic products available will also be addressed, particularly in light of regulatory factors in the United States that have resulted in a proliferation of products with limited supporting evidence. Further, the presentation will explore the concepts of demand matching and specificity of use, emphasizing the need for more robust data to facilitate the rational selection of the optimal osteobiologic. Finally, the BoNE classification system will be reviewed as a framework to evaluate the level of evidence for various bone grafts, thereby assisting surgeons and other stakeholders in identifying osteobiologics supported by the strongest research.

Keywords: Bone graft, Osteobiologics, Spine fusion, Tissue engineering

S006

Code Spinal Cord Injury: Laboratory to Clinical Practice

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Spinal cord injury (SCI) is associated with significant morbidity, quality of life issues, long-term costs and adverse impact on the family. A myriad of therapies in the past have targeted different aspects of the pathophysiology of acute SCI with disappointing results. Initially, the use of high-dose methylprednisolone was widely adopted as a treatment standard within eight hours following an acute spinal cord injury. But, closer analysis of data did not show a significant difference between the methylprednisolone (MPSS) and control groups for motor or sensory scores. The corticosteroid was also associated with a significantly higher incidence of complications leading to MPSS no longer being routinely utilized. Novel therapies, such as SUN13837 (a basic fibroblast growth factor), had exciting results in animals, but not in human studies. Likewise, Rho antagonist (BA-210 and VX-210) showed very promising results in Phase 1/2a studies. However, Phase 2b/3 double-blind randomized trial ended prematurely due to lack of efficacy. We recently completed the enrollment for Phase 2a, double-blinded, randomized, placebo-controlled, multicenter study to evaluate the safety and efficacy of elezanumab in subjects with acute traumatic cervical SCI. Elezanumab is a human anti-RGMa monoclonal antibody shown to provide neuroprotection and neuroregeneration in nonhuman primates. Direct surgical intervention at the site of injury such as implantation of an intraparenchymal bioresorbable scaffold (NSS) is being explored. In a rat contusion model, NSS implantation significantly reduced cyst volume and increased tissue sparing and new tissue formation. In a single-arm study (INSPIRE; ClinicalTrials.gov, NCT02138110), acute NSS implantation appeared to be safe through 24 months post-implantation in patients with thoracic complete SCI. Those treated with this biopolymer had a 6-month American Spinal Injury Association Impairment Scale (AIS) conversion rate (44%) that exceeded historical controls (14%-21%). Randomized study showed a disappointing result but demonstrated the feasibility of performing a myelotomy on an acutely injured spinal cord without causing serious neurological deterioration. Performing a SCI clinical trial is not only very expensive but remains particularly challenging. UC Davis has implemented Code SCI based on historical animal data and mounting clinical evidence to support early surgical decompression of the spinal cord. UC Davis spine surgeons take SCI patients to OR within 12 hours after "Fast Spine MRI" that takes only 8 minutes. A multimodal approach including an acute surgical intervention to minimize damage to spinal cord and neuromodulation to facilitate in restoring function to those with SCI.

Keywords: Spinal cord injury, Clinical trials, Biopolymers, Code spinal cord injury, Early surgery

S007

Artificial Intelligence in Spine Surgery and Research

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Artificial intelligence (AI) has emerged as a transformative tool in spine surgery, enhancing diagnostic accuracy, surgical planning, intraoperative precision, and outcome prediction. With the rapid development of machine learning and deep learning models, AI applications in spinal care continue to evolve, providing significant improvements in both efficiency and patient safety. This presentation explores the latest advancements in AI-driven technologies within spine surgery, focusing on key areas such as medical imaging analysis, automated diagnosis, robotic-assisted procedures, and predictive analytics. AI algorithms, particularly convolutional neural networks (CNNs), have demonstrated remarkable accuracy in detecting degenerative spinal diseases, fractures, and deformities via radiological assessment. Furthermore, natural language processing (NLP) techniques are increasingly utilized for automated clinical documentation, reducing administrative burden and improving workflow efficiency. The integration of AI

with robotic-assisted spine surgery has enhanced surgical precision, reduced complications, and improved learning curves for complex procedures. AI-driven predictive models are also revolutionizing personalized treatment strategies by analyzing patient-specific factors such as demographics, imaging findings, and perioperative variables to forecast surgical outcomes and potential complications. Despite these advancements, several challenges remain, including data standardization, model generalizability, regulatory compliance, and ethical considerations regarding AI implementation in clinical practice. Addressing these limitations requires interdisciplinary collaboration between spine surgeons, biomedical engineers, and AI researchers. In conclusion, AI has the potential to significantly advance spine surgery by improving diagnostic capabilities, optimizing surgical procedures, and enhancing patient outcomes. Future research should focus on refining AI algorithms, validating their clinical applicability, and establishing standardized guidelines for AI integration into routine spinal care.

Keywords: Spine, Artificial intelligence, Machine learning, Robotic surgery, Predictive analytics.

Free Paper: Cervical (1)

S008

Elderly Specific Characteristics of Preoperative Presentation and Postoperative Course of Cervical Myelopathy Patients Treated with Laminoplasty

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Purpose: Laminoplasty is widely used for cervical myelopathy in patients with preserved cervical lordosis and multi-level involvement. However, elderly patients may experience less neurological recovery and greater sagittal alignment deterioration post-laminoplasty due to reduced functional capacity. This study aimed to: 1) analyze preoperative characteristics, 2) evaluate postoperative outcomes, and 3) compare results between elderly and younger patients undergoing cervical laminoplasty.

Materials and Methods: Eighty-eight patients with cervical myelopathy who underwent laminoplasty and had over 2 years of follow-up were reviewed. Patients were divided into >65 and ≤65 groups. Radiographic parameters included C2-C7 lordosis, sagittal vertical axis (SVA), T1 tilt, K-line tilt, range of motion (ROM), and cervical extension/flexion capacity. Clinical outcomes were assessed using neck pain VAS, arm pain VAS, neck disability index (NDI), and Japanese Orthopedic Association (JOA) score.

Results: The >65 group (n=54, 61.4%) had greater preoperative C2-C7 SVA (p=0.031), K-line tilt (p=0.021), and less ROM (p=0.004) compared to the younger group (≤65 years). Postoperatively, C2-C7 SVA (p=0.008) and K-line tilt (p=0.006) significantly worsened in the younger group (≤65 years) but remained stable in the older group (>65 years). At 2 years, both groups showed no significant differences in C2-C7 SVA, T1 tilt, K-line tilt, or ROM. The >65 group had worse preoperative clinical scores but demonstrated significant improvements in neck pain VAS, arm pain VAS, NDI, and JOA scores (all p<0.001). Despite worse postoperative NDI (p<0.001) and JOA scores (p<0.001), the NDI improvement rate (p=0.116) and JOA recovery rate (p=0.556) were similar between groups.

Conclusions: Elderly patients had worse preoperative sagittal balance and symptoms but experienced comparable symptom improvement to younger patients post-laminoplasty. While the younger group (≤65 years) showed greater sagittal alignment deterioration, alignment in the older group (>65 years) remained stable. Laminoplasty offers significant benefits for older patients, challenging the notion of poorer outcomes in this population and confirming its role in neurological recovery and reducing cervical myelopathy disability.

Keywords: Age, Laminoplasty, Cervical myelopathy, Prognosis

S009

Comparative Study on Revision Rate after ACDF or ADR: A Review of Korean Healthcare Data

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Purpose: Anterior cervical discectomy and fusion (ACDF) and cervical artificial disc replacement (ADR) are two common surgical techniques used to treat degenerative cervical spine disease. While previous studies report excellent clinical outcomes for both surgeries and an earlier return to work for ADR, comparison of clinical outcomes between the two techniques has not been extensively explored. This study aims to compare the long-term revision rates of ACDF and ADR.

Materials and Methods: This research utilized data from South Korea's Health Insurance Review and Assessment (HIRA) service to identify all one-level, two-level ACDF or ADR cases performed between January 2010 and November 2023. ACDF group was defined as patients with both N1491 and N2463 procedure codes, while ADR group included those with only N2463 code. Patients under age 20 and cases for tumor, infections, or trauma were excluded. Revisional surgeries through either posterior or anterior approach were identified using additional codes. Subgroup analyses based on age, sex, and comorbidities were conducted to explore the risk factors influencing reoperation rates.

Results: Among 132,502 patients (ACDF: 101,791; ADR: 30,711), ADR was associated with a lower 10-year cumulative revision incidence (ADR: 7.4%, ACDF: 8.4%; p<0.001). Patients receiving ADR were younger (mean age: 51.82 vs. 55.42 years) and predominantly male (ADR: 60.93%, ACDF: 63.7%). Subgroup analysis showed ADR provided significant benefits in reducing revision rates among younger patients (age <50 years) (hazard ratio 0.803, p<0.001; incidence ADR: 6.1%, ACDF: 7.6%). Conversely, in older patients (age >50 years), ACDF showed comparable outcomes to ADR (incidence, ACDF 8.7%, ADR 8.5%, p-value 0.76). Multivariate analysis identified age, male sex, psychiatric history, and diabetes as significant risk factors for reoperation.

Conclusions: This study demonstrates that ADR leads to a significantly lower revision rate than ACDF, particularly in younger patients (age <50 years). This finding, based on extensive national data, suggests ADR may be an optimal treatment strategy for young patients with degenerative cervical spine disease.

Keywords: ACDF, ADR, Revision, Long-term, Cervical

S010

Distinct Clinical Characteristics in the Thoracic versus Cervical Ossification of the Posterior Longitudinal Ligament

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Purpose: To analyze and compare the clinical characteristics and surgical outcomes of thoracic versus cervical ossification of the posterior longitudinal ligament (OPLL).

Materials and Methods: Patients undergoing surgery for cervical or thoracic OPLL between 2014 and 2024 were retrospectively reviewed. Data were collected from seven hospitals, including demographics, medical history, lipid profiles, imaging findings, surgical outcomes and postoperative complications. Exclusion criteria included trauma, infection, or other degenerative conditions causing myelopathy. Statistical analyses were conducted to compare the two groups.

Results: A total of 187 patients were included (166 cervical OPLL, 21 thoracic OPLL). Thoracic OPLL patients were younger (45.4 vs. 63.5 years, p<0.001) and had higher BMI (30.0 vs. 25.3, p<0.001). Neurological deficits were more frequent in thoracic OPLL (100% vs. 48.8%, p<0.001), and postoperative complications, including motor weakness, were significantly higher (42.9% vs. 18.1%, p=0.019). Lipid metabolism dysfunction was more pronounced in thoracic OPLL, with higher total cholesterol and LDL levels. Radiologically, thoracic OPLL showed more even distribution across vertebrae and higher tandem lesion prevalence (52.4% vs. 5.4%, p<0.001).

Conclusions: Thoracic OPLL exhibits distinct clinical and radiological characteristics compared to cervical OPLL,

including younger age, higher BMI, worse surgical outcomes, and greater lipid metabolism dysfunction. Differentiating thoracic from cervical OPLL may provide better insights into the ossification process and improve management strategies.

Keywords: Ossification of posterior longitudinal ligament, Thoracic, Cervical, Surgical outcomes

S011

The Value of Treatment Guidance by Facet Fluid Effusion Found on MRI in Patients with Cervical Degenerative Spondylolisthesis

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Purpose: Along with the growing prevalence of cervical spondylosis in this era of smartphones, cervical degenerative spondylolisthesis (CDS) has become more common. However, unlike the well-established connection between lumbar degenerative spondylolisthesis(LDS) and presence of facet fluid on MRI, similar findings over cervical levels still lack definitive confirmation from current literature. Therefore, this study aims to investigate the association between cervical facet fluid findings on MRI and the value of treatment guidance in patients with CDS.

Materials and Methods: From 2010 to 2020, patients diagnosed with CDS by radiography and followed with MRI in a medical center were enrolled. The baseline demographics and radiologic parameters were collected under verification by the Institutional Review Board(IRB). The Facet Fluid Index(FFI) (ratio of facet fluid width and facet joint width) was applied to assess the subaxial cervical spine (C3-C7). The clinical outcomes, including VAS, modified JOA score, and NDI, were traced and analyzed, Multivariate Logistic regression and the receiver operating characteristic (ROC) were conducted to analyze the cut-off points of FFI, predicting the deterioration of instability.

Results: 185 patients with CDS were enrolled. The larger FFI (OR:22.88, 95% CI 18.38-30.26), wider local ROM (OR:1.52, 95% CI 1.03-1.84), shorter disc height (OR:0.89, 95% CI 0.72-0.99), and existing cord signal change (OR: 3.51, 95% CI 2.03-6.77) were found to be independent predictors of poor clinical outcomes under the regression model.

Conclusion:s Several predictors, including the most dominant FFI, were associated with the presence of CDS. After verifying the FFI threshold associated with the rapid progression of cervical instability, spine surgeons could identify candidate patients indicating proper fixation despite relatively mild symptoms.

Keywords: Cervical degenerative spondylolisthesis, Facet fluid index, Facet fluid effusion

Free Paper: Cervical (2)

S012

Biomechanical Analysis Comparison of Different Cervical Posterior Fixation Techniques: A Finite Element Study

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Purpose: This study aims to biomechanically analyze the stress distribution of various types of cervical posterior fixation techniques, including the traditional pedicle screw technique, Abumi's technique, unicortical lateral mass screw, and bicortical lateral mass screw, and to compare them with a novel pedicle screw technique, the Lee's Point technique.

Materials and Methods: A FEM of posterior fixation methods was constructed from high resolution CT scan data of degenerative cervical spine model involving C5, C6 level. Five surgical models were simulated: Model 1(Medial pedicle pivot point technique, Lee's Point technique), Model 2(Abumi's technique), Model 3(traditional pedicle screw technique), Model 4(uni-cortical lateral mass screw), Model 5 (bi-cortical lateral mass screw). ø3.5×28 mm implants were used for pedicle screw, ø3.5×14 mm for LMS uni-cortical,

ø3.5×20 mm for LMS bi-cortical. The PVMS (Peak von Mises Stress) of the vertebral body and implant in each of the different models were recorded for a pure moment of 1.0 Nm of flexion, extension, axial rotation, and lateral bending loading condition.

Results: For the Abumi technique, stress was primarily concentrated at the entry point. In contrast, for Lee's technique and the traditional pedicle screw technique, stress was distributed across both the pedicle and the entry point. In the LMS technique, stress was also concentrated at the entry point. The stress distribution at C5 under flexion, extension, axial rotation, and lateral bending was the highest in Abumi's technique compared with other pedicle screw and both lateral mass screw techniques (23.09, 31.96, 43.22, 27.07 MPa). The stress distribution at C6 across all motion (flexion, extension, axial rotation and lateral bending) was the highest in Abumi's techniques compared with others (24.96, 28.65, 39.91, 26.25 MPa).

Conclusions: The Abumi's technique exhibited the highest stress levels exceeding the yield strength of cancellous bone at the entry point, suggesting a potential risk of failure if the fusion is not achieved. In contrast, Lee's technique demonstrated a stress distribution comparable to the traditional pedicle screw technique, indicating that it is a safe and novel fixation method.

Keywords: Pedicle screw, Lateral mass screw, Cervical

S013

Precision in Cervical Spine Surgery: A Systematic Review and Network Meta-Analysis of Navigated Guides for Safe and Effective Pedicle Screw Fixation

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Purpose: Cervical spine surgery presents unique challenges due to the small, complex anatomy and the high risk of neurovascular complications. Recent advancements in 3D printing and navigation systems offer potential solutions to improve accuracy, reduce surgical risks, and shorten operative times.

Objective: In this systematic review, we aimed to summarize currently available data and to review selected studies focusing on the use of 3D-printed navigation templates and intraoperative computer-assisted navigation systems in cervical pedicle screw placement.

Study Design: A Systematic Review and Network Meta-analysis

Materials and Methods: This study adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for conducting systematic reviews and meta-analyses. We searched for publications from 2019 to 2024 using the keywords "Cervical spine" OR "Navigation assisted system" OR "3D printing template" OR "computer-assisted system." An initial screening identified 130 articles, from which 8 met the comprehensive inclusion and exclusion criteria and were included in the analysis.

Results: Eight studies were included in the final systematic review and network meta-analysis. The findings indicated that 3D-printed templates demonstrated higher accuracy, reaching up to 95.8% (RR 1.17), and fewer deviations compared to computer-assisted (RR 1.05) and traditional techniques (RR 1.0). computer-assisted methods exhibited greater heterogeneity across studies. However, there was no statistically significant difference in outcomes was observed between 3D-printed templates and computer-assisted navigation systems.

Conclusions: Navigation-assisted systems for pedicle screw fixation in the cervical spine are effective, with both techniques offering advantages in terms of accuracy and safety.

Keywords: Navigation system, 3D-printed navigation templates, Cervical spine, Systematic review, Network meta-analysis

S014

Comparison of Topical Methylprednisolone 40 vs 80 mg on Postoperative Dysphagia After Multilevel Acdf: A Randomized, Doubleblinded, Controlled Trial

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Purpose: To compare the effectiveness of local intraoperative 40 vs 80 mg methylprednisolone (MPS) at decreasing the severity of swallowing difficulty following multilevel anterior cervical discectomy and fusion (ACDF).

Materials and Methods: This was a prospective, randomized, double-blinded, controlled trial of patients undergoing 2, 3, or 4-level ACDF for radiculopathy and/or myelopathy. Patients undergoing multilevel ACDF were randomized to receive the absorbable gelatin sponge mixed with MPS 40 mg (1 ml)+NSS 2 ml or the absorbable gelatin sponge + MPS 80 mg (2 ml)+NSS 1 ml in the retropharyngeal space. Dysphagia was assessed using validated outcomes, including the Eating Assessment Tool-10 (Eat-10) preoperatively and at 3 days (POD3), 14 days (POD14), and six weeks postoperatively. We also evaluated the neck disability index (NDI) and complications.

Results: Forty-nine patients had a complete dataset available for analysis. There were no statistically significant differences in Eat-10 scores between the two groups on POD3 (3.04 vs. 4.33, p=0.33), POD14 (2.64 vs. 2.08, p=0.35), and six weeks postoperatively (1.16 vs. 1.45, p=0.41). There were no statistically significant differences in VAS neck pain between the two groups on POD3 (1.5 vs. 1.25, p=0.16), POD14 (0.96 vs. 0.79, p=0.28), and six weeks postoperatively (0.36 vs. 0.54, p=0.13). There were no statistical differences in NDI between the two groups on POD3 (18.62 vs. 15.41, p=0.10) and six weeks postoperatively (7.00 vs. 6.20, p=0.34). There were no reported cases of postoperative infection in both groups.

Conclusions: Higher methylprednisolone dose after multilevel ACDF did not significantly reduce postoperative dysphagia severity or symptoms from the immediate postoperative period to six weeks postoperatively. Thus, we recommend using the topical administration of 40 mg MPS for postoperative dysphagia is sufficient.

Keywords: Cervical spine, Cervical spondylosis, ACDF

S015

Postoperative Motor Recovery in Patients with Degenerative Cervical Spondylosis and Severe Muscle Weakness: Analysis of Drop Arm and Drop Finger Cases

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Purpose: Patients with cervical radiculopathy or cervical spondylotic amyotrophy rarely develop severe muscle weakness, leading to conditions like Drop Arm or Drop Finger. Due to the rarity of these conditions, few studies have examined on postoperative outcomes, making prognosis prediction challenging. This study aimed to investigate motor recovery in such patients undergoing cervical decompression surgery.

Materials and Methods: A total of 37 patients with severe preoperative upper limb muscle weakness (manual muscle test [MMT] scores of 0–2) who underwent anterior cervical decompression and fusion or posterior decompression were included. MMT scores of the deltoid, biceps, extensor digitorum communis (EDC), and abductor digiti minimi (ADM) were assessed. Weakest fingers among the index, middle, ring, and little fingers were evaluated for EDC. Recovery to MMT ≥ 4 indicated good improvement, while MMT ≤ 3 indicated poor improvement. Patients were grouped as C5 (deltoid weakness), C6 (biceps weakness), or C7.8 (EDC/ADM weakness). The duration of preoperative muscle weakness and postoperative recovery time were also analyzed.

Results: Among the 37 patients, 18 were in the C5 group, 2 in the C6 group, and 17 in the C7.8 group. A good improvement was observed in 24 patients (64.9%), while 13 patients (35.1%) showed poor improvement. Improvement rates were 77.8% for the C5 group and 52.9% for the C7.8 group, with no significant difference (p=0.123). Average recovery times for MMT ≥4 were 4.39 months for the C5

group and 8.1 months for the C7.8 group, with no significant difference (p=0.413). Similarly, the mean time to surgery was 3.2 months in the improvement group and 5.2 months in the poor improvement group, with no statistically significant difference (p=0.167). However, a significant association was observed between severe preoperative muscle weakness (MMT 0–1) and poor outcomes, with 8/13 patients (61.5%) in the poor improvement group compared to 5/24 (20.8%) in the good improvement group (p=0.014).

Conclusions: The overall good improvement rate was 64.9%. While no significant differences were found in recovery time or improvement rates between C5 and C7.8 groups, patients with severe preoperative muscle weakness (MMT 0–1) were more likely to experience poor outcomes. Early intervention alone did not significantly affect outcomes, highlighting the importance of addressing the severity of preoperative weakness.

Keywords: Drop arm, Drop finger, Cervical spondylosis, Clinical outcome, MMT

Free Paper: Cervical (3)

S016

Radiculopathy Patients Experience Greater Gains Despite Worse Preoperative Status Compared to Myelopathy: Evaluating Prognostic Factors for Successful Outcomes in ACDF

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Purpose: Anterior Cervical Discectomy and Fusion (ACDF) addresses distinct goals for cervical myelopathy and radiculopathy—preventing neurologic deterioration in myelopathy and relieving pain and weakness in radiculopathy. This study compares preoperative status and postoperative outcomes between these groups, emphasizing achievement of Minimally Clinical Important Difference (MCID) across multiple patient-reported outcome measures (PROMs) and evaluating prognostic factors for successful outcomes.

Materials and Methods: A retrospective analysis of 451 patients (290 myelopathy, 161 radiculopathy) who underwent primary ACDF with a minimum of 1-year follow-up was conducted. Primary outcomes included the Neck Disability Index (NDI), Short-Form 12 Physical (PCS) and Mental Component Scores (MCS), and Numeric Rating Scale (NRS) for neck and arm pain. Baseline demographics, comorbidities, sensory deficits, weakness, and smoking status were evaluated. MCID thresholds for general and diagnosis-specific outcomes were applied to assess predictors of success.

Results: Patients with radiculopathy had significantly worse preoperative disability, including higher NDI (37.00 vs. 27.17, p<0.001), lower MCS (41.29 vs. 45.59, p<0.001), and greater neck (3.54 vs. 1.91, p<0.001) and arm pain (5.64 vs. 4.36, p<0.001). They also exhibited more upper extremity weakness (52.2% vs. 32.5%, p<0.001). Despite this, radiculopathy patients achieved superior MCID rates across outcomes—NDI (56.3% vs. 44.1%, p=0.014), MCS (64.6% vs. 54.8%, p=0.044), neck pain (22.9% vs. 10.3%, p=0.003), and arm pain (39.8% vs. 20.0%, p<0.001). Multivariate regression showed radiculopathy patients had higher odds of achieving MCID for NDI (OR: 1.67, p=0.01), PCS (OR: 1.68, p=0.010), and arm pain (OR: 2.69, p<0.001). They also demonstrated increased odds for diagnosis-specific MCID in MCS (OR: 1.50, p=0.04), NDI (OR: 1.62, p=0.01), neck pain (OR: 2.58, p<0.001), and arm pain (OR: 2.64, p<0.001). Thresholds for MCID achievement in radiculopathy patients were 26.33 (NDI), 42.71 (PCS), 45.28 (MCS), 4.5 (arm pain), and 4.75 (neck pain). Gender influenced PCS and NDI outcomes, while age, comorbidities, and sensory deficits had no significant impact.

Conclusions: Patients with radiculopathy achieved greater postoperative gains despite worse preoperative status. Identified PROM thresholds and predictors support active surgical intervention and individualized preoperative counseling to optimize patient selection and outcomes in ACDF.

Keywords: ACDF, Patient reported outcome measures, Radiculopathy, Myelopathy, MCID

S017

Is the Formation of Interlaminar Fusion Mass Significant in the Surgical Outcomes of Posterior C1-2 Screw Fixation and Fusion?

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Purpose: In posterior C1-2 screw fixation and fusion, the formation of an interlaminar fusion mass is considered an indicator of successful union, typically using autologous iliac bone grafts (AIBG). However, the use of iliac bone grafts can lead to donor site morbidity and increased surgical time. This study aimed to assess whether an interlaminar fusion mass is essential for favorable radiologic and clinical outcomes.

Materials and Methods: This retrospective study included patients who underwent posterior C1-2 screw fixation and fusion with either AIBG or rhBMP-2 as graft material, and were followed up for at least 2 years. Interlaminar fusion mass was assessed on CT at 1 year postoperatively. C1–2 lordosis, C1–2 range of motion (ROM) and anterior atlantodental Interval (AADI) were measured preoperatively, at postoperative 1-year, and 2-year mark. The visual analog scale (VAS) scores for neck pain and arm pain, NDI, and JOA scores were analyzed. Based on the presence of an interlaminar fusion mass, patients were divided into the fusion mass group and non-fusion mass group. The radiographic and clinical outcomes were compared.

Results: Eighty-four patients were included after application of the inclusion criteria. The fusion mass group (n=42, 50%) included 37 patients (88.1%) with AIBG and 5 (11.9%) with rhBMP-2. The non-fusion mass group (n=42, 50%) included 19 patients (45.2%) with AIBG and 23 (54.8%) with rhBMP-2 (p=0.000). No significant differences in patient demographics were observed between the two groups. The fusion rate in dynamic radiographs did not show a statistically significant difference between the two groups. In the clinical results, both groups exhibited improvement in PROMs postoperatively. There were no significant differences in the change in clinical scores between the preoperative and 2-year postoperative timepoints in either group. However, 6 cases of C2 screw loosening occurred in the non-fusion mass group, and all of these cases involved the insertion of pars interarticularis or translaminar screws.

Conclusions: In posterior C1-2 screw fixation and fusion, the absence of interlaminar fusion mass did not show a statistically significant difference in clinical and radiologic outcomes compared to the presence of a fusion mass. This suggests that omitting invasive AIBG and replacing with available non-invasive products such as rhBMP-2 could be a viable option. However, when anatomical variations compromise C2 screw stability, the use of AIBG should be considered to facilitate the formation of interlaminar fusion mass.

Keywords: Posterior C1–2 screw fixation and fusion, Interlaminar fusion mass, Upper cervical lordosis, Range of motion, Surgical outcomes

S018

Clinicoradiological Outcomes of Surgical Treatment of Cervicothoracic Junction Tuberculosis: A 10-year Retrospective Study

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Purpose: There is a paucity of literature on the surgical management of cervicothoracic junctional tuberculosis (CTJTB). We aimed to analyze the clinical and radiological outcomes of surgically treated CTJTB.

Materials and Methods: We conducted a retrospective study of 22 CTJTB cases that were surgically treated at Indian Spinal Injury Center institute from January 2010 to December 2019. The demographic and clinical data were obtained from the patient records and radiological data were obtained from Picture Archiving and Communication System (PACS) and analyzed with SPSS.

Results: The mean preoperative ODI was 79.91±2.04, while the mean ODI at the final follow-up was 45.82±2.05, which was statistically significant (p=0.04). The difference in Cobb angle between preoperative, immediate postoperative, and

final follow-up was statistically significant ($p<0.05$).The mean VAS score improved from 8.18±0.15 to 2.73±0.24 at the final follow-up but was not statistically significant ($p=0.64$).

Conclusions: CTJTB with progressive neurological involvement or with kyphosis, when treated surgically, gives a better clinicoradiological outcome, which was statistically significant.

Keywords: Cervicothoracic, VAS score, ODI, Cobb angle

S019

Surgical Outcome of Acdf With Total Uncinectomy for Proximal Type of Cervical Spondylotic Amyotrophy

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Purpose: Proximal type of cervical spondylotic amyotrophy (CSA) is a degenerative cervical spine disorder causing selective motor dysfunction and muscle atrophy in the upper limbs, particularly affecting shoulder abduction and elbow flexion without sensory deficits. Anterior cervical discectomy and fusion (ACDF) with Total Uncinectomy, involving removal of the entire uncinate process and osteophytes, is is performed to achieve full neural decompression and stabilization. This study evaluates the effectiveness of ACDF with Total Uncinectomy for proximal type of CSA, focusing on motor recovery and complications.

Materials and Methods: Twenty-eight patients (22 men, 6 women) with proximal type of CSA treated with Total Uncinectomy were included. Duration of preoperative muscle weakness in the deltoid and biceps averaged 14.1 weeks. The mean follow-up period was 34.9 months. Surgical outcomes were evaluated using manual muscle testing (MMT) to measure motor recovery, with a minimum follow-up of 2 years. Improvements in the muscle strength of the most atrophic impaired muscle were classified from excellent to poor (Excellent: full recovery to grade 5 or improvement of more than 2 MMT grades; Good: 1 grade of improvement by MMT; Fair: no improvement by MMT; Poor: worsening by MMT). Patient satisfaction was rated on a numerical scale (0–10).

Results: Preoperative MMT scores averaged 3.18 (range: 2–4) and improved to 4.61 (range: 3–5) at the final follow-up. Seven patients had high-intensity zones on T2-weighted MRI. Surgical outcomes were excellent in 23 patients, good in 5, none were rated fair or poor with a mean patient satisfaction score of 8.8/10. No vertebral artery injury occurred during surgery.

Conclusions: ACDF with Total Uncinectomy is a safe and effective treatment for proximal type CSA, especially in cases with severe foraminal stenosis due to uncovertebral osteophytes. Patients showed significant motor recovery and high satisfaction with no major complications.

Keywords: Cervical Spondylotic Amyotrophy, ACDF, Total uncinectomy

Invited Lecture I

S020

Looking Back on 10 years of Adult Spinal Deformity Surgical Treatment: How to Prevent Complications

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Abstract: Symptoms caused by adult spinal deformity (ASD) are primarily related to sagittal plane imbalance and the treatment goals prioritize sagittal correction over coronal plane alignment. Also, emphasis has been placed on sagittal plane alignment correction, especially on correction of kyphosis. In terms of surgical treatment of adult spinal deformity (ASD), it has become possible to correct severe deformities using VCR and PSO, and the invasiveness has also been reduced since the application of LLIF. However, three-column osteotomy such as VCR and PSO has high possibility of serious complications. PJK and rod breakage frequently occur when corrective fixation is performed from the thoracic to the ilium. Over the past 10 years,

many advances have been made to avoid perioperative complications, such as PJK, rod breakage and neurological deficit. Recently, the evaluation of muscle quality has advanced, and the importance of rehabilitation has also been highlighted. Looking back on this decade of evolution, I will talk about the future prospects for adult spinal deformity treatment.

Keywords: Adult spinal deformity, Surgical treatment, Complication

Plenary Lecture I

S021

Treatment Strategy for Spinal Cord Tumors

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In recent years, there has been a remarkable improvement in the surgical outcomes of intramedullary spinal cord tumors, due to advances in diagnostic imaging, microsurgical techniques and intraoperative monitoring. However, functional prognosis is still poor in patients with severe preoperative paralysis and patients with specific tumors. The purpose of this study was to retrospectively review the results of surgery for spinal cord tumors, treated at our hospital to elucidate the surgical challenges and establish optimal treatment strategies. In cases of meningiomas, Simpson grade I resection should be selected whenever practicable in treating younger patients or dumbbell-type, since tumors recurred at 12 years, on average, in approximately 30% of the patients who underwent grade II resection. In cases of ependymomas, early diagnosis and surgery, before the paralysis becomes severe, are important to obtain good functional outcomes. Early surgery is particularly important in cases with the tumors arising in the thoracic cord, even if the neurological deficit is mild. In contrast, the prognosis was much poorer in the astrocytoma cases than ependymoma cases, but still significantly better in the low-malignancy group than the high-malignancy group. Total resection should be attempted whenever possible, even for high-grade astrocytomas. However, because it is often extremely difficult to distinguish the tumor from the spinal cord, postoperative radiation therapy and chemotherapy should also be considered in such cases. Saving the patient's life by spinal cord transection would be a reasonable choice for high-grade thoracic cord astrocytomas, even if the lower limb function must be sacrificed. In conclusion, predictors of good surgical outcome for spinal cord tumors were histological grades of the tumors, surgical margins, and neurological status of the patient before surgery. In cases of spinal cord tumors, early diagnosis and surgery, before the paralysis becomes severe, are important to obtain good functional outcomes.

S022

Regenerative Medicine of Spinal Cord Injury Using iPS Cells

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We have previously reported that transplantation of safety-validated iPS-derived neural progenitor cells (iPS-NPCs) into injured spinal cords of immunodeficient mice and monkeys promotes motor function recovery. Based on these results, we initiated a clinical study targeting subacute complete spinal cord injury (2-4 weeks post-injury) and performed the first cell transplantation in December 2021. Eventually, this clinical trial was concluded in November 2024. This presentation will introduce the current status and prospects of this clinical study. In chronic incomplete spinal cord injury, demyelinated residual axons are the therapeutic target. We established an induction method for spinal cord-type iPS-derived neural stem cells (iPS-NSCs), which have a high differentiation potential into oligodendrocytes, and conducted preclinical studies. As a result, we demonstrated that even in chronic spinal cord injury, where functional recovery was difficult with conventional hindbrain-type iPS-NSC transplantation alone, spinal cord-type iPS-NSC transplantation alone was able to achieve functional recovery. Based on these findings, our project was selected

for AMED's Practical Research Project for Regenerative Medicine, and we plan to conduct a physician-led clinical trial for chronic incomplete spinal cord injury in 2026. This presentation will discuss the preparation status for this trial and our ongoing efforts toward addressing chronic complete spinal cord injury.

Keywords: Spine, Spinal cord injury, Regenerative medicine, Cell therapy, IPS cell

Asian Spine Society Session I

S023

Management of Cervical Pott's Disease

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Background and Introduction: Cervical Pott's Disease, a rare form of spinal tuberculosis affecting the cervical vertebrae, accounts for only 3–5% of spinal TB cases, and presents unique challenges due to its proximity to vital structures, leading to severe neurological risks, diagnostic difficulties, as it can mimic other conditions, and high surgical risks due to spinal cord and vascular complications. The pathophysiology of Pott's disease leads to the destruction of bone and discs, causing spinal instability and potential deformity. Inflammatory processes may form abscesses that compress neural structures, resulting in severe neurological deficits, such as paralysis and sensory loss. Early intervention is crucial to prevent permanent damage and maintain spinal and neurological health. Several surgical techniques can be employed in cases of cervical Pott's Disease, such as Occipitocervical Fusion (OCF) C1-C2 Fusion and intraoral debridement .

Conclusions: Cervical Pott's Disease, a rare form of spinal tuberculosis, poses high surgical risks due to its proximity to vital structures. Surgical solutions such as OCF (stabilizes, decompresses, and aligns with over 90% fusion rates) and Intraoral Debridement (direct access to infection with minimal scarring and quicker recovery) are outlined. Combined techniques can improve deformity, neurological deficits, and quality of life, resulting in significant improvements in postoperative pain, function, and alignment. Research focuses on minimally invasive approaches to reduce complications and recovery time, emphasizing the importance of multidisciplinary teamwork for effective management.

Keywords: Cervical Pott's Disease, Occipitocervical fusion (OCF), C1–C2 fusion, Intraoral debridement

S024

The Role of Traditional Growing Rods (TGR) in the Management of Early Onset Scoliosis

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Early Onset Scoliosis (EOS) refers to scoliosis diagnosed before the age of 10. In patients with severe curves requiring surgery, spinal fusion is typically avoided due to the risks of the crankshaft phenomenon, thoracic insufficiency syndrome, and potential growth restrictions of both the spine and trunk. Traditional Growing Rods (TGR) offer a non-fusion surgical option for EOS, allowing continued spinal and thoracic cage growth during the critical growth phase. The dual growing rod construct is the most commonly used configuration. In this presentation, this presentation shares the outcomes of TGR in the management of EOS. This is based on a retrospective review of 35 patients who underwent TGR at our center. Of these, 11 (31%) were still undergoing rod distraction, 14 (40%) completed distraction but had not yet undergone final fusion, and 10 (29%) completed rod distraction and proceeded with final fusion. The mean age of the cohort was 10.4±2.2 years, with a major Cobb angle averaging 93.8±21.9°. Preoperatively, the T1-T12 length averaged 170.1±27.0 mm. The most common diagnosis was idiopathic scoliosis, with 7 (20%) patients having syndromic scoliosis. At the final follow-up, the percentage of patients achieving the T1-T12 length thresholds of 18 cm, 20 cm, and 22 cm were 97.1%, 80.0%, and 51.4%, respectively. The Space Available for Lung (SAL) ratio improved from 88.1±8.5% preoperatively to 94.7±5.2% postoperatively.

There were two cases of surgical site infections, and the implant-related complication rate was 34%. In conclusion, TGR is effective in lengthening both the trunk and thoracic cage. However, implant-related complications remain a significant concern. Strategies to minimize these complications are also presented in this presentation.

S025

Modified Cortical Bone Trajectory for Thoracolumbar Spine Fixation: Clinical Implications and Feasibility

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Purpose: The significant pullout strength in CBT is believed to be due to increased screw–cortical bone contact; however, it requires shorter or smaller-diameter screws, and the fixation is limited to the posterior one-third of the vertebral body, compromising the screw anchorage in the anterior vertebra. The present study compares bone density by computed tomography Hounsfield unit (CTHU) between the original pedicle trajectory (OPT), cortical bone trajectory (CBT), and modified cortical bone trajectory (MCBT) of lumbar spine and evaluates its clinical implications for thoracolumbar spine fixation.

Materials and Methods: Computed tomography transverse sections of the L1–L5 (1,000 vertebrae) of 200 patients were cut into three planes: (1) horizontal to the pedicle, representing the plane for OPT; (2) in a caudocranial sagittal plane with transverse divergence representing the CBT; and (3) a caudocranial sagittal plane with transverse parallel alignment representing the MCBT. For each trajectory, the CTHU of four points, namely, posterior cortex, mid-pedicle, midbody, and anterior cortex, were compared at the screw insertion zone.

Results: The mean CTHUs of OPT, CBT, and MCBT were 354.2±70 HU, 529.9±75 HU, and 457.3±90 HU, respectively ($p<0.01$). The CTHU of the posterior cortex in MCBT was 65.6% higher than that in OPT and 14.9% lower than that in CBT. A comparable decline in CTHU with age was noted in CBT and MCBT (Pearson's r: −0.20 vs. −0.22; adjusted R^2: 0.040 vs. 0.047). However, a higher decline in CTHU with age was observed in OPT (Pearson's r=−0.38, adjusted R^2=0.14).

Conclusions: MCBT has a significantly higher CTHU than OPT. The density in the posterior cortex in MCBT is comparable to that in the CBT trajectory. MCBT is an alternative trajectory for lumbar spine fixation.

Keywords: Cortical bone trajectory, Modified cortical bone trajectory, Original pedicle trajectory, Computed tomography hounsfield unit

S026

OLIF in NO Corridor: Possible or Not?

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Abstract: The Oblique Lateral Interbody Fusion (OLIF) technique is a minimally invasive spinal surgery that offers a promising alternative for treating various spinal disorders. Traditionally, OLIF involves accessing the intervertebral space through an oblique corridor between anterior psoas muscle and major arteries (aorta or iliac artery). Narrow surgical corridor may be broadened by the psoas muscle retraction and vascular mobilization. Our studies reported comparable outcome of less than 10 mm to wider corridor without significant complication. However, the only significant radiographic difference was the angle of the cage inserted at L4/5. We also propose a new term "Expanded surgical corridor" (ESc) for OLIF approach. The ESc is distance between the major vein and lumbar plexus. This approach reduced the proportion of cases with no surgical corridor from 7% to 1.8%. Ultimately, the exploration of OLIF without a defined surgical corridor using ESc, may represent a significant advancement in spinal surgery, offering a less invasive option for treating complex spinal conditions while improving recovery times and overall patient satisfaction.

Keywords: Lateral lumbar interbody fusion, Oblique lumbar interbody fusion, Oblique surgical corridor

Symposium (I) Cervical: Current Trends in Degenerative Cervical Myelopathy

S027

Clinical Assessment and DDx. of Cervical Myelopathy

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Background and Introduction: Degenerative cervical myelopathy (DCM) is a prevalent cause of progressive spinal cord dysfunction characterized by age-related degenerative changes such as cervical spondylosis and ossification of the posterior longitudinal ligament (OPLL). Its nonspecific and variable early presentations, including upper limb paresthesia, hand incoordination, gait imbalance, and subtle motor weakness, frequently lead to delayed diagnosis and management, resulting in suboptimal patient outcomes.

Main Body: Accurate diagnosis is challenging due to symptom overlap with conditions like peripheral neuropathies, cervical radiculopathy, brachial plexopathy, amyotrophic lateral sclerosis (ALS), Parkinsonian syndromes, and cerebrovascular diseases. A structured diagnostic pathway begins with detailed patient history and comprehensive neurological examination, emphasizing key clinical signs. High-specificity signs, such as Babinski, clonus, and the inverted supinator sign, are useful in confirming a diagnosis of DCM. Symptoms like neck pain, hand incoordination, and altered hand sensation should heighten the index of suspicion and guide differential diagnosis and reduce delays in treatment. Magnetic resonance imaging (MRI) is indispensable in diagnosing DCM, providing high-resolution images that reveal spinal cord compression, signal intensity changes, and structural alterations indicative of chronic damage. Electrodiagnostic studies primarily aid in differentiating DCM from peripheral nerve disorders and neuromuscular conditions. Specifically, nerve conduction studies (NCS) and electromyography (EMG) help identify nerve root or peripheral nerve pathology. Non-compressive neurological diseases should be considered in patients who present with bilateral extensive paresis or intact sensory function, without neurological abnormalities in the upper extremities. ALS presents distinct electrophysiological characteristics such as prominent fasciculations, muscle wasting, and specific EMG abnormalities, differentiating it clearly from DCM. Multiple sclerosis (MS) can be distinguished by visual symptoms, distinct MRI lesions in the brain and spinal cord, episodic neurological symptoms, and younger patient demographics. Parkinsonian syndromes should be considered in the differential diagnosis for patients presenting with non-spastic abnormal gait. Objective assessment tools such as the modified Japanese Orthopedic Association (mJOA) score are traditionally employed to quantify functional impairment and monitor disease progression. Recently, the Graded Redefined Assessment of Strength, Sensibility, and Prehension Version-Myelopathy (GRASSP-M) has gained increasing recognition as a valuable evaluation method.

Conclusions: This review synthesizes contemporary evidence and highlights practical strategies for early recognition and accurate differentiation of DCM from similar conditions. Raising clinicians' awareness and integrating standardized diagnostic approaches significantly enhance early intervention, improving clinical outcomes for patients with degenerative cervical myelopathy.

Keywords: Degenerative cervical myelopathy, Differential diagnosis, Clinical assessment

S028

Combined Radiculopathy in Cervical Myelopathy

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Abstract: Cervical myeloradiculopathy (CMR) is a common degenerative spinal condition characterized by the

coexistence of cervical myelopathy and radiculopathy. The optimal surgical treatment for multi-level CMR remains debated, with anterior cervical discectomy and fusion (ACDF) and posterior decompressive techniques such as laminoplasty being widely utilized. While laminoplasty is an effective procedure for decompressing the spinal cord in multi-level cervical spondylotic myelopathy, its efficacy in addressing concurrent nerve root compression remains uncertain. This study evaluates the feasibility of laminoplasty, with or without additional foraminotomy, for treating multi-level CMR. A propensity score-matched analysis was conducted comparing outcomes of laminoplasty combined with foraminotomy versus ACDF with uncinate process resection. A total of 84 patients (42 per group) were included, with a minimum two-year follow-up. Radiographic and clinical outcomes, including cervical sagittal alignment, range of motion (ROM), visual analog scale (VAS) scores for pain, neck disability index (NDI), and Japanese Orthopaedic Association (JOA) scores, were assessed. Results demonstrated that both procedures were effective in improving neurological function and arm pain. ACDF resulted in superior maintenance of cervical lordosis but led to a significant reduction in ROM. Laminoplasty alone was associated with inferior radicular symptom relief due to inadequate foraminal decompression, but laminoplasty combined with foraminotomy yielded outcomes comparable to ACDF in terms of radiculopathy relief. Additionally, unilateral or bilateral foraminotomy did not significantly increase segmental instability or complication rates. Patients undergoing laminoplasty experienced greater early postoperative neck pain and disability compared to ACDF, likely due to posterior muscle disruption. However, this difference diminished with long-term follow-up. The opening side of the lamina in laminoplasty did not affect radicular symptom improvement, further supporting the use of laminoplasty combined with foraminotomy as a viable option for multi-level CMR. In conclusion, while laminoplasty alone is insufficient for adequately addressing multi-level myeloradiculopathy, combining it with foraminotomy can provide equivalent clinical outcomes to ACDF with fewer complications. Given its motion-preserving nature, laminoplasty with foraminotomy represents an effective alternative for appropriately selected patients. The choice of surgical approach should be individualized, considering sagittal alignment, number of involved levels, and presence of neck pain.

S029

Mild Cervical Myelopathy: Observation or Operation?

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Background and Introduction: The long-term outcomes of nonsurgical treatments for mild cervical myelopathy are generally favorable, though some patients may experience deterioration over time. For mild cervical myelopathy, the decision between surgical intervention and conservative management is not straightforward and depends on various factors.

Main body: An initial trial of non-operative management with a medically-supervised structured rehabilitation program and careful follow-up is considered reasonable. This includes structured physical therapy, activity modification, and medications. Some patients may benefit from cervical traction or temporary immobilization with a soft collar. Surgery is associated with significant improvements across a range of patient-reported outcome measures even for mild myelopathy. Early surgery compared to initial observation was found to be cost-effective from the Canadian healthcare payer perspective. Surgery aims to decompress the spinal cord and prevent neurological deterioration. Surgery should be considered in cases where symptoms progress or worsen despite conservative treatment. The patient has experienced myelopathy for six months or longer. There is significant spinal cord compression evident on imaging. Patients should be informed that complete symptom resolution is unlikely following surgery, and there is associated risk. In a study with a 3-year follow-up period, only 26.9% of patients with mild cervical spondylotic myelopathy experienced deterioration during conservative treatment. A study with a 5-12 years follow-up period found that 74.5% of patients with mild myelopathy maintained their condition without deterioration through conservative treatment. One study reported that 82% of patients did not require surgery 5 years after initial

conservative treatment, while 56% did not require surgery after 10 years.

Conclusions: While surgery aims to prevent progression and potentially offers better long-term outcomes, nonsurgical treatments may provide adequate symptom relief for many patients with mild cervical myelopathy. The decision between conservative management and surgery should be individualized based on factors such as age, symptom severity, and patient preferences

Keywords: Cervical Myelopathy, Mild, Operation, Observation

S030

Diagnosis of Osteoporotic Spinal Fractures

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Background and Introduction: Intraoperative spinal cord injury (ISCI) during cervical surgery can critically affect patients' postoperative outcomes and may result in severe neurological deficits, including both sensory and motor paralysis. The risk of ISCI is notably higher in patients with preexisting spinal cord pathology, such as those with severe cervical spondylotic myelopathy caused by ossification of the posterior longitudinal ligament (OPLL), spinal cord tumors, or unstable fractures. In recent years, intraoperative neurophysiologic monitoring (IONM) has been increasingly employed to monitor neural function in real time, thereby detecting potential damage early and enabling timely intervention to prevent permanent neurological injury. Representative IONM modalities include somatosensory evoked potentials (SSEPs), motor evoked potentials (MEPs), and electromyography (EMG). Often, multimodal monitoring is used to enhance the sensitivity and specificity of neuromonitoring; however, controversies remain regarding the true efficacy of IONM, and some studies report the potential for false-negative results. Accordingly, certain experts argue that the routine use of IONM should be reserved for only the highest-risk procedures. The cost-effectiveness and necessity of IONM for lower-risk cases thus remain contentious. Moreover, variations in signal interpretation and implementation highlight the importance of standardized protocols and proper training to ensure consistent and reliable application.

Recommendation

Implementing intraoperative neurophysiologic monitoring is recommended for high-risk patients undergoing spinal surgery. Specifically, for those with complex spinal deformities or moderate-to-severe cervical spondylotic myelopathy (CSM) and for patients with spinal cord tumors, the risk of ISCI is substantial. When changes in SSEP or MEP are detected, it is possible to reverse or mitigate potential spinal cord injury by adjusting the position of implants (e.g., plates or cages), re-verifying decompression, and applying hemodynamic control. Despite the added costs—equipment, personnel, and extended operating time—IONM offers advantages when balanced against the potential burden of permanent neurological deficits, particularly in high-risk patients.

Risk Factors for Intraoperative Spinal Cord Injury

1. Patient-Related Factors: advanced age, hypertension, BMI, etc.
2. Clinical Factors: preoperative neurological status and presence of myelopathy (especially severe CSM due to OPLL).
3. Surgical Factors: the number of spinal levels involved and whether an osteotomy is performed.

Management Strategy for Intraoperative Neuromonitoring Protocols

1. Preoperative Evaluation and Team Coordination: conduct neurological and radiological assessments and screen for risk factors.
2. Interdisciplinary Consultation: Anesthesiology, spine surgery, rehabilitation medicine, and IONM specialists collaborate on patient care planning.
3. Intraoperative Monitoring (SSEP+MEP+EMG): Triple-modality IONM is often employed.
    - SSEP: an alert is triggered if amplitude decreases by ≥50% or latency increases by ≥10%.
    - MEP: an alert is triggered if amplitude decreases by ≥70% or latency increases by 10–15%.
    - When such alerts occur, promptly investigate technical issues (electrodes, equipment), surgical factors (instrumentation, compression), and anesthetic variables (blood pressure, temperature), and intervene accordingly.

4. Postoperative Care: In the event of neurological deficits, consider high-dose steroids and hemodynamic support for further management.

Examples of IONM Applications

1. ACDF in Patients with Moderate Preoperative Neurological Deficits: MEP monitoring can help predict the likelihood of postoperative motor recovery based on intraoperative signal stability.
2. OPLL with Severe Cervical Kyphosis: Continuous SSEP monitoring during decompression allows surgical teams to adjust traction in response to significant decreases in amplitude, thereby preventing neurological deficits from spinal cord injury.
3. ACDF Using SEP and MEP: A sudden loss of MEP signals in the upper extremities can indicate brachial plexus injury risk, prompting immediate corrective measures.
4. Posterior Cervical Surgery: MEP monitoring helps detect early signs of spinal cord injury or C5 palsy, allowing timely intervention.

Conclusions: Multimodal intraoperative neuromonitoring—especially MEP, SEP, and EMG—can play a crucial role in preventing spinal cord injury and detecting complications early during surgery, particularly in high-risk patients with conditions such as OPLL or advanced degenerative myelopathy. Early detection and immediate response to abnormal signals help the surgical team rapidly identify and correct intraoperative problems, thereby improving neurological outcomes.

Keywords:

S031

Surgical Strategy in Mild Kyphosis

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Background and Introduction: In patients with cervical myelopathy at the multilevel cord compression, posterior decompression (laminoplasty or laminectomy with/without fusion) can be done due to developmental stenosis and long-standing symptoms. Recently, laminectomy and fusion (LF) showed good results in some research instead of laminectomy, which could result in post-laminectomy kyphosis or nerve injury. Laminoplasty can usually be taken in case of cervical lordosis, due to the risk of aggravating preoperative kyphosis and restricted spinal cord movement after laminoplasty. However, mild kyphosis is still controversial for cervical laminoplasty indication.

Main Body: With various techniques, laminoplasty is performed due to its feasibility, short-operation time, low complication rate and satisfactory outcome. Laminoplasty is commonly considered in patients with lordotic or straight cervical curves. However, LP is not preferred in patients with spinal instability, neck pain, and especially kyphotic alignment because spinal cord shift is restricted in kyphotic deformity. In these cases, LF with or without anterior cervical fusion is preferred. In case of mild kyphotic alignment, it remains controversial whether to perform LP or LF. Although mild kyphosis (≤10°) is treated same as the straight curve, severity of spinal cord distraction and local angulatory deformity causing anterior cord compression and injury of anterior horn or pyramidal tract should be considered in patients with kyphotic spinal curve. Additionally, preoperative hypermobility is considered a poor prognostic factor after cervical LP and in this case, LF with or without anterior procedures can be chosen. Recently, it is thought that muscle-sparing LP techniques may broaden its indications

Conclusions: Therefore, in decision making whether to do LP or LF in patients with mild kyphosis, proper procedures should be considered according to neck pain, segmental hypermobility, distraction of spinal cord, anterior cord compression, severity of canal stenosis and whether to do muscle sparing technique.

Keywords: Cervical laminoplasty, Cervical posterior decompression and fusion, Mild kyphosis

Invited Lecture III

S032

Cervical Spine Injury in spinal Ankylosing Disorders

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Cervical spine injuries in patients with spinal ankylosing disorders (SADs) present unique diagnostic and therapeutic challenges. SADs are also known as stiffening or metabolic bone diseases which cause spine ankylosis or fusion. Commonly seen SADs include ankylosing spondylitis(AS), diffuse idiopathic skeletal hyperostosis(DISH), ossification of posterior longitudinal ligament(OPLL), severe degeneration or previous fused spine. Patients with SADs have a higher risk of spine fractures compared to the general population. Most of the fractures occur in the cervical spine, predominantly affecting lower cervical levels with extension mechanism. The combination of CT and MRI is crucial for accurate diagnosis and detection of associated complications such as epidural hematoma. Surgical complication is higher in SADs compared with general population. However, outcome is better in surgical group compared with non-operative group in SADs. From January, 2021 to January, 2025, there 400 cervical spine surgeries in Orthopedic Department of Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Taiwan. 30 of them were SADs with cervical spine injuries, including 6 AS, 3 DISH, 8 OPLL, severe degeneration 6, and previously fused spine 7. 20 were male and 10 were female. The average age was 68 years old. 15 patients were more than 70 years old. There were 4 patients with complete spinal cord injury (SCI), 15 with incomplete SCI, 8 with radicular symptoms, 3 with neck pain only. There were 6 patients presented with multiple levels or skipped levels of injuries. Patients received CT and MRI for accurate diagnosis. Most of the patients received immediate stabilization with Halo vest application followed by definitive surgical management. Long-segment posterior instrumentation, with or without anterior approach, has demonstrated favorable outcomes in these highly unstable cervical spine injuries. 5 patients died during hospitalization due to multiple injuries or medical comorbidities. For the patients with incomplete SCI, the ASIA impairment scale improved 1-2 grades at final follow up. All cases of neck pain and radicular symptoms improved postoperatively. Cervical spine injuries are more common in patients with spinal ankylosing disorders. A combination of CT and MRI is essential for comprehensive diagnostic evaluation. Immediate stabilization is necessary for these unstable cervical spine injuries. Most of our patients received Halo vest immobilization with early posterior long instrumented fusion/ decompression with or without anterior reconstruction, which was the key for successful treatment.

Keywords: Cervical spine injury, Spinal ankylosing disorders, Spinal cord injury, Halo vest, Long segment posterior instrumentation

Free Paper: Lumbar (1)

S033

Sacroiliac Joint Degeneration Following Lumbar Fusion: The Influence of Pelvic Mechanics and Spino-Pelvic Alignment

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Purpose: Sacroiliac (SI) joint degeneration is a known complication following lumbosacral fusion surgeries, and it is associated with several factors, such as the number of fused levels, involvement of the pelvis or sacrum, and sagittal alignment. This study aims to identify whether alterations in specific spino-pelvic parameters correlate with the progression of degeneration in the SI joint.

Materials and Methods: A multicenter retrospective study was conducted involving 472 patients who underwent fusion surgery across three hospitals from March 2021 to February

2024. SI joint degeneration was evaluated using seven indicators: sclerotic changes, erosion, osteophyte formation, intra-articular bone formation, joint space narrowing, intra-articular gas formation, and subchondral cysts. CT scans were performed before surgery and at 6 months post-surgery. A total score of 14 points was calculated for both sides, and a difference of 2 or more points between pre- and post-surgery was defined as SI joint degeneration. The patients were categorized into two groups: those with SI joint degeneration progression and those without. Pre-surgery and at 6 months post-surgery, standing whole spine lateral X-rays were used to measure a total of 10 spinopelvic parameters: T1PA, GT, PT, SS, PI, LL, TK, TLK, SVA, and PI-LL. Two-sample t-test and multivariable logistic regression were used for the statistical analysis.

Results: Among the 472 patients, 135 showed progression of SI joint degeneration, accounting for 28.6%. Comparing two groups, age (p=0.022), alcohol (p=0.001), smoking (p<0.001) and S1 involvement (p=0.04) were associated with SI joint degeneration. In terms of spino-pelvic parameters, patients with SI joint degeneration exhibited a significant changes in thoracic kyphosis (p=0.017) and pelvic tilt (p=0.049) reflecting altered nutation and counternutation movements of SI joint depending on the anterior-posterior tilt of the pelvis.

Conclusions: Although the SI joint is considered stable, changes in pelvic tilt after lumbar fusion surgery can accelerate SI joint degeneration due to the repetitive movements of nutation and counternutation of the SI joint.

Keywords: Sacroiliac joint, Degeneration, Fusion, Nutation, Counternutation

S034

Modified Open TLIF with Contralateral Facet Fusion vs. Conventional Open PLIF: A Retrospective Case-Control Study on Fusion Rates and Clinical Outcomes at 1-Year Follow-Up

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Purpose: This study introduces and evaluates a modified transforaminal lumbar interbody fusion (TLIF) technique with contralateral facet fusion, with the aim of improving fusion rates and clinical outcomes compared to the conventional posterior lumbar interbody fusion (PLIF).

Materials and Methods: A retrospective case-control study was conducted on patients undergoing modified TLIF or conventional PLIF between July 2009 and November 2020. Patients with one- or two-level lumbar fusion were included, excluding cases involving long-level fusions, revision surgeries, or other diseases. Perioperative parameters, radiological outcomes, fusion rates, and clinical outcomes were analyzed.

Results: The study included 101 patients in the modified TLIF group and 89 in the PLIF group, with a mean follow-up of 57 months. The modified TLIF group showed significantly higher fusion rates at six months (84.9% vs. 66.4%, p<0.001) but fusion rates were comparable at the one-year mark. Modified TLIF showed significant improvements in low back pain (VAS) and radiating pain scores at 3, 6, and 12 months postoperatively (p<0.05). Complications, operation time, and long-term functional outcomes (ODI, SF-36) were not significantly different between groups.

Conclusions: Modified TLIF with contralateral facet fusion is a promising alternative to conventional PLIF, demonstrating advantages in early fusion rates and reduced pain within the first year. Further prospective studies are warranted to validate these findings.

Keywords: Modified TLIF, Contralateral facet fusion, Fusion rate, Spinal fusion outcomes, Posterior lumbar interbody fusion

S035

Adjacent Segment Degeneration in Single Level Transforaminal Lumbar Interbody Fusion: Comparative Study Between Expandable Versus Static Cages

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Purpose: Adjacent segment degeneration (ASD) is a significant postoperative complication associated with Transforaminal Lumbar Interbody Fusion (TLIF). In recent years, expandable cages have gained popularity due to their perceived advantages in correcting radiological parameters and potentially reducing the incidence of ASD. This study aimed to evaluate whether expandable cages offer these benefits and to identify potential risk factors contributing to ASD.

Materials and Methods: This retrospective cohort study reviewed patients with degenerative lumbar spinal pathologies who underwent single-level TLIF using either a static or expandable cage at AHNH and NDH, with a minimum follow-up period of 3 years. Patient demographics, clinical outcomes and radiological parameters were assessed. Outcomes were compared between the expandable and static cage groups. Patients were further stratified into ASD and non-ASD groups, and risk factors were evaluated.

Results: A matched group of patients included 46 expandable cages and 50 statics cages. Radiologically, the expandable group showed significantly greater distraction in anterior disc height (ADH), posterior disc height (PDH), and mean disc height (MDH) (4.25 mm vs. 1.32 mm, p=0.01), disc height expansion ratio (1.65 vs. 1.15, p<0.001), SL (8.92° vs. 6.85°, p=0.005), and GL (47° vs. 41°, p=0.004). Clinically, expandable group demonstrated statistically significant improvement in NRPS scores for back and leg pain compared to static group. The overall incidence of symptomatic ASD was 5.21%. There were no statistically significant differences in complication profiles, including ASD, cage subsidence and migration. ASD group exhibited a statistically significant smaller pre-operative disc height (MDH 6.35 mm vs. 10.37 mm) and a smaller post-operative disc height (MDH 10.25 mm vs. 13.12 mm, p<0.001). This group had a higher mean disc height expansion ratio (2.12 vs. 1.34, p=0.242). Modic type 3 changes at the cranial segment were associated with ASD (odd ratio 22.88 , CI 2.93-178.65, p=0.003). Factors such as mean disc height distraction, vacuum phenomenon, and bone density in the lumbar spine were not identified as risk factors for ASD.

Conclusions: Expandable cages provided better restoration of radiological features including disc height, SL and GL and improvement in clinical outcome compared with static cage in one-level open TLIF. More severe initial spinal disease, excessive disc space expansion and modic type 3 changes at cranial segment are associated with higher risk of ASD.

Keywords: Expandable cage, Adjacent segment disease

S036

Duration of Aggravated Symptoms Can Affect Satisfaction after Degenerative Lumbar Surgery

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Purpose: Lumbar spinal stenosis (LSS) is a common degenerative condition requiring surgical intervention when conservative treatment fails. While multiple factors affect surgical outcomes, the impact of symptom duration on patient satisfaction remains unclear. In this study, we investigated patient-reported surgical satisfaction and identified factors associated with unsatisfactory outcomes, with particular focus on the timing of surgical intervention.

Materials and Methods: This retrospective cohort study analyzed 132 patients who underwent lumbar fusion surgery for degenerative LSS between January 2021 and December 2023. Patient satisfaction was evaluated using a 4-point Likert scale at a minimum one-year follow-up. Clinical outcomes were assessed using Visual Analogue Scale (VAS) for back and leg pain, and Oswestry Disability Index (ODI).

Radiological parameters were evaluated using preoperative magnetic resonance imaging.

Results: Among 132 patients, 70.4% reported satisfaction with surgical outcomes (51.5% very satisfied, 18.9% satisfied). The satisfied group showed significantly shorter duration of aggravated symptoms compared to the unsatisfied group (10.30±9.47 vs 19.7±14.60 months, p<0.001). Satisfaction significantly declined after 12 months of symptom duration. The satisfied group was younger (68.40±6.80 vs 71.90±6.00 years, p=0.005) and had fewer stenotic levels (2.06±0.99 vs 2.47±1.18, p=0.041). Multiple regression analysis identified major depressive disorder and COPD/Asthma as independent predictors of satisfaction.

Conclusions: Longer duration of aggravated symptoms (particularly beyond 12 months), advanced age, and severity of neuropathic pain were significantly associated with lower satisfaction rates. Additionally, comorbidities emerged as independent predictors of patient satisfaction. It can be suggested that timely surgical intervention, before the progression of neuropathic pain and development of age-related comorbidities, can provide better patient satisfaction outcomes.

Keywords: Spinal stenosis, Patient satisfaction, Treatment outcome, Spinal fusion, Neuropathic pain

Free Paper: Lumbar (2)

S037

Dynamic Interspinous Radiology as a Predictor for Early-Onset Adjacent Segment Degeneration after Multilevel Lumbar Interbody Fusion (L2–Ilium)

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Purpose: This study aimed to evaluate dynamic interspinous radiology (DIR) as a predictor of early-onset adjacent segment degeneration (ASD) following multilevel lumbar interbody fusion (L2-ilium).

Materials and Methods: From 2018 to 2022, 52 patients who underwent L2-ilium surgery for degenerative spinal disease at a single institution were enrolled. The patients were divided into two groups: Group A, consisting of those who developed ASD (n=25), and Group B, those who did not develop ASD (n=27). Patients with preoperative high-grade adjacent-level disc degeneration (Pfirrmann grade ≥III) were excluded. DIR was defined as the difference in the distance between the midpoints of the superior aspects of the spinous processes during flexion and extension. Demographic data and radiological spinopelvic parameters were compared between the two groups. Adjacent-level muscle quality and flexibility were additionally assessed and compared.

Results: The follow-up period was 13.2±6.3 months in Group A and 11.7±6.8 months in Group B (p=0.522). There were no significant differences in demographic data between the two groups. In both groups, spinopelvic parameters were improved compared with preoperative measurements (p>0.05), except for cervical lordosis and pelvic incidence. The correction of sagittal vertical alignment (SVA) in Group A was greater than in Group B, but the difference was not statistically significant (p=0.05). There was no difference in adjacent-level muscle quality between the groups (p>0.05). Changes in the proximal junctional angle during flexion and extension were also not significantly different between the two groups (p>0.05). However, Group A exhibited a significantly larger DIR compared to Group B (10.1±4.1 mm vs. 6.0±3.5 mm, p=0.004). The optimal cut-off value of preoperative DIR as a risk factor for ASD was >8.1 mm.

Conclusions: Our study demonstrated that patients who developed ASD had significantly larger DIR compared to those who did not, with an optimal preoperative DIR cut-off value of >8.1 mm as a potential risk factor for ASD.

Keywords: Adjacent segment degeneration, Spinous process, Lumbar interbody fusion, Correction, Dynamic interspinous radiology

S038

Trans-pedicular Intravertebral Cage Augmentation (TPICA) with Short-level Fixation in the Treatment of Kummell Disease: Mid-term Results from a Case Series

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Purpose: Kummell disease is a post-osteoporotic vertebral fracture condition characterized by non-union or avascular necrosis (AVN), leading to intravertebral instability, progressive kyphosis, intractable pain, or neurologic deterioration. Surgical treatment often involves anterior column reconstruction, but trans-pedicular intravertebral cage augmentation (TPICA) offers a less invasive alternative, while providing anterior support and stabilization with short-level fixation. This study aimed to evaluate the clinical and radiographic outcomes of TPICA with short-level fixation in patients with Kummell disease

Materials and Methods: This study retrospectively analyzed 37 patients who underwent TPICA with short-level fixation. Patients were included if they exhibited significant vertebral body collapse, progressive kyphosis, intravertebral instability causing neurologic deterioration, or intractable back pain unresponsive to conservative treatment. Radiographic parameters, including Local Kyphotic Angle (LKA), Thoracolumbar Kyphosis (TLK), and Relative Anterior Vertebral Height (RAVH), were measured preoperatively, immediately postoperatively, and at the final follow-up. Fusion was defined as the disappearance of air clefts on dynamic radiographs or the presence of bone trabeculation in the index vertebral body on CT. Complications such as screw pullout, junctional kyphosis, infection, hematoma, and revision surgery were documented.

Results: The study included 37 patients with a mean age of 77.8 years and a mean follow-up period of 52.3 months. Surgical fixation level involved two-segment (62.2%), three-segment (27.0%), or four-segment (10.8%).

Radiographic parameters showed improvement after surgery. The mean LKA decreased from 21.2°±14.5° preoperatively to 9.8°±13.9° immediately postoperatively and increased to 14.4°±15.9° at the final follow-up. Similarly, TLK decreased from 26.5°±14.9° preoperatively to 19.5°±12.8° postoperatively but increased to 24.4°±14.1° at the final follow-up. RAVH improved from 0.446±0.296 preoperatively to 0.705±0.270 immediately after surgery and stabilized at 0.634±0.300 at the final follow-up. However, repeated measures ANOVA revealed no statistically significant differences for any radiographic parameter (LKA, p=0.167; TLK, p=0.496; RAVH, p=0.192). Surgical complications were observed in 18 patients (48.6%), including junctional kyphosis, revision surgery, non-union, hematoma, and periprosthetic infection.

Conclusions: TPICA with short-level fixation provides a minimally invasive alternative for Kummell disease, demonstrating favorable radiographic and clinical outcomes in mid-term follow-up. Although the improvements in radiographic parameters were not statistically significant, the procedure effectively restored structural stability and corrected kyphosis with favorable fusion rate.

Keywords: Kummell disease, Trans-pedicular intravertebral cage augmentation, Local kyphotic angle, Short-level fixation

S039

The Effect of Obesity on Post Surgical Complication in Patients with Degenerative Spondylolisthesis Spectrum: A Meta-Analysis

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Purpose: Obesity plays a role as a risk factor for spinal surgery complications. Several previous studies have shown that high body mass index causes increased operating time and thereby increasing the risk of early complications, longer surgical times are associated with increased blood loss, infection risk, and DVT, blood loss, infection, and deep vein thrombosis (DVT) in patients undergoing lumbar spine intervention. Recent studies assessing the relationship between obesity

and post-surgical complications in cases of degenerative spondylolisthesis still show varying results. This study aims to show the relationship between obesity and post-surgical complications in cases of spondylolisthesis based on the highest evidence.

Materials and Methods: The research design is a systematic review and meta-analysis. The writing of systematic reviews and meta-analyses will be adjusted to the Preferred Reporting Items for Systematic Review and Meta- Analysis Protocols (PRISMA-P) in Literature searches conducted using electronic media databases using data centers including Pubmed, Cochrane, and Science direct. With the criteria of the Patient Population with degenerative spondylolisthesis spectrum with surgical procedures comparing the outcomes of early or late postoperative complications between patients with obesity and patients without obesity

Results: The analysis of outcomes was divided into early complications, long-term complications, infectious complications, neurological complications, and ASD with most studies reporting an increase in early complications in the obesity group, Five studies were included in the analysis of long-term complications with three studies showing an increase in complications in the obesity population, Neurological complications were described in six studies, Three of the four studies showed an increase in the incidence of ASD in the obesity population, which from all the heterogeneity analysis of these complications showed significant variation in each study but with an overall effect that was not significant. However, in the criteria for infectious complications, there were seven studies that showed an increase in the incidence of infectious complications. The results of the heterogeneity analysis of the obesity group showed a moderate level of variation in the studies with significant overall effects. The z score for the overall effect on infectious complications showed a value of 3.25.

Conclusions: This study showed that there was no significant increase in the incidence of early postoperative complications in patients with degenerative spondylolisthesis spectrum with obesity with an incidence of 17.4%, inconclusive results on a significant increase in the incidence of late postoperative complications in obese patients with an incidence of 16.3%, inconclusive results on a significant increase in the incidence of postoperative neurological complications in obese patients with an incidence of 0.6%, inconclusive results on a significant increase in the incidence of postoperative ASD in obese patients with an incidence of 11.6%, and finally there was a significant increase in the incidence of postoperative infectious complications in obese patients with an incidence of 2.3%.

Keywords: Obesity, Lumbar spine, Spondylolisthesis, meta-analysis protocols, Postoperative complications

S040

Anti-osteoporosis Medication in Patients with Posterior Spine Fusion: A Systematic Review and Meta-analysis

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Purpose: Osteoporosis and osteopenia are common in patients undergoing posterior spine fusion surgery, increasing risks of osteoporosis related complications. However, there is no consensus on perioperative management or the comparative effectiveness of treatments. This study assessed the effects of anti-osteoporosis medications in adult posterior spine fusion patients with low bone mineral density (BMD) focusing on radiographic and functional outcomes.

Materials and Methods: A systematic search of PubMed, EMBASE and Cochrane Library was conducted. Adult patients with low BMD undergoing posterior spine fusion surgery were included. Studies using perioperative anti-osteoporosis medications-teriparatide, bisphosphonates, denosumab, romosozumab-to compare treatment versus no treatment or comparison between medications were also included. Outcomes analyzed were fusion rate, subsequent vertebral fracture (VF), screw loosening, cage subsidence, proximal junction kyphosis, patient reported outcomes (PROs); particularly VAS for pain and ODI for functional status. Two reviewers independently selected studies, extracted data and assessed quality of relevant studies. Random effects model was used for the meta-analysis. Four

comparative groups-bisphosphonate vs control, teriparatide vs control, teriparatide vs bisphosphonate and denosumab vs control-were analyzed for the effectiveness of anti-osteoporosis medications.

Results: Total 28 studies were included. Bisphosphonate reduced subsequent VFs [OR=0.27, 95% CI=0.09-0.81], cage subsidence [OR=0.29, 95% CI=0.11-0.75] and improved ODI at 12 months [SMD (95% CI)=-0.75(-1.42, -0.08)] compared to control. Teriparatide increased fusion rate [OR=3.52, 95% CI=1.84-6.75], reduced screw loosening [OR=0.23, 95% CI=0.09-0.60] and improved ODI at 24 months [SMD(95% CI)=-0.57(-0.99, -0.15)] compared to control. Compared to bisphosphonates, teriparatide increased fusion rate [OR=2.28, 95% CI=1.67-3.11], reduced subsequent VFs [OR=0.22, 95% CI=0.09-0.51], improved VAS for back pain (VASB) [MD(95% CI)=-0.30(-0.54, -0.07)] and ODI [SMD(95% CI)=-0.39(-0.65, -0.13)] at 12 months. Denosumab showed no significant differences in fusion rate and complications.

Conclusions: Teriparatide is recommended as first line perioperative treatment for low BMD patients undergoing posterior spine fusion, as it shows superior fusion rates, reduced complications, and improved PROs compared to control and bisphosphonates. Bisphosphonates are an alternative for patients contraindicated to teriparatide, as it reduced complications and improved PROs, compared to controls. Further research is needed on denosumab and romosozumab, which shows promising potential in model studies.

Keywords: Osteoporosis, Spine fusion, Teriparatide, Bisphosphonate, Denosumab

Free Paper: Lumbar (3)

S041

Expandable and Static Cages in Posterior Lumbar Interbody Fusion in Patients with High Risk Factors for Subsidence

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Purpose: Expandable cages have emerged as a promising option in lumbar interbody fusion, offering potential advantages in insertion and height restoration. However, concerns exist regarding their risk of subsidence, particularly in high-risk patients for subsidence. This study aims to evaluate the clinical and radiological outcomes of expandable cages compared to static cages in patients with high-risk factors for subsidence who underwent posterior lumbar interbody fusion (PLIF).

Materials and Methods: This propensity score-matched analysis compared 38 patients who underwent single-level PLIF using expandable cages with 38 matched controls using static cages. Included patients were aged 50-85 years with at least one high-risk factor for cage subsidence (osteoporosis [Hip T-score <-2.5], fusion at the lowest level in multi-level procedures exceeding 3 levels, or grade 2 or higher spondylolisthesis). Clinical outcomes were assessed using the Oswestry Disability Index (ODI) scores at multiple time points up to one year postoperatively. Radiographic parameters including Disc Height Index (DHI), Foraminal Height (FH), Segmental Lordotic Angle (SLA), and Disc Angle (DA) were evaluated preoperatively, early postoperatively, and at last follow-up.

Results: Both groups demonstrated comparable improvements in ODI scores throughout the follow-up period with no significant differences between groups. The expandable cage group maintained significantly greater DHI than the static cage group at both immediate postoperative (0.37±0.05 vs 0.29±0.05, p<0.001) and final follow-up periods (0.34±0.05

vs 0.25±0.06, p<0.001). FH was significantly higher in the expandable cage group at final follow-up (16.54±2.46 mm vs 14.39±4.16 mm, p=0.011). The expandable cage group demonstrated significantly lower subsidence ratio compared to the static cage group (0.078±0.083 vs 0.140±0.096, p=0.004), with fewer Grade 1 subsidence cases (expandable: 2 vs static: 6 patients).

Conclusions: In patients with high-risk factors for subsidence, while both cage types showed similar improvements in clinical outcomes, expandable cages demonstrated superior maintenance of disc height index and foraminal height compared to static cages, with significantly lower subsidence ratio. Our results suggest that expandable cages may be a favorable option for patients at high risk of subsidence in PLIF.

Keywords: Expandable cage, Static cage, Posterior lumbar interbody fusion, Subsidence, Disc height index

S042

Inferior Clinical and Functional Outcomes in Revision Versus Primary Transforaminal Lumbar Interbody Fusion

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Purpose: This study aimed to compare clinical and economic outcomes between primary and revision TLIF performed under well-defined and consistent indications, providing a more accurate understanding of the differences in clinical and economic results.

Materials and Methods: This study was conducted on patients who underwent TLIF at a single institution between 2011 and 2021. Revision surgery was defined as TLIF performed on patients who had previously undergone primary lumbar fusion, either at the same institution or elsewhere. Data collected included Visual Analogue Scale (VAS) scores for back and leg pain, Oswestry Disability Index (ODI) scores preoperatively and at 2 years postoperatively, postoperative complications, intraoperative blood loss, operative time, follow-up duration, hospital stay, and total hospitalization costs including surgical expenses. Radiological parameters such as changes in lumbar lordosis and fusion rates were also evaluated at the 2-year postoperative mark. To control for differences between patient groups, propensity scores were calculated using sex, BMI, ASA score, and the number of treated levels as covariates. Groups with identical propensity scores were matched in a 1:2 ratio, and differences were analyzed using t-tests for continuous variables and chi-square or Fisher's exact tests for categorical variables. Multiple regression analysis was performed to confirm the statistical significance of results with notable differences.

Results: Out of 555 patients who underwent TLIF from 2011 to 2021, 194 met the study criteria. Among them, 162 were in the primary surgery group and 32 in the revision surgery group. After propensity score matching, 64 patients in the primary group and 32 in the revision group were included in the final analysis. No significant differences were observed between the groups in terms of postoperative complication rates, back pain VAS scores, blood loss, follow-up duration, hospital stay, hospitalization costs, or radiological outcomes. However, the primary surgery group demonstrated significantly greater improvement in ODI scores (7.9 vs. 2.4, p=0.0162) and leg pain VAS scores (5.12 vs. 2.84, p=0.0152). Additionally, the operative time was significantly longer in the revision group (250 minutes vs. 225.1 minutes, p=0.0036).

Conclusions: This study highlights that revision TLIF results in less improvement in ODI and leg pain scores and requires longer operative times compared to primary TLIF. These findings provide valuable insights for clinicians when considering revision surgery in patients who have previously undergone lumbar fusion.

Keywords: Transforaminal lumbar interbody fusion, Revision surgery, Propensity score matching

S043

Indirect Decompression Lateral Lumbar Interbody Fusion Risk Score (ID-LLIF Risk Score System) to Predict Successful Indirect Decompression in Lateral Lumbar Interbody Fusion

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Purpose: To develop a predictive risk scoring system to identify successful outcome of indirect decompression surgery through the lateral approach

Materials and Methods: This 10-year retrospective observational cohort study included 200 patients who underwent lateral lumbar interbody fusion surgery. Patients were categorized into two groups: patients with Successful surgery and unsuccessful surgery requiring reoperation or further intervention at the same site . Potential risk factors were examined using multivariable analysis to derive a predictive risk score from independent predictors. Results are presented as odds ratio with a 95% confidence interval (95% CI). The accuracy of the calculated predicted score was demonstrated by the area under the receiver operating characteristic curve (AuROC)

Results: Risk factors influencing LLIF outcomes from multivariate analysis included osteoporosis (mOR [95% CI]=96, p=0.002), residual symptoms <50% improvement (mOR [95% CI]=37, p=0.006), instability (mOR [95% CI]=68, p=0.003), and reducible disc height >13% (mOR [95% CI]=36.90, p=0.0001). The mOR values were used to derive the ID-LLIF risk score, which assigns the following point values: osteoporosis=3 points, residual symptoms <50%=1 point, instability=2 points, and reducible disc height >13%=1 point. The cut-off score for dividing groups was determined based on sensitivity and specificity derived from the area under the receiver operating characteristic (AuROC) curve into three groups: successful (6–7 points), intermediate (4–5 points), and unsuccessful (1–3 points) with a predictive accuracy (AuROC) of 0.95 (95% CI: 0.91–0.98).

Conclusions: The ID-LLIF risk score is a tool designed to predict the success of surgery using the indirect decompression technique via the lateral approach. It also aids surgeons in selecting the appropriate surgical method, thereby reducing the likelihood of reoperations or interventions at previously operated sites.

Keywords: Predictive score, Scoring system, Risk factor, Indirect decompression, Lateral lumbar interbody fusion, Lateral lumbar interbody fusion, Oblique lumbar interbody fusion, Extreme lateral lumbar interbody fusion

S044

Unilateral Laminotomy and Bilateral Decompression (ULBD) for Lumbar Spine Stenosis (LSS): An Early Experience in Eastern Nepal

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Purpose: Lumbar Spinal Stenosis (LSS) is a very common condition in elderly population, presenting with claudication, leg pain. Patients with severe claudication symptoms, who do not respond to conservative management or develop cauda-equina symptoms need surgical decompression; there is no need for additional fusion in patients without any instability. Conventional laminectomy is a well- known procedure, but this involves extensive damage to paraspinal muscles and spinous process and interspinous & supraspinous ligaments. This procedure is associated with high blood loss, longer hospital stay & high incidence of back pain on long term follow up. Unilateral Laminotomy and Bilateral Decompression (ULBD) technique for decompression involves less damage to muscles and no damage to posterior midline structures.

Materials and Methods: This is a retrospective study conducted in Spine-X Hospital, an eastern part of Nepal where resources are constrained. The data was collected from those patients who were diagnosed with degenerative Lumbar Spine Stenosis and required surgical decompression. Demographic parameters (Age, sex, BMI) were included. Outcomes were evaluated based on preoperative and postoperative Oswestry Disability Index (ODI) and Neurogenic claudication outcome score (NCOS).

Results: The mean follow up period was 23 months with a minimum of 14 months. Mean blood loss was 65ml. All the patients were mobilized within 24 hours and mostly were

discharged within 48 hours. Duration of surgery was shorter compared to our previous experience with Laminectomy surgery. This study showed significant improvement in claudication and leg symptoms - NCOS ($p<0.01$). All patients were able to perform their daily activities.

Conclusions: ULBD is an effective technique for decompression of LSS with added advantages of early mobilization & discharge, minimal incidence of back pain at long term follow up.

Keywords: ULBD, Lumbar, Stenosis

Best Paper Candidates Presentation I (Domestic)

S079

Impact of Restricted Prophylactic Antibiotic Guideline on Surgical Site Infection Rates Following Spinal Surgery: A Nationwide Cohort Analysis

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Purpose: Surgical site infections (SSIs) remain a significant challenge in spinal surgery, with profound impacts on patient outcomes. Prophylactic antibiotics are critical in reducing SSI risk, but the optimal regimen and duration for spinal procedures are not well established. This study aimed to evaluate the association between restrictive prophylactic antibiotic guidelines and SSI rates in elective spinal surgeries.

Materials and Methods: A nationwide retrospective cohort study was conducted using data from three Quality Assessment (QA) waves administered by the Health Insurance Review and Assessment Service of South Korea between 2015 and 2020. A total of 58,829 patients who underwent elective spinal surgeries were included. Patients in the 9th QA wave received restricted prophylactic antibiotics (limited to first- or second-generation cephalosporins within 24 hours post-surgery), while the 7th and 8th QA waves allowed broader antibiotic use. The primary outcome was SSI incidence, with secondary outcomes including rates of infections at non-surgical sites and subgroup analyses by hospital type and surgical complexity. Statistical analyses included multivariate logistic regression to adjust for potential confounders.

Results: Among 58,829 patients, the overall postoperative infection rate was 5.79%. The the group receiving restricted antibiotics experienced a significantly higher incidence of SSIs compared with the unrestricted group (2.41% vs. 0.84%, $p<0.001$). Tertiary hospitals and complex surgeries demonstrated the strongest association with increased SSIs (OR, 4.16 [95% CI, 2.99-5.78]). After adjusting for confounding factors, restricted prophylactic antibiotic use was identified as an independent risk factor for SSIs (adjusted OR, 2.479 [95% CI, 2.128-2.894]).

Conclusions: Restrictive prophylactic antibiotic guidelines were associated with increased SSI rates in elective spinal surgeries. These findings highlight the need for individualized antibiotic strategies based on surgical complexity and patient-specific risk factors to optimize patient outcomes and reduce postoperative infections.

Keywords: Surgical site infection (SSI), Spinal surgery, Prophylactic antibiotics

S080

Deep Learning-Based Object Detection Algorithm Using Magnetic Resonance Imaging for Differential Diagnosis of Pathological Vertebral Fractures Caused by Malignant Metastasis in Patients with Vertebral Compression Fractures: A Retrospective Multicenter St

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Purpose: This study aimed to apply and evaluate the

performance of various object detection algorithms in detecting benign vertebral compression fractures and malignant tumors on lumbar spine magnetic resonance imaging (MRI). By improving the early detection of pathological fractures caused by metastatic cancer, this study aims to enhance diagnostic efficiency for medical professionals and contribute to better treatment planning.

Materials and Methods: Patients diagnosed with vertebral compression fractures or spinal metastases based on MRI results from the six affiliated hospitals of the institution from March 2013 to February 2023 were included in the study. The MRI scans included sagittal views of the lumbar spine, with T1- and T2-weighted images. Vertebral bodies with compression fractures or malignant metastasis were annotated according to the reports of radiologists. The dataset was divided into training, validation, and test sets in a 7:2:1 ratio. The object detection models used were YOLOv8, YOLOv11, and DETR. To mitigate differences in MRI resolution across the different exams, the HAT SRx2 model was applied to standardize resolution.

Results: Among the included total of 2,165 patients, 1,742 had benign fractures, and 423 had malignant tumors. A total of 15,975 MRI images were included, including 19,058 vertebral bodies with fractures and 8,485 with malignant tumors. The best-performing model was YOLOv11, which achieved a precision of 91.2, a recall of 92.7, an F1-score of 91.9, and a mean average precision (mAP) of 95.9.

Conclusions: Deep learning algorithms show excellent performance in automatic differential diagnosis between vertebral malignant metastasis and benign compression fracture in MRI, which can help with screening and diagnostic processes.

Keywords: Object detection, Vertebral compression fracture, Malignant metastasis, Deep learning

S081

Sacral Insufficiency Fractures in Postmenopausal Women with Low Back and Buttock Pain: Prevalence and Risk Factor Analysis in 752 Patients

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Purpose: Sacral insufficiency fractures (SIF) are often overlooked as a cause of low back and buttock pain. However, their prevalence and risk factorss have been poorly reassessed in aging populations. This study aimed to evaluate the prevalence and identify the risk factorss of SIF in postmenopausal women within an aging population.

Materials and Methods: A retrospective study included 752 postmenopausal women who presented with vague low back or buttock pain between January 2021 and March 2024. All patients underwent bone scans with single-photon emission computed tomography (SPECT)/CT. Demographic, laboratory, and radiological findings were compared between the SIF and non-SIF groups. Risk factors were analyzed using logistic regression, and the serum vitamin D cutoff value was determined via ROC analysis.

Results: Among 752 patients (mean age: 74.4±8.8 years), 48 (6.4%) were diagnosed with SIF. Univariate analysis identified age ≥80 years, cognitive disorders, compression fractures ≥3, osteoporosis, and lower vitamin D levels as significant risk factorss. Multivariate analysis confirmed age ≥ 80 years (OR=3.736, p=0.043), osteoporosis (OR=2.220, p=0.029), and low vitamin D levels (OR=0.913, p<0.001) as independent risk factors. Vitamin D level ≤20.8 ng/mL was identified as the cutoff for low vitamin D (AUC=0.767). Multiple risk factorss increased SIF prevalence: 1.7% with no risk factorss, 3.7% with one, 11.0% with two, and 31.7% with three (p<0.001).

Conclusions: In an aging society, the incidence of SIF is 6.4%. Key risk factorss include age ≥80 years, osteoporosis, and low serum vitamin D levels (≤20.8 ng/mL). Managing osteoporosis and maintaining serum vitamin D above this threshold are crucial. SIF should be considered in patients with vague low back or buttock pain, especially with risk factorss.

Keywords: Sacral insufficiency fracture, Prevalence, Old age, Osteoporosis, Vitamin D deficiency

S082

Role of Mitofusion 1 in Mitochondrial Quality Control and the Anti-Inflammatory Effects in Nucleus Pulposus Cells during Inflammation-induced Degeneration

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Purpose: Mitochondrial dysfunction is a key driver of intervertebral disc (IVD) degeneration. Therefore, maintaining mitochondrial dynamics, governed by mitofusin (MFN) proteins, is essential for cellular health. Despite the recognized potential of antioxidant therapies, the specific mechanisms influencing mitochondrial function in nucleus pulposus cells (NPCs) under inflammatory stress remain unclear. This study aimed to evaluate the roles of MFN1 and MFN2 in mitochondrial quality control (MQC) and their responses to inflammation and antioxidant treatments, focusing on grades I and III disc NPCs.

Materials and Methods: NPCs were isolated from human IVD tissue and treated with tumor necrosis factor-α (TNF-α) to induce inflammation. The antioxidant effects of Vitamin E and saponin were assessed via quantitative PCR, western blotting, immunocytochemistry, and transmission electron microscopy. For in vivo analysis, MFN1 knockdown NPCs were subcutaneously transplanted into BALB/c nude mice to evaluate the effects of MFN1 suppression on the integrity of extracellular matrix (ECM) under physiological conditions. Statistical analysis was performed to determine significance. Statistical analyses were performed using the paired t-test and the Mann–Whitney U test for parametric and nonparametric data, respectively, with a significance threshold of $p<0.05$.

Results: TNF-α treatment significantly increased the expression of MFN1 and MFN2, MFN1 exhibited a slightly stronger response in grade III disc NPCs than in grade I disc NP cells. Antioxidant treatments with Vitamin E or saponin effectively reduced the expression of these proteins, with Vitamin E exhibiting a more potent anti-inflammatory effect than saponin. Importantly, MFN1 was identified as a key regulator of mitochondrial fusion and ECM integrity under inflammatory conditions. The alterations in mitochondrial morphology and ECM levels were notably more pronounced in grade III disc NPCs than in grade I disc NPCs, reflecting the advanced degeneration in these cells.

Conclusions: MFN1 and MFN2 contribute to mitochondrial dynamics during inflammation, with MFN1 being particularly responsive to inflammatory and anti-inflammatory conditions. Vitamin E showed superior efficacy in mitigating inflammation-induced damage compared to saponin. Therefore, these findings suggest that targeting mitochondrial dynamics, particularly through MFN1 modulation, provides novel therapeutic approaches for degenerative disc disease.

Keywords: Mitochondrial quality control, Nucleus, Pulposus cells, Disc degeneration, Mitofusin

Best Paper Candidates Presentation II (Domestic)

S083

Real-Time Locating System (RTLS) Analysis of Early Postoperative Recovery: A Comparison Between Biportal Endoscopic Spine Surgery (BESS) and Traditional Open Surgery

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Purpose: Although BESS has been reported as advantageous, objective data demonstrating its efficacy beyond subjective patient-reported outcomes remain limited. RTLS, used in hospitals, provides comprehensive, real-time tracking of patients' mobility and activity from admission to discharge through wearable devices, offering a novel approach to objectively evaluating recovery progress. This study aimed to

objectively evaluate early postoperative recovery (first three days) in lumbar spinal stenosis patients using RTLS data as an objective alternative to subjective assessments such as VAS and ODI scores.

Materials and Methods: Between March 2020 and May 2024, RTLS data were collected from patients undergoing decompression or fusion surgery via traditional open surgery or BESS at our institution. Daily activity levels were monitored from surgery until discharge, focusing on early recovery within the first three days postoperatively. Exclusion criteria included patients requiring revision surgery, extended bed rest due to complications (infection or dura tear), or additional orthopedic surgeries within six months. A total of 535 patients were analyzed: 212 underwent open decompression, 158 open fusion, 131 BESS decompression, and 34 BESS fusion surgeries.

Results: By postoperative day 3, RTLS data revealed that patients who underwent BESS exhibited superior mobility compared to those receiving traditional open surgery. The average daily distance traveled was higher in the BESS decompression (4,477.55 m) and BESS fusion groups (4,194.39 m) compared to open decompression (4,039.64 m) and open fusion (3,352.69 m). While the average walking speed was consistent across all groups (0.05–0.06 m/s), the maximum walking speed was notably higher in the BESS groups (2.77 m/s for decompression, 2.66 m/s for fusion) compared to the open surgery groups (2.66 m/s for decompression, 2.46 m/s for fusion). Additionally, the proportion of time spent inactive was lower in BESS patients (75.04% for decompression, 75.23% for fusion) than in the open surgery groups (77.01% for decompression, 78.08% for fusion). Furthermore, the BESS decompression group exhibited a significantly higher percentage of time in active motion (4.55%) compared to the open decompression (3.87%) and fusion groups (3.68% and 3.66%, respectively).

Conclusions: RTLS-based analysis demonstrates that BESS provides superior early postoperative mobility compared to traditional open surgery for lumbar spine conditions. These findings highlight the utility of RTLS in objectively assessing recovery and underscore the advantages of minimally invasive techniques like BESS in promoting early postoperative activity.

Keywords: Real time locating systems, Biportal endsocopic spine surgery, Early postoperative outcomes

S084

Cervical Nerve Root Variations: Observations During Full-Endoscopic Spine Surgery

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Purpose: Cervical nerve root variations are rarely reported compared to the relatively common variations in lumbar spine. We identified confluent or double root, referring to ventral and dorsal roots emerging through separate dural sleeves and joining at dorsal root ganglion. This study aimed to analyze the frequency and characteristics of cervical nerve root variations observed during Posterior Endoscopic Cervical Foraminotomy (PECF) and discectomy (PECD) using Full-endoscope and to evaluate their clinical significance.

Materials and Methods: This retrospective study included 250 patients who underwent PECF or PECD using a Full-endoscope at a single institution between January 2022 and December 2024. Data were collected on sex, age, surgical level, surgical side (right/left), and the presence or absence of nerve root variations.

Results: Among the 250 patients included in this study, the overall incidence of confluent root variations was 13.6% (34/250). For levels, C6-7 showed the highest rate (16.35%), while C4-5 (5.56%) and C5-6 (13.27%) showed lower rates (chi-square p=0.668). Males had a confluent root incidence of 11.36%, while females showed a slightly higher rate of 18.92% (chi-square p=0.301, z-test p=0.215). Regarding sides, the incidence was 14.71% on the left side and 12.28% on the right side (chi-square p=0.802, z-test p=0.660). Although variations were observed, no factors showed statistically significant differences.

Conclusions: Confluent root variations were previously difficult to identify due to the limitations of imaging modalities such as MRI and CT, as well as the constraints of earlier surgical techniques. Due to the limited recognition of cervical nerve root variations in prior literature, this study is significant as it provides the first detailed quantification of these variations, with C6-7 showing the highest incidence (16.35%). These variations are clinically significant as they may be mistaken

for herniated discs or ligamentous structures, potentially leading to iatrogenic nerve root injury. The much closer view of Full-endoscope compared to other surgical techniques (e.g., Microscope, Biportal endoscope) enables more accurate visualization of neural structures, facilitating the identification of these variations and ensuring safe surgical procedures. The limitation of this study lies in the lack of statistical significance in the observed variations. Further studies with larger sample sizes are required to strengthen the conclusions.

Keywords: Cervical nerve root, Full-endoscope, PECF, Confluent root

S085

In Vitro Comparison of Endplate Preparation in Biportal Endoscopic and Microscopic Tubular Transforaminal Lumbar Interbody Fusion Procedures

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Purpose: Successful spinal fusion heavily depends on the condition of endplate preparation in transforaminal lumbar interbody fusion (TLIF). The biportal endoscopic (BE) approach offers a flexible surgical field of view inside the body, allowing for direct visualization of the entire process of endplate preparation. This difference may affect the adequacy and completeness of endplate preparation. We evaluated the adequacy and completeness of endplate preparation in BE- and microtubular (MT) TLIF.

Materials and Methods: Four cadaveric torsos were procured for the study. Three lumbar segments were prepared using BE- and MT-TLIF techniques in each cadaver, totaling twelve intervertebral discs and twenty-four endplates. After completing endplate preparations using each approach, the lumbar spines were excised from the cadaveric torsos. Each disc space of the lumbar spine was dissected and split open in the axial plane at the center to expose the cranial and caudal endplates. These endplates were digitally photographed. A quantitative assessment was performed using digital imaging software to calculate the percentage of prepared endplate area (Prep%), which evaluated the adequacy of endplate preparation by comparing the prepared endplate cross-sectional area to the total endplate area. The entire endplate was divided into a grid of 6×8 pixels to evaluate the completeness of endplate preparation, and each pixel was qualitatively scored on a 4-point scale (0–3 points) based on the extent of bony endplate exposure. Each pixel was then counted based on its score, and the percentage relative to the total number of pixels (Pixel%) was calculated. The difference between the two approaches was then evaluated.

Results: In terms of adequacy of endplate preparation, the Prep% was significantly larger with the BE than with MT approach (55.10%; 44.94%; p=0.001). Notably, when the entire endplate was divided into quadrants for analysis, the BE approach had significantly larger Prep% in the contralateral anterior and contralateral posterior quadrants (p<0.001). In evaluating the completeness of endplate preparation, the Pixel% with complete endplate exposure (3 points) was significantly higher with the BE approach than with the MT approach (15.60%; 5.93%; p<0.001). There was no significant difference in the Pixel% scored as 0, 1, or 2 points (p>0.05).

Conclusions: The results of this study indicate that the BE approach provides significantly greater adequacy and completeness of endplate preparation than provided by the MT approach in TLIF surgery.

Keywords: Endplate preparation, Biportal endoscopic, Microscopic tubular, Transforaminal lumbar interbody fusion

S086

The Natural History of Duchenne Muscular Dystrophy Scoliosis in Corticosteroid era: A mean 15-Year Follow-Up Study

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Purpose: Previous studies have demonstrated that

corticosteroid use significantly decreases the prevalence of scoliosis and the necessity for spinal surgery in patients with DMD. It has also been revealed that the onset of scoliosis is associated with the onset of ambulation loss. However, studies investigating how the onset of scoliosis and progression has changed following the use of corticosteroids are still lacking. This study aims to clarify the natural history of scoliosis in the corticosteroid era through a long-term follow-up investigation of its onset and progression.

Materials and Methods: From 2005 to 2024, corticosteroid therapy with deflazacort was administered to 140 DMD patients who had not been diagnosed with scoliosis. During annual outpatient visits, we evaluated the patient's motor function, measured spinal curve angles using sitting Cobb angles, and documented the curve types.

Results: The mean follow-up period was 15.8±3.4 years, and scoliosis developed in 119 (85%) patients. The curve types were categorized as follows: long thoracolumbar curve in 55 patients, lumbar curve in 50 patients, and thoracic curve in 14 patients. Scoliosis occurred within 3 years after becoming a wheelchair-bound state in 98.3% of the patients. During follow-up, 52 patients (43.7%) were found to have a a final spinal curve of less than 35°. Among the 67 patients with curves measuring between 35° and 50°, surgery was performed in 40 patients, while 27 patients were managed conservatively with observation. Of these 27 patients, 18 did not experience curve progression beyond 50°.

Conclusions: Long-term follow-up of patients with DMD shows that all patients eventually become wheelchair-dependent. After the onset of wheelchair dependency, close monitoring of scoliosis is essential. If scoliosis does not develop within three years, its future development is unlikely. Furthermore, even in cases where the spinal curve exceeds 35°, conservative management without surgery can be considered.

Keywords: Duchenne muscular dystrophy, Neuromuscular scoliosis

Best Paper Candidates Presentation III (Domestic)

S087

Effectiveness in the Referral of Adolescent Idiopathic Scoliosis by Healthcare Professionals: A Single-Center Retrospective Study for Assessing the Role of School-Based Scoliosis Screening in South Korea

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Purpose: To evaluate the effectiveness of scoliosis screening conducted by healthcare professionals (HCPs) by analyzing the appropriateness of referrals compared to those initiated by non-HCPs.

Materials and Methods: We retrospectively reviewed 2,533 scoliosis referrals from the second semester of 2021 through the first semester of 2024. Patients were categorized by referral source: (1) school-based scoliosis screening programs, (2) incidental clinical findings, (3) symptomatic complaints, and (4) recognition by patients/guardians. Each referral was evaluated for appropriateness (appropriate, inappropriate, late). We compared referral volumes over time, assessed curve severity among referral categories, and examined factors influencing late referrals (LR). In addition, we calculated the rate of inappropriate referrals (IR) by referral type and identified predictors of LR specifically in adolescent idiopathic scoliosis cases detected through school-based screening.

Results: Patient and/or guardian's recognition was the main leading cause of inappropriate referrals (IR) (n=184, 49.07%) and LR (n=591, 42.12%), while school-based scoliosis screening program was the primary source of appropriate referrals (AR) (n=340, 35.71%). The relative risk (RR) and attributable risk (aR) for the referral rate of Cobb angle ≥ 25° were 1.12 (95% CI, 1.05–1.19) and 10.52%, respectively. The LR rate was significantly higher in the non-HCP group

(60.62%; 95% CI, 57.47%–63.70%) than in the HCP group (51.99%; 95% CI, 49.10%–54.87%) (p<0.001). The RR and aR for the LR rate were 1.16 (95% CI, 1.08–1.26) and 14.24%, respectively. Compared to the IR by school-based scoliosis screening, the risk showed 2.09 (95% CI, 1.54–2.84) of RR and 52.15% of aR in the incidental findings by clinicians, 2.36 (95% CI, 1.63–3.40) of RR and 57.55% of aR in the symptomatic manifestations, and 2.43 (95% CI, 1.84–3.19) of RR and 58.78% of aR in the recognition by patients and/or their guardians.

Conclusions: School-based scoliosis screening programs demonstrated a significant reduction in inappropriate and delayed referrals compared to other referral patterns. However, in light of the recent trend toward earlier skeletal maturity, our study also suggests the necessity of improving school-based scoliosis screening programs to enhance the early detection of asymptomatic scoliosis.

Keywords: Adolescent idiopathic scoliosis, School-based scoliosis screening, Referral, Health-care professionals

S088

Relationship Between Improvement in Functional Mobility Tests and Spinopelvic Parameters, Patient-Reported Outcomes Following Adult Spine Deformity Surgery

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Purpose: Adult spine deformity (ASD) refers to the abnormal alignment of the spine in adults caused by degeneration. This condition not only leads to back and leg pain but also causes balance problems, resulting in a decline in locomotive function. The purpose of this study is to evaluate the degree of improvement in locomotive function in patients with adult spine deformity using functional mobility test (FMT) before and after surgery. Additionally, we aim to investigate the correlation between the improvement in locomotive function and spinopelvic parameters, as well as patient-reported outcomes (VAS for back pain and leg pain, ODI, EQ-5D).

Materials and Methods: This study included 115 consenting adult spine deformity patients from February 2020 to December 2023. To assess locomotive function, Functional Mobility Tests (FMT), including the Timed Up and Go Test (TUG), Sit-to-Stand Test (STS), and Alternate-Step Test (AS), were conducted both preoperatively and one year postoperatively. The correlations between the degree of postoperative improvement in FMT and spinopelvic parameters (SRS-Schwab modifiers), as well as between FMT improvement and patient-reported outcomes, were analyzed using multiple linear regression analyses.

Results: Compared to preoperative measurements, significant improvements in TUG, STS, and AS were observed one year postoperatively (all p<0.05). In the regression analysis of PROs and FMT, significant correlations were observed between the improvement in TUG, STS, and AS test results and the improvement in ODI (TUG: t=3.240, p=0.002; STS: t=2.729, p=0.007; AS: t=2.615, p=0.010). In the regression analysis of spinopelvic parameter (SRS-Schwab modifiers) improvement and FMT improvement, a significant correlation was observed between the degree of improvement in PI-LL mismatch and the improvement in TUG and AS tests (TUG: t=-2.513, p=0.004; AS: t=-3.462, p<0.001).

Conclusions: In patients who underwent ASD surgery, significant improvements in FMT were observed postoperatively compared to preoperative measurements. The degree of improvement in FMT shows a significant correlation with the degree of improvement in ODI, and there is a significant correlation between the improvement in TUG and AS and the postoperative PI-LL mismatch.

Keywords: Adult spine deformity, Functional mobility test, Locomotive function

S089

Radiographic Progression of Lumbar Degenerative Spondylolisthesis: Natural History and Associated Risk Factors

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Purpose: To evaluate the radiographic progression rate of degenerative spondylolisthesis (DS) and its associated risk factors over a long-term follow-up period.

Materials and Methods: We enrolled patients with DS (at L3-4, L4-5, or L5-S1) who underwent at least five years of follow-up. We evaluated the demographics, comorbidities, smoking history, follow-up duration, and the presence of surgery (after at least 5 years of non-surgical follow-up). The degree of DS was measured using the slippage distance (mm) and Taillard method (%) on the standing plain radiographs. Patients showing a slippage increase of ≥3 mm during follow-up compared to the initial status were classified as progression of DS. The variables were compared between two groups (progression vs. non-progression).

Results: We retrospectively analyzed 76 patients with DS (80 levels) with a mean age at diagnosis of 60.2 years. The mean follow-up period was 104.8 months (minimum 60.7, maximum 239.4). Initial slippage distance averaged 3.9 mm (9.6% of the Taillard method), increasing to 6.7 mm (16.6% of the Taillard method) at the final follow-up. DS progression (≥3 mm increase in slippage distance) occurred in 41.3% (33/80) during follow-up. When comparing the two groups, the progression group exhibited younger age at diagnosis (57.6 vs. 62.1 years, p=0.009), longer follow-up (117.9 vs. 95.6 months, p=0.043), and milder initial slippage (2.3 mm vs. 5.0 mm, p<0.001). Multiple logistic regression analysis identified an initial degree of DS (slippage distance) as the determinant factor, with a cutoff of <4 mm indicating higher progression risk (AUC: 0.751, sensitivity: 81.8%, specificity: 61.7%). An initial slippage of ≥4 mm was associated with a significantly lower risk of DS progression. Kaplan-Meier survivorship curve showed rates of DS progression were 15% at 5 years and 54% at 10 years. Cox proportional hazards modeling confirmed significantly higher progression rates for initial slippage <4 mm (p = 0.011).

Conclusions: The overall rate of DS progression (≥3 mm increased slippage distance compared to initial diagnosis) was 41.3% (33/80). DS progression predominantly occurred in patients with mild initial degree (<4 mm of slippage distance), younger age at diagnosis, and longer follow-up periods. Survival analysis showed a clear distinction in DS progression risk based on the 4 mm threshold of initial slippage distance.

Keywords: Lumbar, Spondylolisthesis, Natural history, Progression, Risk factors

S090

Analysis of Risk Factors for Vertebral Body Subsidence After Oblique Lumbar Interbody Fusion: Extraction of Region of Interest Values for Vertebral Endplate Compartmentalization

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Purpose: After extracting the region of interest values for the vertebral endplate compartments prior to oblique lumbar interbody fusion, this study aimed to determine whether these values are associated with vertebral body subsidence in each compartment postoperatively.

Materials and Methods: We analyzed each surgical segment of 83 patients who underwent oblique lumbar interbody fusion, totaling 190 segments. The lower endplate of the upper vertebra and the upper endplate of the lower vertebra at the surgical segments were divided into 12 zones on preoperative computed tomography scans, and Hounsfield units (HU) were extracted through region of interest settings. At six months postoperatively, computed tomography scans were used to compare the segments with and without implant-induced subsidence in these 12 zones, and a cutoff value was derived using the ROC curve. Additionally, sagittal plane

factors and clinical outcomes were also evaluated.

Results: At six months postoperatively, the average HU of the segments with subsidence was 213.3, whereas it was 295.6 for the segments without subsidence, which showed a statistically significant difference. The proportion of subsidence across different zones was not significantly different, nor was there an association with other sagittal plane angles, patient factors, or bone density in multiple regression analysis. The cutoff value was determined to be 268.6 with an AUC of 0.85.

Conclusions: Vertebral body subsidence following oblique lumbar interbody fusion was not influenced by patient factors, sagittal balance, or bone density, but was significantly associated with the HU values obtained through region of interest settings on the endplate. It is crucial to analyze the endplate using preoperative computed tomography to identify positions with a high likelihood of subsidence.

Keywords: Oblique lumbar interbody fusion, Vertebral body subsidence, Region of Interest, Hounsfield unit

Best Paper Candidates Presentation IV (International)

S091

Circumferential Bioelectronics Enable Spinal Cord Recording and Stimulation Bypass Following Spinal Cord Injury

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Purpose: Spinal cord injury (SCI) is a disabling neurological condition that can lead to irreversible loss of sensory, motor and autonomic functions. Although advances in spinal cord stimulation (SCS) have enabled the restoration of overground walking in patients with SCI via external triggers, this does not constitute true restoration of the patient's volitional motor activity. To truly achieve a closed-loop electronic bypass of SCI to restore volitional motor activity, recording motor signals proximal to the SCI site is essential.

Materials and Methods: By harnessing advances in thin-film bioelectronic devices that closely match the stiffness of neural tissue, we have designed a non-penetrating conformal bioelectronic array capable of interfacing with the spinal cord circumferentially without causing iatrogenic SCI. In this exploratory in vivo study, we firstly implanted the electrode array epidurally around the spinal cord at the T10 vertebral level in adult female rats (Sprague-Dawley, n=16) and recorded the compound action potentials evoked by stimulation of the motor cortex (motor evoked potentials (MEP)) and sciatic nerves (somatosensory evoked potentials (SSEP)). Next, to bypass an SCI site functionally, we implanted recording and stimulation electrode arrays at the T10 and L1 vertebral levels respectively and excised the spinal cord in between. We then produced a low-latency communication between the two arrays using a threshold detection method.

Results: Firstly, we have demonstrated that flexible bioelectronic arrays can be implanted around the spinal cord without causing iatrogenic SCI, enabling comprehensive recording of epidural neural signals circumferentially. These signals can be represented in a topographic heatmap, enriching the analysis of electrophysiological data in both the time and spatial domains. The unique topographic heatmap signatures enabled machine learning modelling of channel activity following SSEP and MEP, achieving 93.5% classification accuracy of stimulation source. The topographic resolution proved sufficient to accurately classify SSEP from sciatic nerve branches with an accuracy of 100%. Secondly, we used the recorded spinal cord signals as triggers as stimulation triggers for spinal cord stimulation using a low-latency communication between 2 arrays above and below a site of SCI.

Conclusions: In this proof-of-concept study, we have demonstrated that interfacing circumferentially around the spinal cord enables the comprehensive spatiotemporal representation of neural signals. This approach represents the next generation of spinal cord neural interfaces, showing that closed-loop bypass of SCI is feasible and can one day restore volitional motor function to patients with paralysis.

Keywords: Spinal cord, Spinal cord injury, Paralysis, Neural interface, Bioelectronics

S092

Tapping the Role of Wnt Signaling for Neural Segeneration in Spinal Cord Injury - A Novel Approach

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Purpose: Spinal cord injury is a major social health burden and the resulting neurological deficits remain unresolved. The complexity of cellular interactions and their response is not completely understood. Wnt signaling plays a vital role in neurogenesis. Studies indicate that Wnt ligands and their antagonists are upregulated post spinal cord injury. Our aim is to identify Wnt signaling molecules critical to facilitate Wnt signaling to function in Pro-neuron and anti-glial mechanism.

Materials and Methods: Neuronal cell lines were obtained from ATCC which were individually tested for the effect of Wnt ligand (Wnt3a and Wnt5a) and Wnt antagonists (DKK1, Ryk, SFRP2, 3 and 4) on their cell fate. The effect of SFRP2 and SFRP4 in the presence of Wnt3a and Wnt5a were also tested. PC12 and SHSY5y neuronal cell lines were maintained in DMEM F12 media with 10% fetal bovine Serum. A panel of Wnt antagonists, including SFRPs, Ryk, Wif1, DKK1 added as recombinant proteins in combination with recombinant Wnt ligand will be tested in the above mentioned cell culture conditions. The treatment will be done for 24-48 hours. These experiments will help us identify the critical inhibitor/antagonist to Wnt signaling for neuron cell fate.

Results: 125pg/ml and 500pg/ml concentration of Wnt3a and Wnt5a respectively increased neuronal proliferation. Treatment with SFRP2 and SFRP4 resulted in significant down regulation of neuronal proliferation. To assess if this reduction in cell proliferation as assessed by Alamar blue assay was because of reduced cell survival, the effect of SFRP2 and SFRP4 on neuronal cell survival was assessed using Acridine Orange and Propidium Iodide staining. The results suggest that SFRP2 and SFRP4 result in increased cell death as seen with decrease number of cells as well as increase in PI positive cells. Subsequently, the effect of SFRP2 and SFRP4 in the presence of Wnt3a and Wnt5a were tested. The SFRP4s were able to inhibit the Wnt ligand induced cell proliferation.The other antagonists had minimal to no effect.

Conclusions: Our results proposes that Wnt ligands and their antagonists (SFRPs) acts as key regulators for neuronal proliferation which could serve as a potential therapeutic target for neural regeneration. Our results suggests that this axis also regulates glial cell fate. Understanding the spatiotemporal regulation of the Wnt axis in the neural-glial interaction would pave way for development of strategies to revert spinal cord injury.

Keywords: Wnt signalling, Spinal cord injury, Neural regeneration, Neural proliferation- Corrected grammatical errors and typographical mistakes

S093

International External Validation of the SORG Machine Learning Algorithm for Predicting Sustained Postoperative Opioid Prescription After Anterior Cervical Discectomy and Fusion Using a Taiwanese Cohort of 1,037 Patients

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Purpose: This study aimed to externally validate the SORG Machine Learning Algorithm (SORG-MLA) for predicting sustained postoperative opioid use following anterior cervical discectomy and fusion (ACDF) in a Taiwanese cohort. The goal was to assess its generalizability across different cultural, regulatory, and demographic contexts.

Materials and Methods: A retrospective cohort of 1,037 patients who underwent ACDF between 2010 and 2018 at a tertiary care center in Taiwan was analyzed. The primary outcome was sustained postoperative opioid

prescription, defined as continuous use of opioids for ≥90 days postoperatively. The SORG-MLA was evaluated for discrimination (AUROC, AUPRC), calibration, overall performance (Brier Score), and clinical utility (decision curve analysis). Data were imputed using the MissForest algorithm, and model predictions were calibrated to align with Taiwan's healthcare system.

Results: The SORG-MLA demonstrated good discriminative ability, achieving an AUROC of 0.78 and an AUPRC of 0.35. Calibration analysis revealed overestimation of prolonged opioid use risks, likely due to disparities in baseline characteristics and opioid use prevalence. The validation cohort had a prolonged opioid use rate of 3.3%, significantly lower than the development cohort's 9.9% ($p < 0.01$). The Brier score (0.033) indicated an 18% improvement over the null model. Decision curve analysis showed net clinical benefits across threshold probabilities, with the uninsured scenario yielding the closest prediction to the observed prevalence. These results underscore the impact of Taiwan's stringent opioid regulations and cultural norms in pain management on model performance.

Conclusions: The SORG-MLA demonstrated robust overall performance and clinical utility in predicting prolonged opioid use in a Taiwanese cohort, despite differences in demographics, medicolegal frameworks, and cultural contexts compared to the U.S. development cohort. However, model recalibration with contemporary data is necessary to address overestimation and enhance accuracy. Integration into electronic healthcare systems for prospective validation could facilitate personalized postoperative pain management and optimize clinical outcomes.

Keywords: Opioid, Anterior cervical discectomy and fusion, External validation, Machine learning, Taiwanese cohort

S094

Short Segment Posterior Fixation Including the Fracture Level Yields Favorable Outcomes in Unstable Thoracolumbar Burst Fractures

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Purpose: To assess surgical, clinical, and radiological outcome in patients treated with short segment posterior fixation including fractured vertebra for unstable thoracolumbar burst fractures

Materials and Methods: 20 patients with single level unstable thoracolumbar fractures underwent short segment posterior fixation including fractured vertebra in National Trauma Center, Kathmandu, Nepal and were followed up for one year from January to December 2021. Demographic, injury, and surgical details were recorded. All patients were analyzed with conventional X-ray to evaluate Cobb angle, anterior vertebral body height (AVBH), retropulsion, and spinal canal width and clinically with Visual Analog Scale (VAS), and Oswestry Disability Index (ODI). Radiological and clinical outcomes were assessed pre- and post-operatively at immediate postoperative, 2 weeks, 1 month, 3 month, 6 months, and 1 year.

Results: Age of the patients ranged from 18-63 years (mean: 33.6±8.75 years). 65% were males and 35% were females. L1 was the most common fractured vertebra. Most common mode of injury was fall from height. Complete neurologic injury was present in 5 patients and remaining had incomplete neurology. Mean pre-operative Cobb angle (26.7±3.70) significantly improved to 8.55±2.15 at final follow up. Mean AVBH, retropulsion, and spinal canal width showed significant improvements post-operatively and were maintained till final follow up. Mean VAS and ODI score at one year were 2.25±0.83 and 25.1±5.87 %, respectively. No neurological improvement was observed in ASIA A patients, while those with incomplete injury showed improvement. No patient needed revision for loss of correction or failure of instrumentation.

Conclusion: Posterior short-segment fixation including the

fractured vertebra for unstable thoracolumbar fractures can correct kyphosis, restore vertebral body height, and avoid the need of anterior reconstruction or long segment fixation. It is safe, feasible, and can achieve favorable clinical outcomes. However, due to paucity of sturdy clinical evidence, these should be corroborated with randomized trials and large registries with long term follow up.

Keywords: Burst, Fixation, Pedicle screws, Short segment, Thoracolumbar

Plenary Lecture II

S095

Transdiscal Osteotomy, Anterior Column Realignment, and Other Alternatives to the Pedicle Subtraction Osteotomy Technique

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For severe kyphotic deformities—including flatback syndrome and chin-on-chest deformity—high-grade osteotomies are often necessary to achieve sufficient correction. Historically, the pedicle subtraction osteotomy (PSO) has been the procedure of choice because its closing wedge configuration enhances stability and can correct deformities by 30 degrees or more. However, clinical experience has led to a significant reduction in the use of PSO in recent years. This shift is partly due to changes in the patient population, such as a decline in cases of ankylosing spondylitis resulting from the use of disease-modifying antirheumatic drugs (DMARDs), and an improved understanding of spinal deformity concepts among surgeons, which has resulted in fewer kyphogenic procedures. Nevertheless, severe kyphosis remains a critical issue, particularly among older patients who have undergone previous spine surgeries that may have resulted in inadequate lordosis, adjacent segment degeneration, or kyphosing fractures. In this presentation, I will discuss alternative surgical strategies for correcting kyphosis, including the Anterior Column Realignment (ACR) procedure, the anterior lumbar interbody fusion (ALIF) procedure, and the Transdiscal Osteotomy technique. I will analyze the specific characteristics of these approaches and outline the clinical scenarios in which each may serve as a superior alternative to PSO.

Keywords: Flatback syndrome, Kyphosis, Osteotomy, Deformity, Spine fusion

S096

Artificial Intelligence in Spine Surgery

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The rapid advancement of artificial intelligence (AI) technology has generated significant excitement and uncertainty across various fields. While many anticipate that AI will profoundly transform human society, with promises of substantial benefits; however, others warn of potential disruption and risks. Concurrently, there remains widespread misinformation regarding emerging AI technologies, particularly neural networks. This presentation aims to clarify essential concepts in artificial intelligence, machine learning, and neural networks, highlighting their applications in image recognition, decision-making processes, and the broader transformation of knowledge-based work. In the context of spine surgery, AI models have already demonstrated significant utility, such as identifying spinal implants, automating patient triage processes, and predicting postoperative complications. This talk will specifically explore the practical integration of large language models into daily spine surgery practices, emphasizing both their current capabilities and limitations. Finally, the discussion will address future directions, urging spine surgeons to develop a comprehensive understanding of large language models' strengths and weaknesses to optimize their potential applications in clinical practice.

Keywords: Artificial Intelligence, Large language model, Spine surgery, Predictive analytics, Image recognition

Invited Lecture V

S097

Lessons Learned from Cervical Disc Arthroplasty

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Abstract: Anterior cervical discectomy and arthroplasty (ACDA) is a motion preserving alternative to anterior cervical discectomy and fusion (ACDF) in properly selected patients. The cervical disc prosthesis was first approved by U.S. Food and Drug Administration (FDA) in 2007. The adoption of cervical disc arthroplasty has been slow with much geographical variation. Although the FDA studies were randomized, potential bias in the study and conflict of interest and other issues were raised. Many surgeons initially saw no benefit in ACDA because ACDF is very good surgery with much longer track record. Some surgeons felt that ASD resulted from the natural history of the disease and that ASD risk was higher with ACDF. Also, ACDF had more favorable reimbursement compared to artificial disc replacement surgery. Some insurers are still reluctant to cover cervical artificial discs or may offer limited reimbursement. While the initial costs associated with an artificial disc replacement procedure might be higher than those of a fusion procedure, cost-effectiveness studies indicate overall cost savings with cervical disc arthroplasty. Long-term study unequivocally showed less adjacent segment disease with ACDA. There may be variation amongst different cervical artificial discs, but compared to ACDF, ACDA maintains greater physiologic range of motion and better cervical spine kinematics. More importantly, most studies report equivalent or favorable clinical outcomes with ACDA compared to ACDF. Data from FDA studies also showed durable cervicogenic headache relief after anterior cervical spine surgery. But a disc migration and delayed osteolysis after ACDA are some of the complications unique to ACDA that the surgeons need to take into consideration. Current clinical study on hybrid surgery is one of the promising types of research that will allow for a more tailored approach to patient care. Prospective randomized studies comparing one artificial disc against another are likely to eliminate inferior devices. As the disc technology improves, treatment guidelines will evolve to incorporate new evidence on when and how to use cervical artificial discs. This will result in more nuanced and personalized treatment plans. Newer-generation artificial discs will be introduced and the advances will expand the indications for artificial disc replacement, making it a viable option for a broader range of patients. This field will evolve to the point where cervical disc arthroplasty, and not ACDF, will be the standard of care for most patients with cervical degenerative disc disease.

Keywords: Cervical disc arthroplasty, Adjacent segment disease, Cost effectiveness, Osteolysis, Cervicogenic headache, Hybrid surgery

Best Paper Candidates Presentation V (International)

S098

Evaluation of Osteoporosis and Sarcopenia on Outcomes of Fusion in MIS-TLIF

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Purpose: Aging populations are experiencing an increasing prevalence of lumbar degenerative disease; lumbar decompression and fusion surgery is an effective surgical option. There has also been increasing recognition of geriatric giants such as osteoporosis and sarcopenia. Prior studies found low Hounsfield unit (HU) on CT scans of the instrumented vertebrae (suggestive of osteoporosis) to be associated with increased screw cut-out and cage subsidence. Poor paraspinal musculature has also been associated with increased prevalence of spinal disease, back pain and poorer post-operative patient reported outcome scores. However, there has been limited evaluation on how these factors influence radiological fusion. Hence, this study aims to evaluate whether sarcopenia and osteoporosis

affect radiological fusion and the outcomes of lumbar fusion surgery.

Materials and Methods: Retrospective analysis was performed of patients who underwent single-level minimally-invasive transforaminal lumbar interbody fusion (MIS-TLIF) during the period of January 2011 to January 2015, and had perioperative CT and MRI of the lumbar spine, with at least 2 years of follow-up. For all patients, a A PEEK cage was inserted into the disc space and packed with autologous bone graft. HU on perioperative CT of the instrumented vertebra bodies were measured and averaged, as a surrogate marker for osteoporosis. Goutallier classification of paraspinal musculature and lumbar indentation value (LIV) were measured on perioperative MRI as a marker of sarcopenia. Clinical outcomes assessed at 6 months, 1 and 2 years included the Visual Analogue Score (VAS) for back and lower limb pain, Oswestry Disability Index (ODI), and Bridwell grading for radiological fusion.

Results: 88 patients were included with mean age 58.5+/-9.58 years, mean BMI 25.6±4.46 kg/m2, 69.3% female. 67 patients (76.1%) achieved fusion at 6 months and all achieved fusion at 2 years. There was no difference in ODI and VAS scores between those who did and did not achieve fusion at 6 months. Mean HU was 155±70.3. Using a HU cutoff of 100 for osteoporosis as per existing literature, there was no difference in radiological fusion, ODI and VAS scores between the two groups at 6 months and 2 years ($p>0.05$). Fatty atrophy of the paraspinal muscles and small LIV did not affect radiological fusion either.

Conclusions: Previously described radiological parameters for osteoporosis and sarcopenia were not associated with achieving radiological fusion. This may suggest that sarcopenic and osteoporotic patients can achieve spinal fusion with appropriate surgical technique.

Keywords: Fusion, Lumbar, Osteoporosis, Sarcopenia

S099

Intraoperative Neuromonitoring Use in Posterior Endoscopic Cervical Decompression: Can It Reduce Complications?

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Purpose: Posterior endoscopic cervical decompression (PECD) become a widely recognized procedure to relieve pressure on the cervical exiting nerve root and spinal cord, potentially leading to improvements in patient symptoms with minimally invasive techniques. However, anatomical considerations and the "high-risk" nature of the cervical spine still presents challenges for surgeons. The routine use of intraoperative neuromonitoring (IONM) currently remains debatable, despite its ability to provide additional real-time neurological observation beyond standard practice. This study aimed to address the challenges and explore potential solutions for improving IONM utilization.

Materials and Methods: In this retrospective cohort control study, we investigated the clinical data of 140 patients with singlesegment cervical spondylotic radiculopathy (CSR) or herniated nucleus pulposus (HNP) from 2020 to 2023. Seventy patients underwent PECD with IONM (IONM group), whereas the remaining 70 patients did not undergo IONM. For both groups, neurological status, IONM data, duration of surgery, and complications were recorded. The curative effect was assessed based on the Neck Disability Index (NDI), the Visual Analog Scale (VAS) for arm and neck discomfort, and the modified MacNab criteria at 3, 6, and 12 months follow-up.

Results: Seventy patients diagnosed with unilateral single-segment CSR or HNP underwent neuromonitoring; 60 patients showed amplitude of motor-evoked potentials (MEP) decreased in IONM, whereas ten did not. Despite this, all 140 patients in both groups experienced postoperative neurological improvement, with significant enhancements in the VAS, NDI, and modified MacNab criteria scores ($p< 0.01$); the greatest improvement was observed at 12 months.

Conclusions: IONM alarms enables early detection and mitigation of potential complications, reducing the need for revision surgery and ensuring patient safety, enhancing surgical decision-making, and strengthening surgeon confidence. Continued advancements in IONM technology hold promise for further optimization of orthopaedic surgical outcomes.

Keywords: Monitoring intraoperative, Cervical vertebrae, Surgical endoscopy

S100

Outcome of Posterior Short Segment Fixation with and Without Index Screws in Thoracolumbar Burst Fractures

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Purpose: To compare the radiological and functional outcome of posterior fixation with and without index screws for thoracolumbar burst fractures (AO Types A3 and A4).

Materials and Methods: Thirty six patients with thoracolumbar burst fractures (AO types A3 and A4) were randomized into 2 groups with equal number of patients. In short segment fixation (SSF) group, patients were treated by segmental posterior instrumentation with 1 level above and 1 level below the fracture level. In short segment fixation with index screws (SSF+IS) group, they were treated as in SSF with index level screws incorporation. Clinical and radiologic parameters were evaluated before surgery, after surgery, and at follow-up (6 weeks, 3 months and 6 months).

Results: Patients' characteristics as well as fracture morphology variation between the two study groups were statically quite comparable. In SSF group, the mean pre-operative Cobb's angle was 24.17±1.69.This improved significantly 1.33±3.19 after post-operative period. The Cobb's angle at final follow up was 3.44±3.69. There was significant correction and maintenance in the SSF group. In SSF+IS group, the mean pre- operative Cobb's angle was 24.56±1.85. This improved to 0.83±2.17 after post-operative period. The Cobb's angle at final follow up was 1.83±2. This maintained the correction significantly in the SSF+IS group. There was no significant difference between the two groups ($p=0.23$) at 6th month follow up. The mean AVH was 61.89±5.1 in SSF group and 60.17±5.63 in SSF+IS group pre-operatively. The AVH was restored significantly in both groups post-operatively (87±4.81 in SSF and 91±4.61 in SSF+ IS group). AVH was better maintained at 6th months by adding the index screws in fracture fixation 83.2±5.94 in SSF group and 88.5±4.24 in SSF+IS group). This was statistically significant result ($p=0.003$). The post-operative ODI was significantly improved after operation in each group.

Conclusions: Both SSF and SSF+IS allow the safe and significant correction of deformity in single level thoracolumbar burst fracture (AO type A3 and A4). Reinforcement with index screw fixation can maintain the vertebral body height and while restoring the stable posterior construction. The functional outcomes improvements at 6th months follow up are no difference between the groups.

Keywords: Posterior short segment fixation, Index screws, Thoracolumbar, Burst fractures

S101

Is C2 Translaminar Screw Feasible in Nepalese Population? A Morphometric Study of C2 Lamina Using Computed Tomography in Nepalese Adults

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Purpose: C2 translaminar screw fixation has been described as an alternative procedure to other C2 screw techniques with the added advantages of decreased risk of vertebral artery injury. It is also safe, easily accessible and technically less demanding. It does not require intraoperative neuro-

navigation or fluoroscopy and no restriction is imposed by the anatomy of the vertebral foramen, pedicle or pars. However, there are considerable morphological differences in C2 lamina among individuals, so a thorough knowledge of C2 lamina anatomy is essential to avoid complications during screw fixation. Chan's criterion is used to determine feasibility of screw placement based on the morphometry. This study aims to analyze morphometric variations of C2 lamina in Nepalese population by use of CT scan and thus evaluate the feasibility of C2 translaminar screw fixation.

Materials and Methods: This was a descriptive cross-sectional study done in Bharatpur Hospital from September 2024 to November 2024 among 140 patients aged 18-60 years undergoing CT scan of head or cervical spine for any causes. Patients with congenital anomalies of C2 vertebra, abnormalities of C2 lamina like fracture, infection, tumor, osteophytes or rheumatoid arthritis, CT images with artifact or poor quality and prior history of upper cervical spine surgery with instrumentation or laminectomy were excluded from the study. Continuous variables were summarized using mean and standard deviation. Independent t-test was used to determine the mean difference in different measurements among males and females.

Results: Among 140 cases, the majority were male (70%). Most of the cases were from middle age group (range 30-40 years) with mean age of 31.12±12.85 years. The mean inner diameter was 3.92±0.54 mm on right side and 3.94±0.53 on left. The mean outer Diameter was 6.38±0.91 mm (right) and 6.37±0.84 mm (left). The mean laminar height was 10.96±1.60 mm (right) and 10.98±1.69 mm (left). There was significant gender difference in laminar height on both right (p=0.022) and left side (p=0.043). There was also significant gender difference in spinolaminar angle on the left side (p= 0.02) i.e. 49.73±2.61 degrees (males) vs 45.92±3.14 degrees (females).

Conclusions: C2 laminar screw fixation is feasible in most of our population but each patient should be individualized and thorough study of preoperative CT scan is necessary before planning surgery.

Keywords: C2, C2 lamina, Translaminar screw, Nepalese population

Best Paper Candidates Presentation VI (International)

S102

Augmented Reality in Spine Surgery

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Purpose: Traditionally, minimally-invasive spine surgery utilises intra-operative image intensifier to guide placement of percutaneous transpedicular screws. CT-based navigation techniques have been increasingly popular, especially so for patients with potentially challenging screw trajectories, to reduce the risk of pedicle breach, as well as nerve, dural, or vascular injury, while reducing radiation exposure to the surgical team. Augmented reality (AR) spine surgery is a form of CT-based navigation that enables the surgeon to visualise their pedicle screw trajectory through optical see-through head-mounted displays. This paper aims to present our institution's experience with AR spine surgery, highlighting the user experience and common pitfalls, so as to guide other surgeons in the use of AR in spine surgery.

Materials and Methods: At our institution, we utilise the VisAR navigation system for AR spine surgery. Adequate preparation is key, and involves having access to intra-operative cone-beam CT to acquire 3D imaging of the spine that is utilised by the VisAR system as well as acquiring of navigation frames. Prior to starting a surgeon's first case, starting with non-AR navigation cases would help flatten the learning curve. Dry runs with involved personnel can aid with smoothing of workflows. Technical steps involved in AR spine surgery include insertion of the navigation frames, optimising spin of the intra-operative CT to ensure capturing of the navigation frame and required spinal levels. This is followed by registration of the navigated needles, optimising the view when inserting the needle into the pedicle, and finally confirmation of screw placement on check radiographs. Extended indications beyond using AR for pedicle screw placement include guiding the direction

of interbody cage placement, use as an educational tool for trainees, and better 3D visualisation of spinal deformity that can be projected over uncut soft tissue.

Results: A total of 13 patients underwent VisAR navigated one or two-level MIS-TLIF. A total of 25 spinal levels were operated on. There was no incidence of improper placement of pedicle screws leading to nerve injury.

Conclusions: The use of AR for spine surgery has potential benefits of improving accuracy of pedicle screw placement and reducing radiation exposure to the surgical team. However, challenges including the learning curve for new technology, along with hardware and software hiccups prevail, and need to be adequately addressed before AR spine surgery becomes ubiquitous in the operating room.

Keywords: Augmented reality, TLIF, Lumbar, Education

S103

Efficacy and Safety Of Preemptive Intravenous Dexamethasone in MIS-TLIF: Double-blinded, Randomized Controlled Trial

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Background: Enhancing postoperative outcomes after minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF) using preemptive intravenous dexamethasone administered preoperatively. The primary objective was to determine whether dexamethasone improves postoperative clinical outcomes with minimal adverse effects, particularly on fusion status.

Objective:

- Postoperative visual analog scale (VAS) scores at rest and during motion at 24 hours, 2 weeks, 6 weeks, and 12 weeks
- Mean morphine-equivalent opioid consumption Comparison of side effects between groups (surgical site infection, hyperglycemia, nausea/vomiting)
- Length of stay
- Fusion status at 1 year

Study Design: double-blinded, randomized controlled trial

Methods: Patients undergoing primary MIS-TLIF for spinal stenosis, spondylolisthesis, or degenerative disc disease were randomized to receive either preemptive intravenous dexamethasone (0.15 mg/kg, max 12 mg) or placebo preoperatively. Postoperative assessments included VAS scores for pain at rest and during motion, morphine consumption, postoperative nausea, blood glucose levels, surgical site infections, total length of stay, and spinal fusion status, with data collected up to 1 year.

Results: Sixty patients were included in the study, with 30 patients in each group. There were no statistically significant differences between the two groups regarding age, sex, diagnosis, BMI, preoperative VAS scores (rest and motion), or preoperative blood glucose levels. Postoperative VAS scores at rest and during motion were significantly lower in the dexamethasone group at 24 hours postoperatively ($p=0.001$ for both) but showed no differences from 2 weeks to 12 weeks postoperatively. Morphine consumption and nausea were significantly lower in the dexamethasone group ($p=0.001$ for both). Length of stay, surgical site infections, serum glucose levels ($p=0.82$), and fusion rates (96.7% in both groups, $p=1$) showed no significant differences.

Conclusions: Preemptive intravenous dexamethasone for patients undergoing MIS-TLIF statistically reduces postoperative pain at rest and during motion, morphine consumption, and postoperative nausea compared to placebo. It was well-tolerated with a favorable safety profile and does not affect fusion status.

Keywords:

S104

Beyond the Operating Room: The Impact of Biopsychosocial Factors on Lumbar Surgery Outcomes

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Purpose: Decompression with or without fixation, represents the mainstay of surgical treatment for Lumbar Canal Stenosis (LCS). Patient satisfaction post-op depends on various clinical and radiological indicators, smoking, obesity, and medical comorbidities. Despite accounting for these, patient satisfaction remains suboptimal. Evidence suggests

biopsychosocial factors are linked to lumbar surgery outcomes. Numerous studies have examined pre-operative predictors that influence surgical outcomes in LCS.

Materials and Methods: Study design - Prospective observational study. A 6-month follow-up was conducted on 53 LCS patients undergoing lumbar decompression with or without fusion. Outcomes were measured pre-operatively, and 3- and 6-months post-op, using Zurich Claudication Questionnaire (ZCQ), Short Form-36 Survey (SF-36), and Depression, Anxiety and Stress Scale-21 (DASS-21). Six months post-surgery, patients were categorized as satisfied or dissatisfied based on surgical outcomes, using a ZCQ satisfaction subscale cutoff of 2.5. Relationship between baseline factors and patient satisfaction was analysed.

Results: Six months post-operatively, 15 (28.3%) and 38 (71.7%) patients were classified as dissatisfied and satisfied respectively. Baseline symptom severity ($p<0.001$), physical function ($p<0.001$), vitality ($p<0.001$), mental health ($p<0.001$), and depression ($p=0.046$) were associated with patient satisfaction, while role limitations due to emotional problems ($p=0.071$), social functioning ($p=0.710$), anxiety ($p=0.055$), and stress ($p=0.134$) were not.

Conclusions: Worse preoperative scores for symptom severity, physical function, vitality, mental health, and depression are linked to patient dissatisfaction. Biopsychosocial factors measured by PROMs may be included in the pre-operative assessment of patients with LCS to guide surgical candidacy and outcome. Integrating biopsychosocial factors into preoperative assessments and postoperative care can enhance patient-centred care and improve surgical outcomes. Failure to identify and address biopsychosocial issues can undermine even the most meticulous surgery.

Keywords: Lumbar spine, Spinal stenosis, Patient Satisfaction, Biopsychosocial model, Decompression, Surgical

S105

Prevalence and Impact of Incidental Thoracic Spinal Stenosis in Patients Undergoing Lumbar Fusion Surgery

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Purpose: This study aims to investigate the prevalence and impact of incidental thoracic spinal stenosis in patients undergoing lumbar fusion surgery. Thoracic myelopathy is rare, with few degenerative changes occurring in the thoracic spine due to the restricted range of motion surrounding the rib cage. TSS can present with symptoms including back, pelvic, or leg pain and neurological deficits such as gait disturbance, motor/sensory loss, or bowel/bladder dysfunction. However, these symptoms often imitate those of cervical or lumbar spinal disorders, and thus, thoracic myelopathy is frequently overlooked. This may result in delayed treatment and suboptimal outcomes in lumbar fusion.

Materials and Methods: A retrospective study was performed on 300 patients who underwent lumbar fusion surgery from 2017 to 2023, with preoperative magnetic resonance imaging (MRI) images and reports analysed to look out for concomitant TSS. Subsequently, a matched analysis was performed comparing two groups. Group A, had 15 patients, with pre-existing TSS, and Group B, with no pre-existing TSS. Both groups were matched according to number of levels of lumbar fusion. Clinical assessment was performed two years postoperatively, with a numerical rating scale of back pain, lower limb pain, and lower limb numbness. Modified North American Spine Society (NASS) Low Back Pain Outcome Instrument was also collected. Independent t-test was used for the comparison of variables.

Results: 300 lumbar fusion surgeries were performed by 6 specialist Orthopaedic spine surgeons between 2017 and 2023. 15 of these 300 patients (5%) had pre-existing TSS. Matched by levels of fusion, postoperative two-year follow-up showed no significant difference in improvement in back pain (A:50% vs B:58%, $p=0.28$), lower limb pain (A:39% vs

B:62%, p=0.05), lower limb numbness (A:28% vs B:35%, p=0.32), NASS back pain disability (A:28% vs B:40%, p=0.11), and NASS neurogenic symptoms (A:31% vs B:40%, p=0.15). However, Group A demonstrated significantly lower NASS satisfaction scores than Group B (A:52% vs B:89%, p=0.01).

Conclusions: Patients with pre-existing TSS have comparable lumbar fusion outcomes to those without pre-existing TSS. Notably, patients with pre-existing TSS have poorer NASS satisfaction scores. Larger data sets may reveal clearer results regarding the underlying cause of the poor satisfaction scores. Concomitant TSS remains an important part of the preoperative assessment in patients undergoing lumbar fusion, given the high possibility of thoracic myelopathy being overlooked.

Keywords: Thoracic stenosis, Thoracic myelopathy

Symposium (III) Lumbar: Lumbo-Pelvic-Hip Complex

S106

Anatomical Characteristics and Functional Significance of the Pelvis

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Background and Introduction: The pelvis and sacrum constitute a critical anatomical and biomechanical unit that plays a pivotal role in load distribution, stability, and movement. The sacrum, a wedge-shaped bone at the base of the spine, articulates with the ilium bilaterally to form the sacroiliac joint, which is essential for load distribution and lumbo-pelvic stability. Understanding the anatomical characteristics of these structures is crucial for spine surgeons, particularly in the context of degenerative diseases, deformities, trauma, and surgical interventions involving the lumbopelvic region.

Main Body: It is important to understand the anatomical characteristics and functional significance of the pelvis and sacrum, emphasizing their structural composition, ligamentous support, and articulation with the lumbar spine and lower extremities. It is also important to understand the functional implications of sacropelvic anatomy in various pathological conditions. Conditions such as sacroiliac joint dysfunction, lumbosacral instability, and spinopelvic malalignment can significantly impact a patient's functional capacity and quality of life. Special attention will be given to the role of sagittal balance and pelvic parameters, including pelvic incidence, sacral slope, and pelvic tilt, in spinal deformity correction and surgical planning. Additionally, the concept of hip-spine syndrome will be discussed, emphasizing the interdependent relationship between the lumbar spine and hip joint. This syndrome, characterized by concurrent spinal and hip pathology, underscores the importance of evaluating both regions in patients presenting with lower back and hip pain. Understanding how pelvic parameters influence both lumbar spine alignment and hip mechanics is essential for accurate diagnosis and treatment planning, particularly in cases of spinal fusion, total hip arthroplasty, and degenerative joint disease.

Conclusions: The pelvis and sacrum play a fundamental role in spinal biomechanics and stability. Understanding their anatomical and functional significance is essential for optimizing surgical outcomes. Pelvic parameters are a very important concept to understand in thoracolumbar surgery. Pelvic tilt (PT) >20°, and PI-LL mismatch >9°, and C7 Sagittal vertical axis (SVA) >5 cm are all independently associated with poor surgical outcomes, so they should be considered when performing thoracolumbar surgery.

Keywords: Pelvis, Lumbo-pelvic stability, Pelvic parameters, Hip-spine syndrome, Sagittal alignment.

S107

Alignment and Biomechanical Relationships Among the Lumbar Spine, Pelvis, and Hip Joint

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Background and Introduction: The relationship between the lumbar spine, pelvis, and hip joint plays a critical role in

maintaining sagittal balance and overall musculoskeletal function. The concept of Hip-Spine Syndrome highlights the close biomechanical interconnection between these regions, where pathology in one structure can significantly affect the alignment and function of the others. However, despite increasing awareness, the interdisciplinary approach to addressing these complex interactions remains underutilized.

Main Body: Pelvic incidence (PI) is a fundamental anatomical parameter that governs the sagittal alignment of the spine and influences both lumbar lordosis (LL) and acetabular cup orientation. Alterations in spinal alignment, such as decreased lumbar lordosis or increased sagittal vertical axis (SVA), can lead to compensatory pelvic retroversion and changes in acetabular coverage, which may accelerate hip osteoarthritis (OA) progression. Conversely, hip joint pathologies, especially in advanced stages, can impair pelvic retroversion and further exacerbate global sagittal malalignment. Clinical evidence suggests that patients with bilateral congenital hip dislocation or advanced hip OA frequently exhibit anterior pelvic tilt and hyperlordosis as compensatory mechanisms. Additionally, musculoskeletal modeling studies have demonstrated that higher SVA correlates with increased hip joint contact forces, potentially contributing to hip OA progression. In the context of total hip arthroplasty (THA), understanding spinopelvic alignment is essential, as increased pelvic tilt and PI-LL mismatch can affect component positioning and increase the risk of postoperative impingement and dislocation. Therefore, interdisciplinary evaluation between spine and hip surgeons is crucial in patients with combined spinal and hip pathologies to optimize surgical outcomes and prevent complications.

Conclusions: The alignment and biomechanical relationship between the lumbar spine, pelvis, and hip joint are deeply interconnected. A comprehensive understanding of these interactions is essential for accurate diagnosis, treatment planning, and surgical decision-making. An interdisciplinary approach involving both spine and hip surgeons is necessary to achieve optimal outcomes in patients with hip-spine syndrome and complex musculoskeletal disorders.

Keywords: Spinal alignment, Pelvic incidence, Hip-spine syndrome, Hip osteoarthritis, Interdisciplinary approach, Spinopelvic balance

S108

The Impact of Pelvic Imbalance on Lumbar Spine and Lower Limb

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Background and Introduction: Pelvic imbalance, characterized by deviations in pelvic orientation such as anterior or posterior tilt, significantly influences the biomechanics of the lumbar spine and lower limbs. These alterations can disrupt normal spinal curvature and lower limb alignment, potentially leading to musculoskeletal disorders. Understanding the biomechanical and clinical implications of pelvic imbalance is essential for improving diagnostic and therapeutic approaches.

Main Body: Pelvic imbalance can alter lumbar lordosis, pelvic tilt, and sacral slope, contributing to sagittal imbalance. This imbalance often leads to compensatory knee flexion and hip adjustments to maintain an upright posture, potentially increasing stress on the musculoskeletal system. Anterior pelvic tilt increases lumbar lordosis, an exaggerated inward curvature of the lower spine. This condition, also known as lumbar hyperlordosis, can result from factors such as tight hip flexors, weak abdominal muscles, or prolonged sitting. Increased lumbar lordosis places additional stress on the posterior elements of the spine, potentially leading to lower back pain and nerve impingement. Conversely, posterior pelvic tilt can flatten the lumbar spine's natural curve, leading to lumbar hypolordosis. This reduction in curvature may cause a narrowing of the intervertebral foramina, increasing the risk of nerve compression and associated pain. Lateral pelvic tilt often results from leg length discrepancies or muscle imbalances. This asymmetry can lead to compensatory scoliosis and uneven loading of the lower limbs, increasing the risk of joint degeneration and musculoskeletal pain. Additionally, restricted hip mobility and muscle weakness exacerbate pelvic asymmetry, impacting gait patterns and overall functional performance. Studies indicate that individuals with chronic LBP exhibit significantly increased pelvic tilt compared to asymptomatic individuals, reinforcing the importance of targeted

rehabilitation strategies to restore pelvic alignment. Pelvic imbalances also influence the function of the sacroiliac joints. Dysfunction in these joints can cause pain and instability, further affecting lumbar spine mechanics and lower limb function.

Conclusions: From a surgical perspective, addressing pelvic imbalance is crucial in spinal deformity correction procedures, including osteotomies and spinal fusion. Proper alignment of the pelvis during surgical planning ensures optimal postural correction and reduces postoperative complications. Restoration of pelvic parameters, particularly pelvic tilt and sacral slope is essential to achieving long-term functional outcomes.

Keywords: Pelvic imbalance, Lumbar spine, Lower limb, Alignment, Biomechanics

S109

The Effect of Lower Limb Imbalance on Lumbar Spine

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Background and Introduction: The biomechanics of the human body are intricately connected, with the lower limbs playing a pivotal role in maintaining postural alignment and distributing mechanical loads during locomotion. Imbalances in the lower limbs, including discrepancies in length, muscle strength, or joint alignment, can lead to compensatory changes throughout the kinetic chain. These compensations often manifest in the pelvis and lumbar spine, potentially contributing to chronic low back pain and degenerative spinal conditions. Understanding the relationship between lower limb imbalance and lumbar spine mechanics is essential for accurate diagnosis and effective treatment planning.

Main Body: Lower limb imbalances may arise from congenital factors, acquired musculoskeletal disorders, or post-traumatic conditions. Leg length discrepancy (LLD), in particular, is a well-documented contributor to pelvic obliquity, which in turn affects the alignment of the lumbar vertebrae. Muscle imbalances, such as asymmetrical activation of the gluteal or hamstring muscles, further compound these effects by altering gait dynamics and lumbar loading patterns. Additionally, structural deformities or joint pathologies in the hip, knee, or ankle can result in altered ground reaction forces, influencing spinal curvature and intervertebral disc pressures. Studies utilizing gait analysis, radiographic imaging, and finite element modeling have demonstrated how these biomechanical alterations correlate with lumbar spine degeneration, scoliosis, and facet joint overload.

Conclusions: Lower limb imbalance significantly influences lumbar spine mechanics and should be considered in the evaluation and management of spinal disorders.

Keywords: Lower limb imbalance, Lumbar spine, Pelvic alignment, Biomechanic

Invited Lecture VII

S110

Solid Rod Tether for Thoracic Scoliosis? An Analysis of Progressive Curve Straightening Behaviour in Anterior Thoracic Spinal Fusion

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Spinal fusion for deformity correction occurs at the expense of growth post-instrumentation while VBT allows non-fusion deformity correction, with risks of revision for tether breakage, curve undercorrection and overcorrection. Progressive curve straightening can occur in anterior single rod fusion in skeletally immature patients, similar to growth modulation with vertebral body tethering (VBT) for thoracic adolescent idiopathic scoliosis (AIS). AIS Lenke 1 thoracoscopic assisted single rod anterior fusions from 2000-2013 in females aged 11-20 years were reviewed, with minimum 5-year follow-up. Patients with Risser scores 0-3 at time of surgery (Group 1) were compared to those with Risser scores 4-5 (Group 2) for Cobb angle changes over time, complications and re-operations. Group1 (n=19) and

Group 2 (n=20) patients had similar preoperative coronal and sagittal radiological parameters. Preoperative main thoracic curves were 48.6°±13.2° (Group 1), and 45.3°±7.9° (Group 2) (p=0.338). Mean Risser grade was 2.4±1.0 in Group1 and 4.0±0.0 in Group 2 (p<0.001). Postoperative instrumented thoracic curves were 10.7°±4.5° (Group 1), and 10.2°±5.4° (Group 2) (p=0.745). 15 patients (79%) in Group1 and 4 patients (20%) in Group2 had further curve straightening of more than 5° compared to their first postoperative erect radiograph (OR 3.9; 95% CI 1.6-9.8; p<0.001). Mean follow-up was 96 months (range 63-180 months). Curve straightening occurred progressively up to 5 years postoperatively in Group 1, and 1 year in Group 2. 7 patients (6 in Group1, 1 in Group 2) had mild overcorrection (p=0.044). One patient required re-operation (from Group 2 for rod breakage). Adding-on and correction loss (>5°) rates were similar. Anterior single rod thoracic fusion behaves like a solid rod tether in skeletally immature patients, showing progressive curve straightening and mild overcorrection. This may be a useful alternative to VBT in growing patients with larger curves to avoid under-correction and tether breakage.

Free Paper: Deformity (5)

S111

Evaluating the Efficacy and Safety of Halo-Femoral Traction and Halo-Gravity Traction Techniques in Severe Kyphoscoliosis with Spinal Cord Risk Classification (SCRC) Type 3 over the Apex.

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Purpose: To analyze the efficacy and safety of Halo-femoral traction (HFT) following spinal release, and preoperative Halo-gravity traction (HGT) in patients with severe spinal kyphoscoliosis and spinal cord risk classification (SCRC) type 3 at the apex.

Materials and Methods: A total of 73 patients (24 males, 49 females, mean age 22.4±6.4 years) and 56 patients (15 males, 41 females, mean age 22.9±10.4 years) were included in the HFT and HGT group, respectively. Radiographic parameters were measured at the initial assessment, post-traction, post-final surgery, and during each follow-up. Neurologic function was assessed using the Frankel score system. IONM alerts and all complications were documented. Quality-of-life was evaluated using the SF-36 questionnaire.

Results: In the HFT vs. HGT group, the total correction rates were 39.9±7.2% vs. 41.3±6.8% for the major Cobb and 36.6±9.3% vs. 44.4±9.2% for global kyphosis (GK) after final surgery, respectively. The traction contributions were 57.6±11.1% vs. 52.3±9.3% for major Cobb and 70.1±10.5% vs. 63.9±11.1% for global kyphosis (GK), respectively. More than half of the total correction can be achieved gradually and safely through preoperative traction with patients in an awake state. No deterioration in neurological function was found post-final surgery. During the last follow-up, SF-36 questionnaire scores improved significantly in both groups (p<0.05).

Conclusions: Significant outcomes can be expected in patients with severe kyphoscoliosis, even with spinal cord risk classification (SCRC) type 3 at the apex undergoing HFT and HGT.

Keywords: Halo-femoral traction, Halo-gravity traction, Severe kyphoscoliosis, Spinal cord risk classification (SCRC), Type 3 spinal cord

Fig. 1. A patient undergoing HFT is presented. An 18-year-old female was diagnosed with severe adolescent idiopathic scoliosis **(A, B)**, with SCRC type 3 over apex **(I)**, and the bending films showed a rigid curvature **(C)**. The patient underwent a first-stage procedure involving the posterior pedicle screw insertion and multiple-level Ponte osteotomies around the apex **(D)**. After two weeks of supine halo-femoral traction in bed, the second-stage posterior spinal correction and fusion were performed **(E, F)**. At the 2-year follow-up, the correction was well maintained with no evidence of correction loss **(G, H)**.

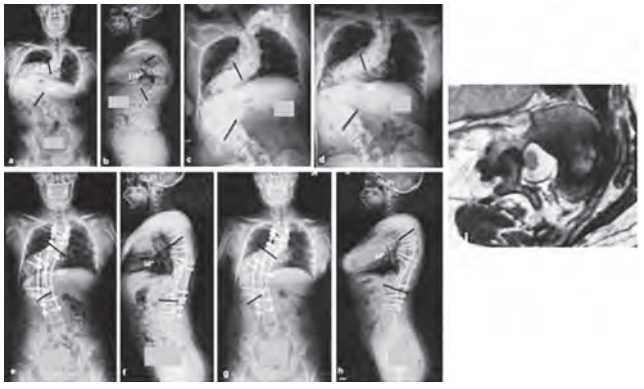

Fig. 2. A patient undergoing HGT is presented. A 24-year-old female was diagnosed with severe neuromuscular kyphoscoliosis **(A, B)**, with SCRC type 3 over apex **(I)**, and the bending films showed a rigid curvature **(C)**. The patient underwent preoperative HGT for two months **(D)**, followed by posterior spinal correction and fusion with multiple-level Ponte osteotomies around the apex **(E, F)**. At the 2-year follow-up, the correction was well maintained with no evidence of correction loss **(G, H)**.

S112

Curve Regression in Mild Adolescent Idiopathic Scoliosis Treated with Periodic Padding Adjustment with Rigo-Cheneau Orthosis

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Purpose: To determine the effect of periodic adjustment with the Rigo-Cheneau Orthosis in patients with mild adolescent idiopathic scoliosis.

Materials and Methods: 69 patients with mild idiopathic scoliosis were treated with bracing, 13 with a Boston-style underarm orthosis, and 53 were treated with the Rigo-Cheneau Orthosis (RCO) with periodic padding adjustment. Brace treatment was started at 12y±1 years old with 98% (n=68) of patients having a Risser grade of 0-3.

Results: Curve regression of at least 5 degrees was observed in 55.36% (n=31) of patients treated with the RCO. Curve maintenance or change within 5 degrees was seen in 39.3% (n=22) and 23% (n=3) in the RCO and Boston orthosis group respectively. Curve progression was 5.36% (n=3) and 61.53% (n=8) in the RCO and Boston orthosis groups respectively. Only 2 (15.38%) patients required surgery in the Boston orthosis group

Conclusions: Periodic padding adjustment in mild idiopathic adolescent scoliosis can result in curve regression. This bracing protocol effectively prevents progression and surgery.

Keywords: Periodic padding adjustment mild scoliosis

S113

Role of Preoperative Halo-Gravity Traction in Management of Pediatric Severe Spinal Deformities

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Purpose: Management of Pediatric Severe and Complex spinal deformities is a challenging task. Complications such as neurological deficit, blood loss, implant related problems often occur. Such children are also often deficient in pulmonary reserve and nutritional status. Preoperative Halo Gravity traction (HGT) helps in correcting the deformity in a controlled and safe way, and also helps in improving pulmonary and nutritional status before definitive correction surgery.

Materials and Methods, and Results: In last 8 years, 15 children with severe kyphoscoliotic deformities were managed with preoperative HGT. Average kyphosis angle of 120 degrees and scoliosis angle of 90 degrees were corrected by an average of 60 percent and 55 percent by the traction.

Remaining correction was achieved through surgery. 2 children had minor complication of pin tract infections. None of the patients had any major complication.

Conclusions: Preoperative HGT is a safe method of correcting severe spinal deformities and improving lung function and nutritional status in these complex cases.

Keywords: Halo gravity traction, Pediatric spinal deformity, Early onset scoliosis

S114

Risk Factor of Scoliosis After Hip Reconstructive Surgery in Patients with Spastic Quadriplegic Cerebral Palsy

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Purpose: Cerebral palsy (CP) is a neurological disorder characterized by impaired movement and muscle tone, often leading to secondary musculoskeletal complications such as scoliosis or hip dislocation. However, the effect of hip stability on scoliosis has been controversial. This study aimed to determine (1) whether hip stability is related to the incidence of scoliosis and (2) whether hip stability is related to the type of scoliosis.

Materials and Methods: We reviewed 168 patients with spastic quadriplegic cerebral palsy who (1) had undergone reconstructive surgery for hip dislocation, (2) had been followed for at least two years postoperatively, and (3) had been diagnosed with early-onset scoliosis or had whole spine radiography follow-up after the age of ten. A more than 40% migration index was used to diagnose hip dislocation preoperatively or hip failure at the most recent follow-up. Scoliosis was defined as a Cobb angle greater than 15 degrees on the whole spine posteroanterior radiography. The curve type was classified as either long C or double curves, and the curve's apex was categorized as typical (right thoracolumbar curve or left lumbar curve) or non-typical (left thoracolumbar curve or right lumbar curve). The sacroiliac joint angle(SIJA) was measured using the pre-hip reconstructive surgery CT.

Results: The average age at hip surgery was 7 years and 10 months (102 boys and 66 girls). Ninety-six patients had GMFCS IV, and 72 had GMFCS V. One hundred and nineteen patients (70.8%) had scoliosis, while 49 did not. The mean Cobb angle was 50.7±33.6 degrees. All patients with right hip failure or bilateral hip failure, and 88.9% of those with left hip failure, had scoliosis. However, only 35% of patients with good hip outcomes had scoliosis. In multivariable logistic regression analysis, the larger SIJA related to scoliosis (r=1.136 (95% CI 1.013-1.274, p=0.0286)). The SIJA was higher in non-typical curve (5.22±3.93 in typical curve vs 6.9±3.77 in non-typical curve, p=0.0274).

Conclusions: In patients with spastic quadriplegic cerebral palsy who had undergone hip reconstructive surgery, patients with scoliosis had more unfavorable hip outcomes, and patients with non-typical apex had larger SIJA. The scoliosis is related to the larger SIJA measured before hip reconstructive surgery. The pelvis and hip deformity may increase the risk of scoliosis, so should be properly managed.

Keywords: Spine, Hip, Scoliosis, Cerebral palsy, Neuromuscular disease

Free Paper: Infection

S115

The Paradigm Shift: Emergence of MDR Gram Negative Bacteria in Postoperative Spinal Infections: Causes, Prevention and Management

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Purpose: Surgical site infection is a nightmare with devastating complications. With ever increasing number of spine surgeries World over it is natural that number of postoperative spinal infections would also increase. Furthermore there is a paradigm shift in the bacteria causing these infections. The purpose of this study is to create awareness and identify the reasons behind the paradigm shift

in deep surgical site infections (SSI)following spine surgery from Gram positive to MDR gram negative infections and discuss the management strategies.

Materials and Methods: 1000 consecutive spine surgeries in a single centre were evaluated for postoperative spinal infections. Age, sex, comorbidities, malnutrition, duration of surgery, use of vancomycin etc were considered in this study. Superficial infections were excluded from the study. The average follow up was 3-5 years.

Results: Duration of surgery, Instilling Vancomycin after surgery , implants, Diabetes, comorbidities and most importantly urinary tract infection played a significant role in the development of MDR gram negative SSI. In all those patients with SSI and who also had UTI, the bacteria isolated from the wound corresponded with the bacteria grown from the urine sample. Only 2 patients had Gram positive SSI and the rest being gram negative SSI. With Immediate Medical and surgical attention all our patients recovered over a period of time. One patient after removal of implants and debridement developed a sinus tract which took 14 months to resolve.

Conclusions: From our study we conclude that all elective elective spine surgery patients should have excellent glycaemic control, undergo pre operative urine cultures as a routine and if positive for UTI be given appropriate medical treatment and subjected to surgeries only after repeat urine cultures are sterile. The routine practice of instilling Vancomycin may result in the growth of MDR gram negative infections and we recommend that this practice should no longer be continued. Medically optimizing the patients, early and thorough debridements, involvement of infection control specialists, use of appropriate antibiotics, attention to nutrition and excellent glycaemic control would lead to satisfactory results.

Keywords: MDR, SSI, Gram negative infection, Spine surgery

S116

Surgical Management of Paediatric Spinal Tuberculosis: A 9-year Experience

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Purpose: Due to the growth modulation and progressive deformity of spine following spinal tuberculosis in growing children, the threshold for surgical intervention is very less. However, outcomes following surgical intervention of paediatric spinal tuberculosis are not clearly evaluated. This study aims to evaluate the outcomes of surgical management of paediatric spinal tuberculosis.

Materials and Methods: A retrospective study was conducted between January 1, 2015, and November 30, 2024. Medical data records of paediatric patients who had undergone surgical intervention for spinal tuberculosis during that period were explored. Patients with follow-up duration of at least 1-year were included in the study. Demographics and radiological data were collected from medical records and Picture Archiving and Communication System (PACS). Outcome measures were sagittal parameters, clinical and neurological improvements.

Results: A total of 31 paediatric patients underwent surgical intervention for spinal tuberculosis. Out of 31, 26 (83.87%) underwent outcome evaluation. Of 26, 14 (53.86%) were females, and the average age at surgical intervention was 10.3±5.2 years. The mean follow-up duration was 6.2±1.4 years. Mean sagittal parameter was improved from 69.7±5.7 degrees preoperative to 18.3±5.6 degrees at final follow up.75% had at least 2 radiological spines at risk sign at presentation, however there was no progression of deformity following surgical intervention. Most common neurological involvement at presentation was ASIA C (46%) followed by ASIA D (23%) however all of them recovered to ASIA E. Along with moderate to severe back pain, 96 % patients had deformity of back and 86 % had weakness and difficulty in walking at presentation, however only 15% had mild residual back pain. One (3.8%) patient had proximal junctional kyphosis requiring proximal extension and 2 (7.7%) patients had implant breakage.

Conclusions: Surgical intervention in children with spinal

tuberculosis not only restores the sagittal parameter of spine but also provides good clinical and neurological outcome.

Keywords: Pediatrics, Surgical intervention, Spinal tuberculosis

S117

A Descriptive Study on the Clinical Profile, Management, and Outcomes of Pediatric Patients with Pott's Disease at the Philippine General Hospital

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Purpose: Pott's disease, or spinal tuberculosis, remains a significant health concern in developing countries, particularly affecting pediatric populations. The disease often leads to severe complications such as kyphosis and neurological deficits due to delayed diagnosis. Despite its clinical relevance, limited data exists regarding the clinical profile, diagnostic challenges, treatment modalities, and outcomes in pediatric patients. This study aims to describe the clinical profile, management strategies, and outcomes of pediatric patients diagnosed with Pott's disease at the Philippine General Hospital. It seeks to identify risk factors for neurological deterioration and surgical intervention to improve management protocols and patient outcomes.

Materials and Methods: A retrospective descriptive study will be conducted over 12 months in the Section of Orthopedic Spine Surgery at the Philippine General Hospital. Pediatric patients aged 0–18 years with confirmed spinal tuberculosis will be included. Data will be collected on demographics, clinical presentation, diagnostic methods, treatment regimens, and outcomes. Statistical analysis will utilize descriptive statistics and logistic regression to identify predictors of neurological deterioration.

Results: The study anticipates enrolling a minimum of 50 patients. Expected findings include a comprehensive understanding of the clinical spectrum of pediatric Pott's disease, identification of imaging predictors like canal encroachment and cord signal changes, and evaluation of treatment outcomes. These results will contribute to optimized diagnostic and treatment protocols.

Conclusions: This study will provide valuable insights into the management of pediatric Pott's disease, guiding early diagnosis and effective interventions to reduce morbidity and improve patient outcomes.

Keywords: Pott's disease, Spinal tuberculosis, Pediatric patients, Clinical profile, Treatment outcomes

S118

Dual Infection in Spine - Tubercular and Pyogenic: An Extremely Rare Case Report

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Purpose: Chronic low back pain has a wide range of etiologies, including degenerative, neoplastic, inflammatory and infectious causes. Among them, tubercular spondylodiscitis is one of the major infectious causes. The concomitant occurrence of TB spondylodiscitis and pyogenic infection is extremely rare and possesses unique diagnostic and therapeutic challenges. Although, tuberculosis of spine or Pott's disease is common in Indian subcontinent, pyogenic infection of spine is rare. In this case report, we aim to describe the diagnosis and management of a highly uncommon case of simultaneously occurring TB and pyogenic infection of spine in a 70-year-old male.

Materials and Methods: The patient presented with a history of chronic low back pain for many years, accompanied by inability to walk for the past 2.5 months. Clinical evaluation and imaging was done. The MRI report revealed paraspinal mass of granulation tissue at L2 -L5 level which was suggestive of tuberculosis spondylitis; disc herniation at L3-4 and L4-5. The patient underwent laminectomy of L3, L4, L5 and discectomy of L3-4 and L4-5 with stabilization by 8 Titanium screws. Post-operative pus culture and a biopsy from the L4-L5 disc were performed. Pus culture detected presence of E. coli and S. aureus. Biopsy was done from two diagnostic centers. One report suggested inflammation and another suggested TB spondylodiscitis.

Results: Post-operatively, the patient showed significant improvement in pain and mobility. No intraoperative or postoperative complications occurred. The patient was

discharged from hospital with appropriate medication along with anti-tuberculosis drugs and advised for follow up.

Conclusions: The rare co-occurrence of TB and pyogenic spondylodiscitis exhibits diagnostic and therapeutic challenge. Timely diagnosis and proper management is crucial for a significant clinical outcome.

Keywords: Tubercular, Spondylodiscitis, Pyogenic, Infection, Pott's disease

Asian Spine Society Traveling Fellowship & Visiting Reports (Crystal Ballroom A)

Travelling Fellowship Reports (Japan)

Dong-Ho Kang

Korea

Travelling Fellowship Reports (Taiwan)

Sung Tan Cho

Korea

Visiting Reports (India)

Ho-Jin Lee

Korea

Visiting Reports (Thailand)

Sang-Bum Kim

Korea

Free Paper: Basic Research (1)

S045

Discordance Between Anatomical Nerve Root Compression and EMG Findings in Patients with S1 Lumbarization or L5 Sacralization

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Purpose: To determine whether the level of radiculopathy detected via electromyography (EMG) corresponds to the anatomically compressed nerve root in patients with S1 lumbarization or L5 sacralization.

Materials and Methods: This retrospective study included patients from 2005 to 2024 who were diagnosed with S1 lumbarization or L5 sacralization based on whole-spine sagittal MRI. Only patients with single-level nerve root compression (e.g., disc herniation, lateral recess stenosis, or foraminal stenosis) and EMG-confirmed radiculopathy were included. Patients with multilevel lesions or severe stenosis potentially compressing the cauda equina were excluded. Data including age, sex, compressed root, and EMG findings were analyzed for concordance. Additional parameters such as the degree of lumbarization/sacralization, conus medullaris level, and iliac crest height were also assessed. Chi-square analysis was used to evaluate the concordance between anatomical and EMG findings and to identify associated factors.

Results: A total of 29 patients were included: 19 with S1 lumbarization (13 complete, 6 partial) and 10 with L5 sacralization (3 complete, 7 partial). Among these, 8 patients (27.6%) showed concordance between the anatomical lesion and the EMG-detected radiculopathy level, while 21 patients (72.4%) showed discordance. In the S1 lumbarization group, 11 out of 13 patients (84.6%) with S1 nerve root compression exhibited EMG findings consistent with L5 radiculopathy. Similarly, in the L5 sacralization group, all 5 patients with L4 root compression showed EMG evidence of L5 radiculopathy. No significant correlation was observed

between concordance and factors such as conus level, iliac crest height, or the presence of lumbarization/sacralization itself. However, concordance was significantly associated with the degree of vertebral transformation (complete: 6.2%, partial: 53.8%, p=0.010).

Conclusions: In patients with S1 lumbarization or L5 sacralization, discordance between anatomical nerve root compression and EMG findings is common. Complete transformations tend to reflect the altered anatomical configuration rather than true nerve root numbering. In cases of partial transformation, concordance and discordance occur with similar frequency. These findings underscore the need for careful anatomical and electrophysiological correlation in patients presenting with nerve root compression.

Keywords: Lumbarization, Sacralization, Radiculopathy, EMG

S046

Enriched Peripheral Blood-derived Mononuclear Cells for Treating Intervertebral Disc Degeneration

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Purpose: Low back pain (LBP) is a leading cause of long-term disability globally. Intervertebral disc degeneration (IVDD) is mainly responsible for discogenic pain in LBP-affected young patients. There is no effective therapy to reverse disease severity and IVDD progression. This study investigates the effect of human peripheral blood-derived mononuclear cells (PBMCs) on pain relief and life quality improvement in IVDD patients.

Materials and Methods: The enriched monocytes of the PBMCs could differentiate into CD14 and CD206 double-positive M2 macrophages in vitro. Preclinical evidence in rats showed that the transplanted PBMCs exhibited anti-inflammatory and tissue-repair effects on controlling IVDD progress in the rat model. The PBMCs significantly steered the aggrecan and type II collagen expressions and attenuated the pro-inflammatory cytokines in the IVDD disc.Based on the promising animal results, 36 patients with chronic low back pain (CLBP) were included in clinical trials and received platelet-rich plasma, PBMCs or observation only (control).

Results: Our clinical trial showed that patients' low back pain and disability were significantly ameliorated after the PBMCs transplantation, neither platelet-rich plasma (PRP) treatment nor non-treated control. These preclinical and pilot clinical studies indicate that intradiscal injection of the enriched PBMCs might be a feasible and potential cell therapy to control the pain and disability of IVDD patients.

Conclusions: Here, we showed that the collected monocytes could consistently differentiate into M2 macrophage lineages. The MoFi-enriched PBMCs significantly alleviated acupuncture-triggered IVDD in rats. The pilot clinical trial further illustrated that intradiscal injection of MoFi-processed PBMCs relieved pain symptoms and disability in CLBP patients.

Keywords: Chronic low back pain, Peripheral blood-derived mononuclear cells, Intervertebral disc degeneration

S047

Development of an AI-Based Object Detection Model for Spine Endoscopic Surgery Using Spine Scope Videos

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Purpose: Endoscopic spine surgery relies on precise identification and differentiation of anatomical structures. To support this, we developed an AI-based object detection model capable of accurately distinguishing structures in spine scope videos.

Materials and Methods: This multicenter study included 112 patients undergoing spine endoscopic surgery. Videos were analyzed by extracting one frame per 300 frames, resulting in a diverse dataset. Patients were divided into training and validation cohorts in a 4:1 ratio. Key anatomical structures were annotated in the extracted frames to create a labeled dataset for training. Model performance was evaluated using Intersection over Union (IoU) to measure the overlap between predicted and ground-truth regions, along with Mean Average Precision (mAP) for classification within detected regions.

Results: The model achieved an average IoU of 0.753 and mAP of 0.857 across the validation dataset, indicating its ability to accurately localize and classify key anatomical structures. Multicenter data enhanced the model's generalizability across diverse imaging conditions.

Conclusions: The proposed AI model successfully distinguishes anatomical structures in spine scope videos with high accuracy. By focusing on region-specific classification and precise localization, the model demonstrates its potential for enhancing surgical navigation and reducing intraoperative errors. Further research will explore real-time deployment in clinical settings.

Keywords: Artificial intelligence, Spine endoscope

S048

AI-based Analysis Highlights the Critical Role of Erector Spinae Muscle Health in Predicting Outcomes After Lumbar Spinal Fusion

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Purpose: This study aimed to investigate the relationship between preoperative muscle health and postoperative outcomes in patients undergoing lumbar spinal fusion.

Materials and Methods: A retrospective analysis was conducted on 135 patients (mean age: 68.12±8.49 years; 51 males [37.8%] and 84 females [62.2%]) who underwent lumbar spinal fusion. The mean number of fusion levels was 1.82±1.01. Preoperative erector spinae and psoas muscle volumes were measured using AI-based volumetric segmentation of body composition on CT images. Metrics included total volume, BMI-adjusted volume, and muscle quality (mean Hounsfield Units). Postoperative outcomes assessed at six months included back and leg pain Visual Analog Scale (VAS), Oswestry Disability Index (ODI), and EuroQol-5 Dimension (EQ5D). Univariate and multivariate linear regression analyses were performed, adjusting for age, sex, BMI, preoperative ASA score, operation duration, estimated blood loss, alcohol use, smoking status, number of fusion levels, and DEXA T-score.

Results: Univariate analysis revealed significant associations between total erector volume and reduced postoperative back pain VAS ($\beta=-4.62\times10-6$, $p<0.001$), leg pain VAS ($\beta=-4.27\times10-6$, $p<0.001$), ODI ($\beta=-4.61\times10-5$, $p<0.001$), and improved EQ5D ($\beta=4.36\times10-7$, $p<0.001$). BMI-adjusted erector volume showed similar associations with back pain VAS ($\beta=-1.01\times10-4$, $p<0.001$) and ODI ($\beta=-9.20\times10-4$, $p=0.027$). Total psoas volume was associated with reduced back pain VAS ($\beta=-6.28\times10-6$, $p<0.001$) and ODI ($\beta=-5.84\times10-5$, $p<0.001$). Multivariate analysis confirmed that total and BMI-adjusted erector volumes remained significant predictors of reduced back pain VAS ($\beta=-8.30\times10-5$, $p=0.033$, $R^2=0.192$), lower ODI ($\beta=-9.20\times10-4$, $p=0.027$, $R^2=0.208$), and improved EQ5D ($\beta=8.70\times10-6$, $p=0.032$, $R^2=0.217$). Psoas metrics were not significant in multivariate models.

Conclusions: Higher preoperative erector spinae muscle volume and BMI-adjusted volume are associated with better postoperative outcomes, including reduced back pain, lower disability, and improved quality of life. These findings highlight the critical role of erector spinae muscle health in predicting lumbar spinal fusion outcomes.

Keywords: Lumbar spine, Back muscles, Clinical outcomes, Fusion, Artificial intelligence

Free Paper: Basic Research (2)

S049

Efficacy of Deep Neural Networks for Automatic Detection of Traumatic Cervical Spinal Fractures on CT Scans

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Purpose: Accurate and timely diagnosis of cervical spine (c-spine) fractures is essential in trauma cases to prevent further complications and improve patient outcomes.

Although CT imaging is the gold standard for fracture detection, it is susceptible to human error. Advancements in artificial intelligence (AI) offer the potential to enhance diagnostic efficiency and accuracy in the management of spinal trauma. This study aimed to evaluate the diagnostic accuracy of a deep learning model for detecting c-spine fractures using CT imaging.

Materials and Methods: A total of 249 c-spine CT studies were retrospectively analyzed. Ground truth labels were established through expert annotation based on CT and MRI images. Fractures were categorized into vertebral body (or anterior arch, dens), posterior element (or posterior arch), left transverse process, and right transverse process fractures. Of the 249 cases, 90% (224 cases) were used for training, and 10% (25 cases) were reserved for testing. The deep learning model was developed using advanced ResNet-based architectures. Model performance was evaluated using sensitivity, specificity, and the area under the receiver operating characteristic curve (AUC).

Results: Males comprised the majority of cases, accounting for 194 patients (77.9%), with a mean age of 53.0±15.5 years. Among the 249 cases, C1 and C2 fractures were identified in 58 and 75 cases, respectively. Fractures of C3 through C7 were observed in 59, 70, 90, 123, and 146 cases, respectively. The AI model demonstrated strong performance with an average AUC of 0.9167 for overall c-spine fracture detection. Specifically, the AUCs were 0.8846 for anterior fractures, 0.8969 for posterior fractures, 0.9547 for left transverse process fractures, and 0.9307 for right transverse process fractures.

Conclusions: The deep learning model demonstrated high diagnostic accuracy for detecting traumatic cervical spine fractures on CT imaging, with particularly strong performance for transverse process fractures. These findings highlight the potential of AI to assist radiologists in achieving timely and accurate diagnoses in trauma settings, ultimately improving clinical outcomes.

Keywords: Cervical spine, Fracture detection, Deep learning, Artificial intelligence

S050

Design and Biomechanical Analysis of Stand-alone Lumbar Cage Implant for Posterior Interbody Fusion

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Purpose: Spine surgery for interbody fusion using intervertebral cage implants has become a prescribed method in the treatment of disc degenerative disease and spondylolisthesis. Cage implant provides stability for functional spinal unit and augments fusion. However, this is almost always augmented with pedicle screws and rods which is an additional procedure resulting in increased blood loss, operative time, cost and hospitalisation. Hence, stand-alone cage devices are being used in cervical spine, but the designs and their effectiveness are still investigational in the lumbar spine. This study aims at designing an intervertebral cage with a selflocking mechanism.

Materials and Methods: The design includes a titanium body with two screws and a slider arrangement, to provide locking of the implant body with the spinal bones. The dimensions of the implant were chosen to best suit the lumbar L4/5 Intervertebral disc. The final element analysis was performed on the modeled implant that is placed between the modeled L4 and L5 vertebrae, to analyze load and stress distribution within the implant during flexion, extension, lateral bending and axial rotation.

Results: The biomechanical analysis displays a higher stiffness in lateral bending. In flexion, higher load is taken by the titanium body and in extension, the screws and the slider take the maximum stress. Results indicate that the proposed design with the locking mechanism withstand load, provide fixation and stability.

Conclusions: The developed models exhibited satisfactory mechanical behavior and hence could be subjected to biomechanical testing with modeled vertebrae in the subsequent work. Based on the study outcome, further analysis and modifications for improvements could be planned. Therefore, these implant designs show more prospects for further biomechanical tests to analyze their effect on the spinal bones and the surrounding ligament muscles.

Keywords: Standalone cage, Lumbar cage, Self locking cage

S051

Feasibility of Lumbopelvic Muscles Volume for Estimating Total Muscle Volume on Computed Tomography: Ai-Based Automatic Image Analysis

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Purpose: Bone mineral density measurements for osteoporosis are typically performed in central body regions, such as the lumbar spine and hip. For sarcopenia diagnosis, skeletal muscle mass is often assessed in the thigh. This study aimed to evaluate the validity of skeletal muscle volume in various anatomical regions, including the abdomen, thorax, abdomen and pelvis, thigh, and torso, as representative indicators of total skeletal muscle mass.

Materials and Methods: A cloud-based artificial intelligence tool (Recomia.org) was used to segment skeletal muscle from whole-torso CT scans of 100 cases performed between 2016 and 2024 for various clinical indications. Linear regression analysis was utilized to assess the correlation between the skeletal muscle volume of specific anatomical regions and the total torso muscle volume.

Results: The mean age of cases was 58.5 years, with 72 male and 28 female cases. Skeletal muscle volume in the abdomen and pelvis region, defined as the area extending from the bottom of the hip bone to the bottom of the heart, exhibited the highest correlation with total skeletal muscle volume(R^2=0.934), outperforming other regions such as the thigh(R^2=0.750), torso(R^2 = 0.880), thorax(R^2=0.887), and abdomen(R^2=0.927), respectively ($p<0.01$). Akaike Information Criterion(abdomen and pelvis=1327, thigh=1754, torso=1396, thorax=1390, abdomen=1347) and Root Mean Squared Error(abdomen and pelvis=905, thigh=1468, torso=1217, thorax=1178, abdomen=947) showed the same order of correlation as R-squared (R^2). A scatterplot of each measure against total trunk muscle volume in a Bland-Altman plot showed identical results.

Conclusions: This study demonstrates that skeletal muscle volumes in the abdomen and pelvis region can be reliably segmented using automated image analysis tools for diagnosis of sarcopenia. Clinically, evaluating the lumbopelvic muscles volume provides a meaningful and representative measure of total skeletal muscle mass. These findings suggest that the lumbopelvic muscle assessment is a valuable tool for understanding spinal and pelvic balance in the diagnosis and management of sarcopenia.

Keywords: Sarcopenia, Body composition, Image analysis, Artificial intelligence

S052

Biomechanical Effects of Cement Augmentation and Prophylactic Vertebroplasty on Adjacent Segment Stability in Multilevel Spinal Fusion : Finite Element Analysis

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Purpose: This study evaluates the biomechanical effects of cement augmentation and prophylactic vertebroplasty in multilevel posterior spinal fusion from T10 to the ilium using finite element modeling (FEM).

Materials and Methods: A validated FEM of T8–Pelvis was constructed from CT data of a healthy 57-year-old male. Five surgical models were simulated: Type 1 (fusion with pedicle screws only), Type 2 (fusion with T10 cement augmentation), Type 3 (fusion with T10 and T11 cement augmentation), Type 4 (fusion with T10 and T11 cement augmentation and T9 vertebroplasty), and Type 5 (fusion with T10 and T11 cement augmentation and T8 and T9 vertebroplasty). Cement augmentation and prophylactic vertebroplasty were modeled with PMMA material properties. ROM, IDP, peak von Mises stress (PVMS) in the posterior ligament complex (PLC) and facet joints, as well as stress distribution on the cement-bone interface and posterior structures were analyzed.

Results: Cement augmentation and prophylactic vertebroplasty did not significantly affect structural stability, as the differences in ROM, IDP, and PVMS in the PLC

and facet joints across models were <5%. However, stress analysis revealed abnormal distributions at the cement-cancellous bone interface in Type 4 and Type 5. Stress increased in the T8 lower and T9 upper regions in Type 5 and in the T9 upper region in Type 4, suggesting potential fracture initiation points. vertebroplasty led to uneven stress distributions, with Type 5 exhibiting the highest stress concentrations during flexion, axial rotation, and lateral bending. Cement screw augmentation at the upper instrumented vertebra (UIV) showed negligible effects on adjacent segments.

Conclusions: While cement augmentation and prophylactic vertebroplasty provide immediate stability, they can lead to abnormal stress distributions at the cement-bone interface, increasing the risk of fractures over time. These effects may be exacerbated in osteoporotic or elderly patients, highlighting the need for further studies in at-risk populations.

Keywords: Prophylactic vertebroplasty, Cement augmentation, Adjacent segment stability, Finite element modeling

Free Paper: Deformity (1)

S053

Neurofibroma Subtypes and Spinal Dural Ectasia: Key Factors Driving Rapid Scoliosis Progression in Neurofibromatosis Type 1 on Whole-Body Magnetic Resonance Imaging

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Purpose: Neurofibromatosis type 1 (NF1) is commonly associated with scoliosis, where curve progression demonstrates significant heterogeneity. The role of neurofibroma subtypes, their location relative to the scoliosis apex, and spinal dural ectasia in rapid progression remains unclear. This study aimed to evaluate the impact of neurofibroma subtypes, their proximity to the scoliosis apex, size, and directionality (concave vs. convex side), as well as spinal dural ectasia on scoliosis progression.

Materials and Methods: A retrospective study of 195 patients with NF1-related scoliosis who underwent whole-body magnetic resonance imaging (WBMR) was conducted. Among 1,936 NF1 patients diagnosed through genetic analysis, 201 were identified with scoliosis. Of these, 6 lacking WBMR were excluded. Patients were stratified into rapid progression (angular velocity [AV] >10°/year) and stationary groups. Neurofibromas were classified as superficial, diffuse, deep localized/plexiform, or malignant peripheral nerve sheath tumor (MPNST). Their proximity to the scoliosis apex, size, and side (concave/convex) were assessed. Spinal dural ectasia was evaluated through imaging. Logistic regression identified predictors of rapid progression.

Results: The prevalence of NF scoliosis was 10.3% (199/1,936). The rapid progression group comprised 38% of the cohort. Deep localized/plexiform neurofibromas (OR: 3.2, $p<0.01$) and MPNSTs (OR: 5.1, $p<0.01$) were significantly associated with rapid progression, particularly when located near the scoliosis apex or on the concave side. Neurofibroma size also correlated positively with progression. Superficial and diffuse neurofibromas demonstrated no significant association. Spinal dural ectasia was observed in 48% of patients and was independently associated with rapid progression (OR: 2.7, $p<0.05$). Patients with both plexiform neurofibromas and dural ectasia had the highest odds of progression (OR: 6.4, $p<0.001$).

ConclusionS: These findings highlight neurofibroma subtypes, location near the scoliosis apex, and spinal dural ectasia as significant predictors of rapid curve progression in NF1-associated scoliosis. Systematic screening with WBMR and early intervention targeting high-risk patients may mitigate severe progression and optimize clinical outcomes.

Keywords: NF 1 scoliosis, Neurofibroma, Dural ectasia, Rapid scoliosis progression

S054

Incidence of Intraspinal Pathology in Patients with Early Onset Scoliosis: A Malaysian Public Tertiary Referral Centre Experience

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Introduction: Early onset scoliosis is defined as scoliosis that occurs in children below the age of 10-years- old due to various diagnoses, work up for these patients include whole spine MRI scans and CT scans where vertebral abnormalities are detected. We report on the incidence of intraspinal abnormalities in this patient group and the need for neurosurgical intervention. In addition, data on aetiology and management techniques involved were also summarized.
Materials and Methods: Data from patients undergoing management for early onset scoliosis at our centre from September 2022 to December 2024 were analysed and a total of 65 patients reviewed, 56 patients had complete documentation of imaging and neurosurgical interventions. Correlation between aetiology, management, spinal abnormality and neurosurgical intervention was performed.
Results: The mean age our patients was 8-years old, gender distribution showed 33 females, 23 males. Aetiology of patients comprised of congenital scoliosis 28 (50%), syndromic scoliosis 20 (36%), neuromuscular 5 (9%), and idiopathic early onset scoliosis 4 (7%). The congenital scoliosis group had 14 patients with a single hemivertebrae and 14 with multilevel hemivertebrae. Management of these patients involved the following methods, growing rods in 20 patients (36%), hemivetebra excision and short segment fusion 16 (29%), definitive long segment fusion 9 (16%), risser cast 6 (11%), and hemiepiphysiodesis 5 (9%). Among them a total of 14 (25%) patients had intraspinal pathology with 3 patients (21%) requiring neurosurgical intervention. The most common intraspinal pathology was syringomyelia in 6 patients (50%), Type 1Arnold – Chiari malformation in 3 patients (21%), spina bifida and sacral related abnormalities in 2 patients (14%), tethered cord in 2 patients (14%) and diastemetamyomelia in 1 patient (7%).
Conclusions: The incidence of intradural abnormalities in our early onset scoliosis patient series is at 25% with syringomyelia being the most common abnormality.
Keywords: Early onset scoliosis, Intraspinal abnormalities, Syringomyelia, Tethered cord

S055

Association of Scoliotic Shoulder Imbalance and Its Post-Operative Correction with Lenke Classification

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Purpose: The aim is to assess the association of pre- as well as post-operative shoulder imbalance with various types of scoliotic curves as per Lenke classification system.
Materials and Methods: A descriptive case series all the patients that underwent surgical correction of AIS during the year of 2020 was retrospectively performed, over a period of two month (i-e July and August, 2024). The pre-op, 6-week post-op and final follow-up RSH, clavicle angle, T1 tilt angle and 1st rib angles were assessed and compared with the Lenke class of scoliotic curve.
Results: RSH and Clavicle angle value changed significantly (p=0.001) from 7.18±9.65 to -0.03±12.23 and 0.29±2.19 to -1.85±1.70, respectively. Similarly medial parameters of shoulder balance i-e T1 tilt angle and 1st rib angle showed statistically significant (<0.001) change from -0.34±9.53 to 4.97±5.77 and -1.65±6.53 to 3.76±4.33, respectively. None of Lenke types had statistically significant difference in lateral shoulder balance w.r.t RSH at either point in time Radiographic lateral shoulder imbalance also didn't demonstrate any significant difference among various Lenke types preop or 6-week postop; however, it was significantly (p=0.03) higher in type 2 curves on final 2-year follow-up. Among the medial shoulder imbalance parameters, Lenke type 2 and 4 curves both demonstrated highest medial imbalance and these readings were statistically significant (p=0.03) at postop 6-wk reading.
Conclusions: All the predictors of shoulder imbalance improved with the posterior spinal fusion irrespective

of Lenke type. However, Lenke type 2 curves showed significantly higher association with both the medial and lateral radiographic parameters of postoperative shoulder imbalance.

Keywords: Adolescent idiopathic scoliosis, Posterior spinal fusion, Shoulder imbalance, Lenke classification

S056

Predicting Postoperative Coronal Trunk Shift in Adolescent Idiopathic Scoliosis Surgery Using Intraoperative Crossbar Measurement Technique

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Background and Introduction: Adolescent idiopathic scoliosis (AIS) surgery seeks to achieve spinal balance and reduce complications. Many studies examine the selection of instrumented levels, prevention of shoulder imbalance, and avoidance of adding-on phenomenon. few addresses postoperative coronal trunk shift and its intraoperative detection. This study aims to evaluate and predict postoperative coronal trunk shift after corrective spinal deformity surgery in AIS patients using an intraoperative crossbar measurement technique.

Study Design: Prospective cohort study

Methods: The study enrolled all individuals diagnosed with AIS and indicated for posterior spinal surgery between 2022 and 2024, based on the Lenke classification system. The fusion levels were chosen according to Lenke's recommendations. Radiographic parameters, such as pre-, intra-, and postoperative C7-CSVL distance and pre- and postoperative major Cobb angle, were assessed in all patients. The postoperative coronal trunk shift was predicted using the distance proportion of the intraoperative crossbar measurement technique.

Results: The study included 40 AIS patients (35 females and 5 males) with an average age of 16.4±4.5 years. The preoperative proximal thoracic curve averaged 57.7 degrees, reducing to 28.6 degrees postoperatively (50.4% correction). The main thoracic curve decreased from 48.9 degrees to 15.2 degrees (68.9% correction), and the thoracolumbar/lumbar curve dropped from 46.8 degrees to 11.3 degrees (75.9% correction). Intraoperative C7-CSVL distance after the deformity correction was 0.27 times the C7 vertebral body, with postoperative distance at 0.55 times.

Conclusions: The intraoperative measurement of C7-CSVL utilizing the crossbar technique can accurately represent 0.5 times the postoperative C7-CSVL distance. This finding serves as a predictive measurement for postoperative trunk shift following posterior spinal surgery in patients with Adolescent Idiopathic Scoliosis (AIS). Our study indicates that this technique is effective in forecasting the postoperative coronal trunk shift in AIS patients undergoing such surgical interventions. This method has been demonstrated to be straightforward, reliable, accurate, and readily accessible.

Invited Lecture II

S057

Craniovertebral Junction Deformity: Its Evaluation and Surgical Planning

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Background and Introduction: Though Craniovertebral junction deformity is a common clinical. Condition but many times it is missed because of subtle clinical signs. This deformity is in different planes either in isolation or in combination. Because of delay in presentation the correction of the deformity becomes challenging in this vital region. We present our algorithm of managing craniovertebral junction deformity.

Main Body: It is a retrospective study of 54 patients of CVJ deformity [44 congenital , 10 acquired (Tuberculosis – 7, neglected trauma -1 , rheumatoid – 2) - 32 patients had BI] treated from 2007 to 2022.All patients had neurological deficit . Preoperative mJOA score and radiological evaluation was done of CVJ region to document the deformity and its different components. CCA (clivus canal angle) was measured. Correction of deformity (reducibility) was assessed by dynamic x- ray. Patients were put on

skeletal traction in the ward and reducibility was checked. Reducibility was also checked under anesthesia. IAAD were taken for anterior release [transoral (TO) – 12 cases , Retropharyngeal -36 cases] where longus colli , longus capitis and anterior longitudinal ligaments were cut , joint capsule was opened and lateral joints were made supple. Under supervision patient was turned prone on head rest and posterior fixation and fusion was done. In cases of occipitalised Atlas , fixation and fusion was done from occiput to C3.C1-C2 transarticular fixtion was done in 4 patients, C1- C2 separate screw fixation in 8 patients , OC (Occipitocervical) fusion in 36 patients. Separate release procedure was not required in 6 patients. There were 45 male and 9 female .46 patients had full correction while 8 patients had partial correction.The mJOA improved from mean preoperative 10.89 to mean postoperative 16.82.Mean preoperative CCA of 110.4 improved to mean postoperative CCA of 146.4.Maceration of posterior wound occurred in 4 patients which healed by daily cleaning and dressing. Implant breakage on one side was noted after 3 months postoperative in one patient who remained asymptomatic. In a pediatric patient occipital plate backed out at 8 weeks. It was reexplored and plate was fixed to occiput with sublaminar wire. Fusion was achieved in all patients.

Conclusions: Clinico-radiological proper evaluation , Pre and intraoperative traction , required release and posterior instrumented fusion gives desirable outcome in craniovertebral junction deformity

Key words: Craniovertebral junction deformity, Atlantoaxial, Irreducible dislocation, Transoral anterior release, Retropharyngeal anterior release, Fusion

Asian Spine Society Session II

S058

Interpretation of Signal Loss in Intra Operative Neuromonitoring

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Intraoperative Neurophysiologic Monitoring (IONM) is widely used to assess neural pathways during high-risk procedures such as skull base surgery, complex cervical spine surgery, spinal deformity corrections, spinal cord tumor resections, and peripheral nerve surgeries. IONM plays a crucial role in reducing the risk of iatrogenic injury to both central and peripheral nervous systems, while simultaneously providing real-time feedback to both the surgical and anesthetic teams. High doses of Total Intravenous Anesthesia (TIVA) using Propofol can reduce the amplitude of Motor Evoked Potentials (MEPs) and diminish EEG waveform size. A multimodal strategy enhances the reliability and effectiveness of IONM by incorporating the following modalities:

1. Somato Sensory Evoked Potential (SSEP), which focuses on the Ascending Pathway;

- Transcranial Motor Evoked Potentials (Tc-MEP): monitor the descending motor pathways.
- Running and triggered Electromyography (EMG): detect disruptions in the nervous system.
- D-wave monitoring: provides continuous assessment of corticospinal tract function.

Alarm criteria during real-time IONM include a reduction in amplitude greater than 50% and a latency increase exceeding 10%. Common causes of signal loss during IONM include spinal deformity correction (33.8%), osteotomy (31.9%), pedicle screw placement (11.7%), and physiological changes such as temperature or blood pressure fluctuations (11.4%).

Keywords: Signal, Loss, Spinal cord

S059

Advancements in Full Endoscopic Spine Surgery: Trends and Clinical Insights

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Abstract: Full endoscopic spine surgery (FESS) has emerged as a minimally invasive alternative to traditional open and microscopic techniques, offering reduced tissue disruption, faster recovery, and improved patient outcomes. Driven by technological advancements and expanding indications, FESS is now widely accepted for the treatment of various spinal pathologies, including lumbar and cervical disc herniation, spinal stenosis, and selected cases requiring interbody fusion. This presentation reviews recent advancements in FESS, focusing on developments in surgical techniques, instrumentation, and clinical applications. The evolution from conventional to refined approaches—such as biportal and uniportal endoscopic spine surgery—has improved visualization and maneuverability, resulting in more effective decompression and enhanced patient satisfaction. The integration of navigation systems, robotics, and artificial intelligence (AI)-assisted technologies has further enhanced surgical precision and safety. Clinical evidence supports that FESS yields outcomes comparable to, or better than, conventional approaches, with advantages including reduced postoperative pain, shorter hospitalization, and fewer complications. Nonetheless, challenges persist, such as the steep learning curve, optimal case selection, and concerns regarding long-term outcomes. Standardizing surgical protocols and training is essential for broader adoption and consistent clinical results. In conclusion, FESS continues to evolve as a highly effective and minimally invasive solution for spinal disorders. Future research should focus on refining patient selection, improving surgical training, and integrating novel technologies to maximize clinical benefit.

Keywords: Spine, Endoscopic surgery, Minimally invasive, Decompression, Surgical outcomes

S060

Beyond the Hunch: Navigating the Landscape of Post TB – Kyphosis

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Background and Introduction Kyphosis is one of the most common complications of spinal tuberculosis. Patients: are never satisfied with the residual kyphosis even If the disease is cured or arrested. Patients with hunchback live secluded lives both mentally & socially. To achieve correction & prevention surgery is desirable. Nonetheless, satisfactory surgical correction is very difficult & dangerous as well

Materials and Methods: This prospective case series was conducted in a tertiary level hospital & in private hospital from January 2003 to December 2024. Most of the patients operated posteriorly to achieve correction. Correction of deformity was easier in wet TB than the dry TB. Global reconstruction was done using single posterior approach in all the cases.

Results: This study comprises 97 cases (M=35, F=62), with an average age of 17 years. Mean kyphosis angle was 85+9° preoperatively which came down to 13‡7° finally. There was no major complication. None of the patients develop or worsened neurologically after surgery. Finally patient achieved satisfactory cosmetic appearance.

Conclusions: Prevention of deformity should be the primary aim. Long standing severe kyphosis produces painful costopelvic impingement, reduced vital capacity, lumbar canal stenosis & late onset paraplegia. With improved surgical technique & rigid spinal instrumentation involving three column - posterior approach is gold standard for prevention & correction of kyphosis

S061

Myanmar Experience of Upper Cervical Spine Problems

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Study Design: Retrospective study.
Aim of Study: To evaluate clinical outcomes of upper cervical spine problems managed by posterior stabilization, with or without fusion.
Overview of Literature: Unstable upper cervical spine problems are not only due to fracture but also infection or other diseases such as tumors, degenerative.Most of the cases need surgical intervention. Different methods of surgical approaches have been published in the literature, with lack of consensus on a uniform or standardized method. In-addition there are limitations in low income countries especially in Myanmar. Controversy still exists regarding stabilization of upper cervical problems by anterior or posterior approach alone or combined approaches.
Materials and Methods: We retrospectively evaluated 21 patients with upper cervical spine problems with their preopera¬tive clinical details, X-ray, computed tomography, and magnetic resonance imaging of the cervical spine for diagnosis and definitive management in 2021 to 2022. All patients were managed with posterior stabilization with or without fusion, only osteosynthesis cases are stabilized without fusion.
Results: Seven patients were female and 14 patients were male. 16 cases were due to trauma and 5 cases were non traumatic cases,15 patients were neurologically intact (ASIA-E) upon arrival. Six patients had neurological symptoms on initial presentation, all patients complained of neck pain. All patients can mobilized after postoperative second day and neurological improvement at subsequent follow-up.
Conclusions: Most of the upper cervical problems can be safely management by posterior stabilization with or without fusion. Posterior stabilization is rapid, safe, and effective and has a low rate of complications.
Keywords: Upper cervical spine, Posterior stabilization

Symposium (II) Deformity: Updates for Adult Spine Deformity (ASD) Decision Making

S062

Perioperative Medical Optimizations for ASD

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Background and Introduction: Adult spinal deformity (ASD) surgeries are complex with a risk of complications, especially in older adults or those with multiple comorbidities. Perioperative medical optimization plays a crucial role in enhancing the outcomes and minimizing complications in patients undergoing surgery for ASD. Therefore, a comprehensive perioperative optimization plan is essential to improve surgical outcomes, minimize complications, and expedite recovery. This process typically begins well before the actual surgery and involves multidisciplinary efforts to address medical, physical, and psychological aspects.
Main Body: Preoperative medical assessment includes medical history such as cardiovascular disease, diabetes, osteoporosis, and respiratory conditions. These factors can significantly affect surgical risks and recovery. Medical conditions are stratified by medical comorbidity, frailty index, or predictive analytics. Moreover, psychosocial assessments include evaluating psychological distress, social support, and quality of life. These assessments can help identify patients who may experience decisional regret or suboptimal outcomes. For patients with known heart disease, risk stratification is vital. This may involve adjusting antihypertensive medications, ensuring adequate control of ischemic heart disease, and considering preoperative stress testing. Managing atrial fibrillation and optimizing anticoagulation therapy are also important for preventing thromboembolic events. Ensuring that diabetes is well-controlled prior to surgery is critical to reduce the risk of infection, delayed wound healing, and poor surgical outcomes. This includes adjusting medications and monitoring blood glucose levels. Assessing

pulmonary function and optimizing the management of chronic obstructive pulmonary disease or asthma is vital, especially since spinal deformity surgery often involves prolonged anesthesia. Preoperative pulmonary rehabilitation may be beneficial for improving lung function and reducing postoperative respiratory complications. Osteoporosis is common in patients with spinal deformities, and optimization of bone health is essential to reduce the risk of fractures and nonunion after surgery. This may involve vitamin D and calcium supplementation, along with the consideration of pharmacological therapies such as bisphosphonates or denosumab. Malnutrition or poor nutritional status can increase the risk of wound complications, infections, and prolonged recovery. A nutritional assessment and intervention may include dietary counseling, supplementation of vitamins and minerals (such as iron, vitamin D), and addressing any deficiencies prior to surgery.

Conclusions: Perioperative medical optimization for ASD is a multifaceted approach that requires careful planning and coordination among a multidisciplinary team. By addressing medical, physical, and psychological factors before surgery, the risks of complications are minimized, and patients are better prepared for a successful outcome. These efforts not only improve the chances of a favorable surgical result but also enhance long-term functional recovery and quality of life for individuals with adult spinal deformity.

Keywords: Adult spinal deformity, Preoperative medical optimization, Enhanced recovery after surgery, Surgical outcome, Complication

S063

Determination of Upper Instrumented Vertebra in Adult Spinal Deformity

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Background and Introduction: The decision regarding UIV placement dramatically influences outcomes in corrective spine surgery. Established principles include Suk's principle of ending instrumentation at a neutral vertebra in healthy adjacent segments without degeneration or instability. The health of segments adjacent to the UIV largely determines the long-term survival of the construct, as patients may become impaired from PJK, vertebral fracture, and limitations in activities of daily living depending on UIV selection

Main Body: Regional thoracic kyphosis plays a critical role in UIV determination. When significant thoracic coronal curve exists, fusion to the upper thoracic (UT) region becomes necessary. Similarly, large thoracic kyphosis (>50 degrees) favors a UIV in the UT region to prevent ending a construct at a kyphotic level. For patients with UIV slope <12.7, selection of upper thoracic UIV depends on T1PA being <7. Conversely, a lower thoracic UIV is preferable in cases with localized kyphosis in the lower lumbar spine, decreased lumbar lordosis, and normal thoracic kyphosis. Special attention should be given when selecting the UIV at the thoracolumbar junction (T11, T12, or L1). Risk factors for proximal junctional failure when the UIV is at the thoracolumbar junction include age >70 years, osteoporosis, and kyphotic preoperative proximal junctional angle. Studies have shown that thoracolumbar junction can be considered as the UIV in select patients, particularly those younger than 70 without osteoporosis and with a lordotic preoperative proximal junctional angle. UT fusions allow for more powerful correction of larger spinal deformities and may reduce overall rates of proximal junctional failure, but potentially negatively impact activities of daily living. In contrast, lower thoracic fusions are associated with less operating time, reduced blood loss, and lower cost. Studies demonstrate that UIV in the UT region results in greater sagittal correction (-59.5 vs -41.0 mm) and lower PJK rates compared to lower thoracic UIV. When an algorithm predicts UT spine as optimal UIV but surgeons select LT spine, significantly higher rates of PJK occur at 2-year follow-up (76.9% vs. 38.9%). Based on collective evidence, an algorithm for UIV selection should incorporate considerations such as thoracic kyphosis, coronal deformity, proximal junctional angle, bone health, and patient-specific factors. Studies support that UIV chosen based on algorithmic recommendations results in better outcomes, underscoring the necessity for careful assessment during surgical planning. T10 is frequently selected as the lower

thoracic UIV as it is typically the lowest immobile vertebrae in the thoracic spine, while T3 is commonly chosen for upper thoracic UIV

Conclusions: Proximal fusion level selection critically impacts outcomes in ASD surgery. While the selection of UIV in lumbar ASD typically involves considering the sacrum and T10, controversy persists regarding the optimal proximal fusion level. A comprehensive algorithm incorporating thoracic kyphosis, coronal alignment, and patient-specific factors can guide surgical decision-making to optimize outcomes and minimize complications

Keywords: Spine, Adult spinal deformity, Proximal junctional kyphosis, Upper instrumented vertebra

S064

Usefulness of Lateral Lumbar Interbody Fusion in Adult Spinal Deformity

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Background and Introduction: Adult spinal deformity (ASD) presents a high degree of surgical complexity, particularly in elderly patients with multiple medical comorbidities and a high incidence of complications. Due to the complexity of ASD, the surgical approach should be carefully selected, taking into account various factors such as the patient's perioperative mobility. Well-established techniques for deformity correction include posterior-based bony osteotomies, which are highly effective and powerful surgical methods for correcting severe and rigid coronal or sagittal plane deformities. However, these techniques are associated with significant morbidity. Recently, combined anterior-posterior (A-P) surgery utilizing lateral lumbar interbody fusion (LLIF) has emerged as an alternative corrective strategy to posterior-only surgery.

Main Body: The surgical treatment of ASD should aim to restore age-specific spinal alignment to improve health-related quality of life (HRQoL) while also considering the patient's comorbidities and the risks associated with frequently encountered minor, occasional, and, unfortunately, catastrophic complications. LLIF, such as oblique lateral interbody fusion (OLIF), provides excellent advantages over the conventional posterior approach for accessing the anterior column of the spine in combined A-P surgery. It allows better access to the intervertebral disc compared to posterior approaches, enabling the insertion of a larger cage and improving the fusion rate. The placement of a large cage increases disc height, which is effective in restoring coronal and sagittal plane deformities while also offering indirect nerve decompression. Additionally, the use of the anterior column realignment (ACR) technique has emerged as a powerful method for spinal deformity correction, potentially replacing three-column osteotomies performed via a posterior-only approach. In cases of severe deformity, additional osteotomies may be required during the subsequent posterior open surgery. Moreover, the fusion level may be shortened during the second-stage operation based on findings from magnetic resonance imaging (MRI) after the anterior surgery.

Conclusions: Combined A-P surgery utilizing LLIF for the treatment of ASD is an effective technique for correcting both coronal and sagittal deformities. It offers indirect nerve decompression, reduces the required fusion level, and minimizes perioperative morbidity.

Keywords: Lateral lumbar interbody fusion, Adult spinal deformity, Combined anterior-posterior surgery

S065

How to Minimize Mechanical Complications After Adult Spinal Deformity Correction

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Background and Introduction: Adult spinal deformity (ASD) surgeries have become increasingly common, particularly in the aging population. Despite improved surgical techniques and planning tools, mechanical complications remain a

major cause of morbidity and revision surgery. These include proximal junctional kyphosis (PJK), rod fracture, and various implant-related failures. Effective prevention requires a comprehensive strategy that spans preoperative risk evaluation, personalized alignment planning, and durable intraoperative constructs.

Main Body: Preoperative risk stratification is essential. Tools such as the Modified Frailty Index, bone density (DEXA), and CT-based Hounsfield units help identify high-risk patients. Modifiable factors like glycemic control, nutrition, and smoking should be optimized.

Traditional alignment targets (PI–LL <10°, SVA <5 cm, PT <20°) may lead to overcorrection in older adults. Age-adjusted alignment goals and the Global Alignment and Proportion (GAP) score offer safer, personalized correction parameters and better predict mechanical failure risk. Fusion levels should be chosen based on sagittal balance and spinal flexibility, often extending proximally to T10+ and distally to the pelvis in severe imbalance. Intraoperative strategies should focus on biomechanical durability. Rod selection (CoCr vs Ti), dual-rod constructs, accessory rods, and careful transition zone management reduce rod fracture and PJK. Fixation in osteoporotic bone is enhanced with cortical trajectory screws, cement augmentation, and S2-alar-iliac fixation. Fusion success depends on endplate preparation, biological enhancement (BMP-2), and interbody device design. Emerging evidence supports the use of osteoanabolic agents like teriparatide and romosozumab, which enhance bone quality and fusion rates, particularly in osteoporotic patients.

Conclusions: Mechanical complication prevention is achievable through comprehensive, patient-specific planning and technique. Modern alignment tools, biologics, and fixation strategies have significantly improved outcomes. Future directions include smart implants and personalized instrumentation to further reduce failure rates and improve long-term success in ASD surgery.

Keywords: Adult spinal deformity, Mechanical complications, Proximal junctional kyphosis, Age-adjusted alignment, Osteoanabolic agents

Invited Lecture IV

S066

Scoliosis Surgery for AIS Patients with Major Lumbar Curves: Preventing Post-operative Truncal Imbalance and Limb Length Discrepancy

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Post-operative coronal imbalance (CI), also referred to as coronal decompensation, is a significant complication following posterior spinal fusion (PSF), particularly in adolescent idiopathic scoliosis (AIS) patients with major lumbar curves, specifically Lenke types 5 and 6. CI can negatively affect patient self-image and overall satisfaction. Reports indicate that persistent CI (PCI) at 2 years postoperatively occurs in 9.3% to 12.5% of Lenke 5 and 6 patients, compared to an overall CI rate of 6.4% across all Lenke types. Overcorrection of lumbar curves in the presence of a stiff lumbosacral fractional curve is a recognized predictor of PCI. Occasionally, patients may compensate for imbalance via functional limb length discrepancy. At our institution, we routinely employ the intra-operative crossbar balancing technique to reduce PCI risk. We present findings from a cohort of 39 AIS patients with major lumbar curves and a minimum of 2 years of follow-up.

Objectives: To validate the intra-operative crossbar balancing technique as a mitigation strategy for PCI in AIS patients with major lumbar curves (Lenke types 5 and 6), and to assess the utility of the preoperative right side-bending (RSB) lowest instrumented vertebra (LIV) tilt angle in predicting intraoperative and final follow-up LIV tilt angles.

Methods: After intraoperative curve correction, the crossbar is aligned with the central sacrum and adjusted to touch both iliac crests, with the upper arm of the crossbar bisecting the C7 vertebra under fluoroscopy. The intraoperative LIV tilt angle (β) is predicted as the sum of the RSB LIV tilt angle (x) and pelvic obliquity (PO), expressed as angle α.

Results: Of the 39 patients, only 2 (5.1%) experienced PCI at 2 years postoperatively. No significant differences were

observed between angle α and intraoperative LIV tilt (β) (p=0.799), or between angle α and final LIV tilt (δ) (p=0.705). Angle α demonstrated a strong positive correlation with both intraoperative (ρ=0.707, p<0.001) and final follow-up LIV tilt (ρ=0.730, p<0.001).

Conclusions: The intra-operative crossbar balancing technique is a reliable tool to mitigate PCI risk in AIS patients with major lumbar curves. The preoperative RSB LIV tilt angle can also predict intraoperative and final LIV tilt angles. In AIS patients with major lumbar curves, over-correction of the lumbar curve with the presence of a stiff lumbosacral spine fractional curve is recognized as an important predictor of persistent CI (PCI) post-operatively. Occasionally, patients may be able to compensate in the coronal plane with functional limb length discrepancy. In our institution, we have routinely used the 'intra-operative crossbar balancing technique' to mitigate the issue of PCI in AIS patients with major lumbar curves. Here we would like to report on our study on 39 AIS patients with major lumbar curves with at least 2 years of follow-up.

Keywords: Scoliosis surgery, Crossbar balancing, Major lumbar curve, Coronal imbalance, Limb length discrepancy

Free Paper: Deformity (2)

S067

Determination of LIV in Single Thoracic Idiopathic Scoliosis: Feasibility of Prone Radiographs

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Purpose: The patient's position affects pelvic rotation, complicating the identification of the neutral rotation level in standing radiographs in Lenke 1A adolescent idiopathic scoliosis (AIS). Conversely, the prone view offers an advantage, as the symmetry of the ASIS positions provides a clearer assessment of rotation. This study examines the relationship between neutral vertebra (NV), stable vertebra (SV), and the last touching vertebra (LTV) by comparing standing and prone views regarding the incidence of adding-on and preservation of distal motion segments.

Materials and Methods: This retrospective study included patients with Lenke 1A (King 3,4) followed for two years. Preoperative standing and prone whole spine PA radiographs were assessed for NV, SV, and LTV. Postoperative 2-year standing radiographs were evaluated to determine occurrences of adding-on phenomenon. Last instrumentation vertebra (LIV) was compared between standing and prone radiographs to identify which view resulted in fewer occurrences of adding-on, with NV-1 defined as one level proximal to NV.

Results: A total of 116 patients were included (King 3:67, King 4:49). For Lenke 1A, the level differences in NV, SV, and LTV were 0.88±0.97, 0.53±0.84, and 0.86±0.70, indicating all measurements were more proximal in the prone view. The adding on phenomenon occurred in 17 cases (17/67, 25.4%) in King 3, When viewed on a standing position, NV-1 was found in 2 cases (2/13, 15.4%), NV-0 in 6 cases (6/21, 28.6%), and NV+1 in 6 cases (6/17, 35.3%). In the prone position, NV-0 was found in 2 cases (2/12, 16.7%), NV+1 in 6 cases (6/26, 23.1%), and NV+2 in 7 cases (38.9%). In King 4, adding on occurred in 4 cases (4/49, 8.2%). On the standing view, NV-4 occurred in 1 case, NV-2 in 2 cases (2/17, 11.8%), and NV-1 in 1 case (1/12, 8.3%). In the prone position, NV-3 was found in 1 case and NV-2 in 3 cases (3/6, 50%).

Conclusions: In Lenke 1A patients, the prone position results in more proximal NV/SV/LTV measurements compared to standing. Particularly for King 4 patients, confirming NV in the prone view and determining LIV up to NV -1 may help prevent the adding-on phenomenon and preserve more motion segments.

Keywords: Adolescent idiopathic scoliosis, Posterior spinal instrumentation, Minimally invasive spine surgery, Muscle sparing technique

S068

Radiation Free Screening of Scoliosis Using Artificial Intelligence and Machine Learning

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Purpose: To investigate the application of AI technology

and machine learning in various aspects of care (Screening, diagnosis and treatment) of patients with adolescent idiopathic scoliosis (AIS).

Materials and Methods: This study involved 25 participants recruited from a specialized orthopaedic hospital. The Kinect V2.0 sensor was used to capture 3D surface topography of the participants' backs, with data processed to measure key spinal metrics such as thoracic kyphosis, lumbar lordosis, and Cobb angles. Both concurrent and criterion validity were assessed. Concurrent validity was evaluated by comparing Kinect measurements with clinical assessments, while criterion validity involved comparing Kinect data with recent spinal radiographs. The procedure included placing adhesive markers on anatomical landmarks (C7, L1, and bilateral PSIS) and capturing images from various distances to enhance generalizability during machine learning (ML) training and scoliosis classification.

Results: The Kinect V2.0 provided valid measurements for thoracic kyphosis but demonstrated less consistent correlation for lumbar lordosis when compared to traditional radiographic methods. AI-driven analysis of Kinect data was effective in detecting trunk rotation, which is useful for scoliosis assessment. The Kinect's non-invasive and radiation-free approach offers advantages in cost, portability, and safety.

Conclusions: AI and surface topography can improve AIS diagnosis and treatment by solving several enigmas for clinicians. It helps develop radiation-free techniques to assess the severity of scoliosis and detect scoliosis progression from back surface topography captured by a laser scanner. Other benefits of using AI are in forming decision trees enabling more accurate classification of AIS by the universally used Lenke scheme, surgical planning and risk estimation. Despite these benefits, the study identifies the need for further refinement of AI algorithms to improve measurement accuracy and clinical reliability

Keywords: Artificial intelligence, Machine learning, Scoliosis, AIS, Lenke classification

S069

Predicting Necessity of Operation for Adolescent Idiopathic Scoliosis after Brace Application

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Purpose: Bracing is recommended for adolescent idiopathic scoliosis (AIS) during the growth phase when the Cobb angle exceeds 25°, aiming to prevent curve progression. However, some patients experience progression requiring surgery if the curve exceeds 45° during growth or 50° after growth. Known risk factors for brace failure include greater Cobb angle at presentation, lower Risser stage, younger age, and low correction rates. The integration of these factors to predict the need for surgery after bracing has not been studied. This study aimed to develop a predictive model to assess the likelihood of surgery in AIS patients treated with a brace.

Materials and Methods: A total of 205 AIS patients treated with bracing were included. Patients were classified into the brace-success group if surgery was not required by growth completion and the brace-failure group if surgery was indicated during follow-up. Logistic regression identified factors associated with brace failure. Patients were split into a training set (70%) and a validation set (30%). A predictive nomogram was developed using significant factors from the regression analysis. The nomogram's performance was assessed with calibration plots, the Hosmer-Lemeshow test, and receiver operating characteristic (ROC) curve analysis.

Results: Of the 205 patients, 44 (21.4%) required surgery and were classified as brace-failure, while 161 (78.5%) were classified as brace-success. Significant factors for brace failure included age ($p=0.003$), height ($p=0.005$), Risser grade ($p=0.018$), largest Cobb angle at presentation ($p<0.001$), apical vertebral translation ($p<0.001$), and correction rate ($p=0.046$). A nomogram was created using these factors. The Hosmer-Lemeshow test indicated good fit ($p=0.261$ for training and $p=0.153$ for validation). The area under the ROC curve was 0.914 for the training set and 0.812 for the validation set, showing excellent predictive performance. Calibration plots and ROC curves confirmed

the nomogram's accuracy.

Conclusions: A predictive nomogram was developed to estimate the likelihood of surgery in AIS patients treated with bracing. Key predictors included age, height, Risser grade, largest Cobb angle, apical vertebral translation, and correction rate. The nomogram demonstrated excellent predictive performance, with high AUC values and good calibration. It can help clinicians identify high-risk patients and guide personalized treatment decisions. Further validation in larger cohorts is recommended.

Keywords: Adolescent idiopathic scoliosis, Brace, Surgery, Nomogram, Prediction model

S070

Spinal Deformity in Osteogenesis Imperfecta: A Filipino Patient's Journey in Corrective Surgical Management

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Purpose: Osteogenesis Imperfecta (OI) is one of the more common genetic abnormalities of the skeletal system. Yet, in general, it is still rarely encountered by spine surgeons. The disease is marred by different levels of fragility making management in these patients more difficult. This would prove to be more challenging when these patient develop spinal deformities or scoliosis as both conservative and surgical management are equally related to severe complications. Because of the rarity and complexity of the disease, there are still no firm guidelines as to how these cases are approached. This will cite the journey of a case of spinal deformity who underwent surgical management.

Materials and Methods: This is a case of an 18 year old male who is a known case of osteogenesis imperfecta with a significantly increasing spinal deformity for the past 4 years with mildly worsening pulmonary dysfunction especially during physical activities. The patient was then prepared for surgery through a multi-institution and multi-disciplinary approach for 12 months which included physical therapy, radiologic monitoring and bisphosphonate management before undergoing surgery. Pre-operative planning was done using Computed Tomography and upright whole spine radiographs. Posterior instrumented surgical scoliosis correction using pedicle screws with cement augmentation on the proximal, apical and distal screws was done with the use of C-arm for image guidance.

Results: Pre-operative CT scan showed multiple poorly developed pedicles especially on the thoracic spine requiring a inside-outside-inside pedicle insertion technique on those pedicles. The surgery lasted for 495 mins (8hr 15mins) with a blood loss of 430cc. There is a 59 percent correction of deformity from a Cobbs Angle of 81 deg to 33 deg. Patient was already able to stand up and ambulate 2.5 days post-operatively. Correction is maintained and implants were still in place after 30 months of follow-up. No neurological, pulmonary nor cardiac complications were noted post-operatively.

Conclusions: A multidisciplinary approach to the management of spinal deformity in OI with patient-tailored surgical management can result to a good outcome with a patient being able to continue and enjoy physical and social function.

Keywords: Osteogenesis imperfecta, Scoliosis, Spinal deformity, Surgical correction

Free Paper: Deformity (3)

S071

Revision Surgery for Adult Spinal deformity with Postsurgical Flatback Deformity: Lateral Lumbar Interbody Fusion with Posterior Column Osteotomy versus 3-column Osteotomy

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Purpose: Postsurgical flatback deformity has become increasingly prevalent, particularly in aging populations. Effective correction of sagittal malalignment in these patients necessitates achieving optimal lumbar lordosis (LL). While pedicle subtraction osteotomy (PSO) remains a powerful

technique for LL correction, it is associated with substantial surgical complexity and a heightened risk of complications. Consequently, in cases where unfused lumbar segments persist following prior surgery, lateral lumbar interbody fusion (LLIF) combined with posterior column osteotomy (PCO) emerges as a viable alternative. This approach offers the potential for sufficient segmental lordosis correction with a reduced complication profile. This study aims to evaluate and compare surgical strategies for sagittal realignment in revision surgery cases, specifically analyzing outcomes based on the fusion status of lumbar segments.

Materials and Methods: This retrospective cohort study included 83 patients (mean age: 71.4 years) with postsurgical flatback deformity who underwent revision surgery between 2016 and 2023. Surgical planning targeted achieving LL correction exceeding pelvic incidence (PI<LL). The degree of lordosis contributed by previously fused segments was measured, and an estimated correction of 20° per unfused segment was factored into surgical planning. Patients were categorized into two groups based on the surgical technique employed: the Corner Osteotomy Group (n=39) and the LLIF with PCO Group (LLIF group, n=40). Radiographic parameters and clinical outcomes, including estimated blood loss (EBL), operative time, and complication rates, were compared between the groups.

Results: The mean number of unfused segments was 3.7 in the PSO group and 4.0 in the LLIF group. The lordosis achieved by previously fused segments averaged -11.1° in the PSO group and -9.4° in the LLIF group, with additional LL correction requirements of >41.1° and >45°, respectively, to meet PI alignment targets. Post-revision surgery, both groups demonstrated comparable improvements in LL correction and PI-LL alignment without statistically significant differences. However, the LLIF group exhibited significantly lower EBL (p=0.044), while operative time was notably longer (p<0.05). The incidence of complications, including proximal junctional kyphosis and rod fractures, did not differ significantly between the groups.

Conclusions: In the context of revision surgery for adult spinal deformity with postsurgical flatback deformity, LLIF combined with PCO represents a preferable approach when sufficient correction can be achieved through unfused lumbar segments. However, in cases where LL correction remains insufficient relative to PI, more aggressive interventions, such as PSO or corner osteotomy, become necessary to optimize sagittal alignment.

Keywords: Adult spinal deformity, Lateral lumbar interbody fusion, Pedicle subtraction osteotomy, Postsurgical flatback deformity

S072

T10-pelvic Angle as a Newly Introduced Sagittal Parameter: Validation study in Terms of Pelvic Tilt Restoration, Proximal Junctional Kyphosis, and Clinical Outcomes in Adult Spinal Deformity Surgery

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Purpose: To validate the usefulness of T10-pelvic angle (T10PA) as a target for thoracolumbar alignment in adult spinal deformity (ASD) surgery, focusing on pelvic tilt (PT) restoration, proximal junctional kyphosis (PJK) development, and clinical outcomes.

Materials and Methods: A retrospective study was conducted on 213 patients who underwent fusion surgery from the lower thoracic spine (T9 or T10) to the pelvis for ASD. T10PA was measured on 6-week postoperative radiographs as the angle between the line connecting the center of the T10 vertebral body to the hip center and the line connecting the hip center to the midpoint of the S1 upper endplate. Patients were categorized into three groups based on PI- and age-adjusted normative T10PA values: undercorrection (offset >3.5°), matched correction (offset within±3.5°), and overcorrection (offset <−3.5°). Outcome measures included pelvic non-response (PNR), PJK, and clinical outcomes assessed using the visual analogue scale (VAS) for back pain, Oswestry Disability Index (ODI), Scoliosis Research Society (SRS)-22 questionnaire, and patient satisfaction scores. Postoperative 2-year outcomes were compared among the groups.

Results: Among the 213 patients, 192 (90.1%) were female, with a mean age of 70.1 years. The undercorrection group

showed significantly higher PNR rates compared to the matched correction and overcorrection groups (p=0.027). PJK occurred more frequently in the overcorrection group compared with the undercorrection and matched correction groups (p=0.011). Clinical outcomes, including ODI (p=0.030), SRS-22 (p=0.018), and patient satisfaction scores (p<0.001), were significantly better in the matched correction group than in the other groups.

Conclusions: Undercorrection of T10PA was associated with higher PNR rates, while overcorrection increased the risk of PJK. The matched correction group demonstrated the best clinical outcomes. Achieving optimal correction relative to T10PA is a balanced strategy to minimize both PNR and PJK risks and to enhance clinical outcomes in ASD surgery.

Keywords: T10-pelvic angle, adult spinal deformity, proximal junctional kyphosis, pelvic non-response, clinical outcome

S073

The Risk Factors for Mechanical Complications After Deformity Correction in Patients with Degenerative Lumbar Scoliosis Combined with Sagittal Imbalance

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Purpose: To identify risk factors of mechanical complications (MCs) occurring after deformity correction using long level instruments and fusions in patients with degenerative lumbar scoliosis (DLS) with sagittal imbalance (SI).

Materials and Methods: A total of 166 patients diagnosed with DLS and underwent deformity corrective surgery at a single institution were retrospectively analyzed. We divided the patients into Group I with SI and Group II without SI and compared the surgical outcomes including radiographic parameters and MCs. SI was defined as satisfying two or more of the following three criteria: Preoperative PT >20°, PI-LL >11°, and SVA >50 mm. MCs included proximal junctional failures (PJFs) and rod fractures (RFs). To identify risk factors for the development of MCs, additional statistical analysis was performed only in Group I patients.

Results: The incidence of MCs was significantly higher in patients of Group I than in patients of Group II (Group I: 50% vs Group II: 21.7%). Within Group I, patients in group A who developed MCs were significantly older and had lower BMDspine than patients in group B who did not develop MCs. The fusion levels (A: 7.12 vs B: 5.35, p=0.022) of group A patients were significantly greater than those of group B patients. The preoperative C7 sagittal vertical axis (C7SVA, A: 132.1 mm vs B: 95.2 mm, p=0.032), T1 pelvic angle (T1PA, A: 41.25° vs B: 31.89°, p=0.041), lumbar lordosis (LL, A: -3.01° vs B: -20.52°, p=0.018), and pelvic incidence - LL mismatch (PI-LL, A: 59.41° vs 39.72°, p=0.015) of group A was significantly greater than group B. There was significant difference in the postoperative change values between the two groups according to the preoperative differences. In cox proportional hazard model, fusion levels (hazard ratio [HR]=1.909, confidence interval [CI]=1.293-2.818, p=0.002), BMD (HR=0.034, CI=0.004-0.264, p=0.001), preoperative LL (HR=1.391, CI=1.293-2.818, p=0.001), and preoperative PI-LL (HR=1.108, CI=1.011-1.178, p=0.011) were identified as factors associated with the occurrence of postoperative MCs.

Conclusions: In patients with DLS, the occurrence of MCs increases after deformity corrective surgery when sagittal imbalance is combined, and risk factors include higher fusion levels, lower BMD, higher preoperative LL, and higher preoperative PI-LL.

Keywords: Adult spinal deformity, Combined deformity, Degenerative lumbar scoliosis, Risk factor, Mechanical complication

S074

A novel Easy-to-measure Radiographic Parameter to Assess Spinopelvic Malalignment: The Pelvic Inclination Angle (PIA)

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Purpose: Pelvic tilt (PT) is an important sagittal parameter

to be restored to the normal range in corrective surgery for spinopelvic malalignment. However, the normative value of PT varies among patients because of different individual pelvic incidence (PI) values. With introduction of pelvic inclination angle (PIA), which is the angle subtended by the vertical axis and the line connecting anterior pubic tubercle and anterior superior iliac spine, we aimed to determine whether the PIA could reflect the symptom severity and if normal PIA values exist.

Materials and Methods: The study cohort consisted of the patients with spinopelvic malalignment (patient group) and normal healthy adults (normal group). In the patient group, correlation analyses were performed to investigate the relationship between PIA and other sagittal parameters and between the sagittal parameters and patient-reported outcome measures (PROMs), including Oswestry disability index, Scoliosis Research Society-22, Short From-36 physical component score, and mental component score. In the normal group, correlation analysis was performed to assess the relationship between PI and other sagittal parameters. The radiographic parameters were compared according to PI categories.

Results: There were 162 patients in the patient group (mean age, 71.1 years) and 108 subjects in the normal group (mean age, 32.1 years). In the patient group, PIA strongly correlated with the conventional parameters such as PI, PI-lumbar lordosis (LL), T1 pelvic angle (T1PA), suggesting that PIA well reflects the severity of sagittal deformity. PIA had weak to moderate correlation with all PROMs, of which correlation coefficient was similar or greater than other sagittal parameters. In the normal group, PI showed moderate to strong correlation with all conventional sagittal parameters except for PIA, which showed nearly no correlation with PI values. Unlike the other sagittal parameters, PIA also did not significantly differ among the PI categories (PIA: -2.7°, -3.3°, -0.3°, and -0.8° for Q1, Q2, Q3, and Q4, respectively; p=0.174).

Conclusions: PIA well reflects the symptom severity in patients with sagittal malalignment. It has normal values which are not affected by PI values. Therefore, as an alternative to PT, PIA can be clinically useful in evaluating the deformity severity in patients with sagittal malalignment and in providing the appropriate surgical target regarding the pelvic version.

Keywords: Pelvic inclination angle, Spinopelvic malalignment, Radiographic parameter, Pelvic tilt, Pelvic incidence

Free Paper: Deformity (4)

S075

The Relationship Between Failure of Pelvic Restoration and Hamstring Tightness After Adult Spine Deformity Surgery

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Purpose: Failure to restore pelvic retroversion following adult spinal deformity surgery is known to be a cause of proximal junctional kyphosis. However, the mechanisms underlying the failure to restore pelvic retroversion remain unclear. The purpose of this study is to investigate the relationship between hamstring tightness, a major contributing muscle to pelvic retroversion, and the failure to restore pelvic retroversion following adult spinal deformity surgery.

Materials and Methods: From May 2022 to November 2023, this study was conducted on patients who underwent adult spinal deformity surgery performed by a single surgeon. Hamstring tightness was defined as a popliteal angle exceeding 50 degrees, a measure commonly used in patients with cerebral palsy to assess hamstring tightness. The degree of pelvic retroversion restoration was compared between two groups: patients with hamstring tightness (HT group) and those without (Non-HT group). The Pelvic incidence to pelvic tilt ratio (PT/PI) was measured preoperatively and postoperatively in both groups. The primary outcome was the comparison of the difference in PT/PI changes (Δ[PT/PI]) between the two groups, and the secondary outcome was the comparison of the PJK rate between the two groups.

Results: Among the total of 50 adult spinal deformity surgery patients, 10 were in the HT group (popliteal angle >50

degrees), and 40 were in the non-HT group (popliteal angle ≤ 50 degrees). In the hamstring tightness group, the Δ (PT/PI) was -0.029±0.078, whereas in the non-hamstring tightness group, the Δ(PT/PI) was -0.196±0.243. This indicates that patients with hamstring tightness had a significantly less effective restoration of pelvic retroversion postoperatively (p=0.038). There was no significant difference between the two groups in terms of the PJK (p=0.629) and PJF (p=0.297) rates.

Conclusions: Failure to restore pelvic retroversion, which can lead to poor outcomes such as PJK following adult spine deformity surgery, is considered to be associated with hamstring tightness. However, the occurrence of PJK is a multifactorial issue, and various other risk factors should also be taken into account.

Keywords: Adult spine deformity, Pelvic restoration, Hamstring tightness, Pelvic non-response

S076

Different Characteristics Between Acute And Delayed Proximal Junctional Failure in Elderly Patients Undergoing Corrective Surgery for Adult Spinal Deformity: Comparative Analysis of Risk Factor, Failure Mode, and Clinical Consequences

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Purpose: While numerous studies have been conducted on proximal junctional failure (PJF), the clinical significance of acute and delayed PJF remains poorly understood. The primary object of this study is to investigate the risk factors separately for acute and delayed PJF. Secondly, we aim to assess the incidence of each failure mode and their clinical consequences in relation to acute and delayed PJF.

Materials and Methods: Retrospective comparative study was performed for patients aged ≥60 years who underwent deformity correction with ≥5-level fusion to sacrum. PJF was defined as proximal junctional angle (PJA) ≥20°. Acute PJF is defined as PJF occurring within 6 months, while delayed PJF occurring after 6 months. Risk factors were analyzed by comparing various clinical and radiographic parameters among three groups: no, acute, and delayed PJF groups. The failure modes, including soft tissue failure, vertebral fracture, fixation failure, and myelopathy, were compared among these groups. The clinical subsequences after PJF development were evaluated by assessing the change in PJA, revision rate, and patient-reported outcome measure (PROM).

Results: A study cohort of 363 patients was included in the analysis. Among them, 156 patients experienced PJF, with 87 patients (55.8%) in the acute PJF group and 69 patients (44.2%) in the delayed PJF group. Multivariate analyses revealed that older age (Odds ratio [OR]=1.057), osteoporosis (OR=2.149), high American Society of Anesthesiology ASA score (OR=2.150), and overcorrection relative to the age-adjusted pelvic incidence - lumbar lordosis target (OR=4.031) were identified as risk factors for the development of acute PJF. On the other hand, a high body mass index (OR=1.150) and an uppermost instrumented vertebra located at ≤T10 (OR=2.267) were found to be associated with delayed occurrence of PJF. No radiographic parameters were found to be related to the development of delayed PJF. In terms of failure modes, vertebral fracture and fixation failure were more commonly observed in acute PJF, while soft tissue failure and myelopathy were more predominant in delayed PJF. The clinical course was more aggressive in the acute PJF group compared to the delayed PJF group, as evidenced by a greater increase in PJA, a higher revision rate, and worse PROM.

Conclusions: This study demonstrated different risk factors, failure modes, and clinical consequences between acute and delayed PJF. Therefore, a different surgical strategy needs to be established to mitigate both acute and delayed PJF.

Keywords: Adult spinal deformity, Proximal junctional failure, Acute, Delayed

S077

Strategies for Managing Post-surgical Deformities in Spine Surgery

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Purpose: Correction of post-spine surgical deformity refers to surgical interventions aimed at addressing complications or deformities that develop after previous spinal surgery.

Materials and Methods: Proximal Junctional Failure (PJF) commonly occurs at or above the upper instrumented vertebra (UIV) after long-segment instrumentation, with fractures being the most common mode of failure. Risk factors for PJF include low bone density, significant preoperative sagittal imbalance, large curve correction, disruption of the posterior tension band, and terminating the UIV at a kyphotic junction. Coronal Malalignment (CM) refers to the lateral deviation of the T1 plumbline, with substantial displacement (more than 20 mm) from the midline of the pelvis. Type 1 (Concave CM): Correction should focus on the apex of the main curve, with the need for a three-column osteotomy (3-CO) depending on the curve's flexibility. Type 2 (Convex and Convex-Like CM): Correction should focus on the lumbosacral junction. Distal Junctional Kyphosis (DJK) is defined as kyphotic angulation of 10° or more at the distal segment of a fusion construct. To address this issue, the stable sagittal vertebra (SSV) concept was introduced. The SSV is the most proximal vertebra touched by a vertical line drawn from the posterior superior corner of the sacrum on lateral imaging. Selecting it as the lower instrumented vertebra (LIV) helps minimize DJK.

Results: A systematic approach to treatment is necessary for adult patients presenting with late or chronic complications after spinal surgery. This involves a thorough patient assessment, including evaluating current symptoms, understanding the patient's previous surgical history, and conducting a detailed physical examination. Preoperative radiographs should be obtained to prioritize global alignment, including sagittal, coronal, and spinopelvic alignment. Low bone density is a crucial risk factor for reoperation and should be addressed during surgical planning. When formulating differential diagnoses, it is important to consider whether the pathology originates from the same spinal levels or adjacent levels and whether it relates to the prior decompression or fusion. Familiarity with different surgical approaches is essential in addressing the common pathologies encountered in patients with post-spinal deformity.

Conclusions: The aim of surgical revision is to restore alignment and balance while minimizing the risk of postoperative complications. By carefully planning and addressing the underlying issues, the surgeon can help improve the patient's functional outcomes and quality of life.

Keywords: Spine deformity, Proximal junctional failure, Coronal Malalignment, Distal junctional kyphosis

S078

Lumbar Stiffness After Pan-lumbar Arthrodesis Adversely Affects Patient-Reported Outcomes But Does not Compromise Patient Satisfaction in Adult Spinal Deformity

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Purpose: Lumbar stiffness following pan-lumbar arthrodesis for adult spinal deformity may impair the activities of daily living. However, the effect lumbar stiffness on the patient-reported outcomes (PROs) and patient satisfaction in Asian populations remains unclear. Therefore, this study aims to investigate the effect of lumbar stiffness on patient-reported outcomes (PROs) and satisfaction in patients undergoing adult spinal deformity (ASD) surgery.

Materials and Methods: Patients who underwent pan-lumbar arthrodesis (≥5-level fusion) including the sacrum were selected for the study. Radiographic and clinical outcomes were evaluated at postoperative 2-year time point. Lumbar stiffness was evaluated using the modified lumbar stiffness disability index (M-LSDI), which comprises 10 questionnaires with higher scores indicating greater disability. The PRO measures included the visual analog scale (VAS), Oswestry Disability Index (ODI), Scoliosis Research Socitey-22 (SRS-22), Short Form-36 (SF-36) physical

component score (PCS), and SF-36 mental component score (MCS). Patients were divided into two groups based on their 2-year SRS-22 satisfaction scores: high satisfaction (≥4.0) and low satisfaction (<4.0).

Results: A total of 194 patients were included in the study (female, 87.6%; mean age, 69.1 years; and mean fusion length, 8.0). All PROs significantly improved after surgery with regard to VAS, ODI, SRS-22, and SF-36. The M-LSDI score was worsened significantly from 22.3 preoperatively to 26.6 postoperatively. Correlation analysis showed that the 2-year M-LSDI scores were negatively associated all PRO measures, including VAS, ODI, SRS-22, SF-36 PCS, and SF-36 MCS. Based on SRS-22 satisfaction scores, 136 patients (70.1%) showed high satisfaction (score ≥4.0), whereas 58 (29.9%) patients showed low satisfaction (score < 4.0). Multivariate regression analysis revealed that the 2-year M-LSDI score did not affect patient satisfaction status; the 2-year SRS-22 score was a single independent factor for high satisfaction.

Conclusions: After surgery, significant improvements were observed in all RROs including VAS, ODI, SRS-22, and SF-36. Patients experienced significant stiffness-related impairment in daiily activites even before surgery. Although the postoperative increase in M-LSDI scores were significant, the changes were so small with only 4.3 of 40 points. The degree of postoperative lumbar stiffness negatively influenced all PRO measures but did not affect patient satisfaction.

Keywords: Adult spinal deformity, Lumbar stiffness, Patient-reported outcomes, Satisfaction

Free Paper: Lumbar (4)

S119

Accuracy of Postero-superior Iliac Spine Reference Array Placement in Robot-navigated Spine Surgery

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Purpose: Computer-navigated spinal instrumentation requires placement of a dynamic reference base (DRB), typically intraosseously in the ilium via a percutaneous stab incision on the posterior superior iliac spine (PSIS) entry point. Data describing the accuracy and complications of DRB placement is limited in literature. The aim of this study is to measure the accuracy of DRB placement in the PSIS, determine its exact placement trajectory and determine the prevalence of related complications.

Materials and Methods: Single-centre, institutional board approved, multi-surgeon retrospective analysis of 69 included DRB placements from 51 robot-assisted lumbar posterior instrumentation procedures. Pin entry point and trajectory were mapped out the intra-operative O-arm computed tomography scans, and skin-to-PSIS depth was also measured. Patient demographics (age, gender, BMI), surgical outcomes and post-operative complications are also recorded.

Results: Of the 69 PSIS pin placement, 47 (68.1%) had the correct entry point on the PSIS, and 35 (50.7%) of them were placed correctly within the ilium without breaching a second cortex. Skin-to-PSIS depth was significantly higher in patients with misplaced DRB placement, while age, gender and BMI were similar. Of those with misplaced DRB (n= 34), 1 had delayed pin site wound healing.

Conclusions: Percutaneous PSIS DRB placement has poor accuracy, with skin-to-PSIS depth being a significant factor. To avoid complications from misplaced DRB placement, the authors recommend the use DRB placement on the iliac wing or on the PSIS following the trajectory used in pelvis posterior column fracture fixation, using fluoroscopy intra-operatively to ensure the DRB pin position.

Keywords: PSIS pin, Robotic navigation, Accuracy, Complication

S120

Awake Endoscopic Lumbar Spinal Decompression on a Patient with Achondroplasia - Literature Review and Case Report

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Purpose : Individuals with achondroplasia are prone to lumbar stenosis with a common need for spinal decompression surgery. However, given anatomical and medical factors, this population is at increased risk for surgical and anaesthetic complications, thus posing a unique challenge to the clinicians. The use of an awake minimally invasive endoscopic technique under monitored anaesthesia care may prove beneficial to mitigate such risks. We present a case of a 52 year old female with achondroplasia suffering from left radicular leg pain. A Magnetic Resonance Imaging scan showed severe lumbar spinal stenosis and lateral recess stenosis at L4/5 and L5/S1, with compression of the descending L5 and S1 nerve roots respectively. There was also moderate foraminal stenosis at both levels with compression of exiting L4 and L5 nerve roots respectively.

Materials and Methods: The patient underwent awake endoscopic decompression utilising a uniportal interlaminar endoscopic system under local anaesthesia with sedation.

Results: The patient recovered well post-operatively, with immediate resolution of her symptoms. She was ambulating up to 100 m on postoperative day one.

Conclusions: The awake endoscopic procedure described is an option that may be well suited for patients with achondroplasia presenting with lumbar stenosis.

Keywords: Endoscopic, Achondroplasia, Awake, Spinal surgery

S121

Lumbar Spinal Stenosis: An Update on the Epidemiology, Diagnosis and Operative Complication

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Lumbar Spinal Stenosis,
**Spinal Stenosis*

Purpose: The aim of this study was to assess the epidemiology, clinical feature, diagnosis and operative complcation of the lumbar spinal stenosis patients.

Materials and Methods: This Prospective Interventional Study study was carried out among 28 patients attending at the department of Orthopaedic Surgery at Dhaka Medical College Hospital, Bangladesh Spine & Orthopaedic Hospital (BSOH), Al-Manar Hospital Ltd, Dhaka for the treatment of lumbar spinal canal stenosis within the defined period from January 2022 to December 2022. Ethical clearance was obtained from the Institutional Review Board (IRB) of DMCH. Purposive sampling was done according to availability of the patients. Statistical analyses of the results were obtained by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-20.1).

Results: Mean age of the patients was 51.32±8.29 years and the ranges were 40-70 years where maximum belonged to 40-49 years of age (42.86%). Greater part of the patients was female 60.71% with a female: male ratio 1.6:1. Maximum patients were Housewife 57.14% and manual worker 32.14%. All of the study patients had low back pain and 85.71% had leg pain. 92.86% patients had Neurogenic **Claudications:** Motor weakness in lower extremities were seen in 22 patients (78.57%) & amp; Sensory changes were seen in 21 patients (75.00%). Most commonly involved intervertebral disc level was L4/L5 (39.29%) & less in L2/3, 3/4 (3.57%). Operative complications were seen in 2 patients (7.14%) where in 2 patients (7.14%) developed superficial wound infection post-operatively.

Keywords: Lumbar spinal stenosis, Epidemiology, Diagnosis, Operative complication

S122

Anterior to Psoas Lateral Lumbar Interbody Fusion vs Transforaminal Lumbar Interbody Fusion: Early Clinical And Radiologic Outcomes

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Purpose: To compare the clinical and radiographic results of patients undergoing lateral lumbar interbody fusion versus transforaminal lumbar interbody fusion

Materials and Methods: From January 1, 2022 to September 30, 2023, 26 patients were included with 18 in the ATP LLIF group and 8 in the MIS TLIF group. A total of 31 levels were studied, 22 under ATP LLIF group and 9 in the MIS TLIF group. To analyze the data between the preoperative and postoperative outcomes and measurements, the researcher used the Paired Sample t Test and Wilcoxon Signed t Test. Comparing the final outcomes between the ATP LLIF group and MIS TLIF group, the study utilized the Independent sample t Test and the Mann-Whitney U Test. The results were tabulated and graphed based on Age, Sex, BMI, Preoperative and Postoperative ODI, VAS back, VAS leg, Intervertebral height, Neuroforaminal height, Lumbar Lordosis using MS Excel.

Results: There were no significant difference in age ($p=0.053$), sex ($p=0.099$), BMI ($p=0.959$) and number of levels operated (0.628) between the 2 groups. The ATP LLIF group showed significant difference between the preoperative and postoperative ODI, VAS (back), VAS (leg), Intervertebral height and Neuroforaminal height ($p<0.001$ for all, respectively) However, there is no significant difference between the preoperative and postoperative Lumbar Lordosis ($p=0.050$). While in the MIS TLIF group, the study also showed significant difference in the preoperative and postoperative ODI, VAS (back), VAS (leg), Intervertebral height and Neuroforaminal height ($p<0.013$, $p<0.018$, $p<0.011$, $p<0.00$, $p<0.00$, respectively). There is also no significant difference in the preoperative and postoperative Lumbar Lordosis ($p=0.327$). When comparing the ATP LLIF to the MIS TLIF group, no significant differences were found in the ODI, VAS back and Lumbar Lordosis between the two groups at preoperative and 1 month postoperative ($p=0.802$; $p=0.368$; $p=0.222$). However, the ATP LLIF group showed significant better VAS leg improvement ($p<0.003$), IVH ($p<0.037$) and Neuroforaminal height (right and left)($p<0.00$, $p<0.001$) restoration.

Conclusions: Compared with MIS TLIF, ATP LLIF showed greater significant change in VAS leg, restoration of intervertebral and neuroforaminal height with no significant difference in terms of ODI, VAS back and Lumbar Lordosis.

Keywords: Anterior to psoas lumbar interbody fusion, Minimally invasive transforaminal interbody fusion, VAS scores, Intervertebral height, Neuroforaminal height

Free Paper: MIS (1)

S123

A Single Surgeon's Experience Transitioning from Tubular-Based Microscopic Decompression to Full-Endoscopic Decompression for Lumbar Spinal Stenosis

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Purpose: Advances in endoscopic technology have enabled less-invasive lumbar decompression surgery with outcomes comparable to traditional methods. However, surgeons accustomed to tubular-based microscopic (TM) systems may face challenges transitioning to full-endoscopic (FE) decompression due to the associated learning curve. This study evaluates the initial outcomes of a senior spine surgeon making this transition, focusing on safety, efficacy, and patient-reported outcomes.

Materials and Methods: We analyzed 47 consecutive patients (33 TM, 14 FE) who underwent unilateral laminotomy for symptomatic lumbar radiculopathy between January 2020 and December 2023, coinciding with the adoption of interlaminar endoscopic decompression by the senior author. Clinical outcomes included straight-leg raise (SLR) angle, Visual Analog Scale (VAS), Oswestry Disability Index (ODI),

and Short-Form 36 (SF-36), measured preoperatively and at 1, 3, and 6 months postoperatively. Patients rated their satisfaction with the procedure at 6 months. Operative time, complications (minor and major), and revision rates were also recorded.

Results: Patient demographics and baseline function were comparable between groups. Operative time was significantly longer in the FE group (142±42 vs. 91±21 minutes, p=0.001). No differences were observed in minor complication rates. One epidural hematoma occurred in the TM group, requiring emergency open decompression. In the FE group, one patient required revision surgery for dural scarring, and another with a calcified disc experienced incomplete decompression but did not undergo further revision. At the 1-month follow-up, the FE group reported higher leg pain intensity (p=0.005), frequency (p=0.023), and persistence of neurological symptoms (p=0.003). However, there were no differences in SLR, VAS, ODI, or SF-36 scores at 3 or 6 months. At the 6-month follow-up, a higher proportion of FE patients rated their surgery as "good" or better (85.7% vs. 69.7%, p=0.249).

Conclusions: Transitioning from TM to FE decompression is safe and yields comparable outcomes at 6 months, despite initial challenges with operative time and symptom resolution. As surgeons gain proficiency, the benefits of less invasive techniques may be more fully realized, leading to improved outcomes. Careful patient selection during the learning phase is critical to mitigate early challenges. This study highlights the potential for broader adoption of FE techniques, contributing to diverse perspectives in minimally invasive spine surgery.

Keywords: Lumbar spinal stenosis, Endoscopic, Tubular-based microscopic, Minimally invasive spine surgery, Functional outcomes

S124

Clinical Efficacy of Biportal Endoscopic Spinal Surgery (BESS) for Lumbar Spinal Stenosis

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Purpose: Biportal endoscopic spinal surgery (BESS) is a minimally invasive technique combining features of microscopic spinal surgery, such as the floating technique, and conventional percutaneous endoscopic spinal surgery, which utilizes endoscopic or arthroscopic instruments. This study reports the clinical outcomes of BESS for lumbar spinal stenosis (LSS).

Materials and Methods: Total 16 consecutive patients with LSS underwent posterior decompression via BESS. 14 patients underwent single-level surgery and 2 patients underwent double-level surgery. Mean age was 65.75±3.08 years old and there were 5 men and 11 women. Clinical outcomes were evaluated using the Numeric Rating Scale (NRS) for back and leg pain, changes in postoperative C-reactive protein (CRP) and the incidence of postoperative complications. Functional outcomes were assessed using the Macnab criteria and Oswestry Disability Index (ODI).

Results: At the six-month follow-up, the NRS for back pain improved significantly from 7.56±1.03 to 2.69±0.95 (p=0.00), while the NRS for leg pain improved from 8.44±0.96 to 2.38±1.15 (p=0.01). According to the Macnab criteria, 68.75% of patients achieved the satisfactory outcome. The ODI showed significant improvement from 79.88±11.35 to 24.38±13.96 (p=0.01). At 5 days after surgery, mean CRP was increased from 1.72±4.11 to 2.40±2.90 (p=0.59). Only one patient with liver cirrhosis received total 800cc of packed red blood cell transfusion on the day of surgery.

Conclusions: BESS demonstrates clinical efficacy in treating lumbar spinal stenosis, with significant pain relief and functional improvement. Key advantages include a lower postoperative infection rate due to continuous irrigation during the procedure and reduced need for fusion surgery, facilitated by wide sublaminar and foraminal decompression with minimal sacrifice of stabilizing structures.

Keywords: Lumbar spine, Degenerative lumbar spinal stenosis, MISS, BESS

S125

Can Cauda Equina Syndrome Caused by Lumbar Herniated Intervertebral Disc Be Treated with Biportal Endoscopic Technique? A Retrospective Cohort Study

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Purpose: Cauda equina syndrome (CES) is a severe neurological condition caused by significant compression of the cauda equina nerve roots. Traditional treatment involves open discectomy, but minimally invasive techniques, including endoscopic approaches, are gaining popularity. This study evaluates the efficacy of biportal endoscopic (BE) lumbar discectomy in treating CES caused by lumbar herniated intervertebral discs.

Materials and Methods: This retrospective case series includes 32 patients treated for CES with BE lumbar discectomy across three institutions from March 2017 to July 2022. Patients were selected based on Fraser's criteria for CES, confirmed via MRI. Patient demographics, surgical details, and outcomes were analyzed. Clinical outcomes were assessed using the Visual Analog Scale (VAS) for back and leg pain, Oswestry Disability Index (ODI), and EQ-5D scores at baseline, 3, 6, and 12 months postoperatively.

Results: The mean age of patients was 44.44±13.70 years. The average duration from symptom onset to surgery was 44.81±32.69 hours. At 12 months postoperatively, significant improvements were observed in VAS for back pain (from 5.00±2.82 to 1.28±1.63, $p<0.01$) and leg pain (from 7.44±1.79 to 1.16±1.55, $p<0.01$). ODI scores decreased from 58.25±20.15 to 10.13±14.54 ($p<0.01$), and EQ-5D scores improved from 0.414±0.175 to 0.859±0.163 ($p<0.01$). Bladder and bowel symptom recovery rates were 86.7% and 85.0%, respectively. The mean operation time was 42.50±17.91 minutes, with an average hospital stay of 3.34±2.59 days. Complications included incidental durotomy (6.3%), and facet joint injury (6.3%).

Conclusions: Biportal endoscopic spine surgery is a feasible option for treating cauda equina syndrome, maintaining the benefits of minimally invasive surgery while allowing more flexible handling of surgical instruments through two independent portals. Biportal endoscopy represents a promising advancement in the surgical management of CES, offering effective decompression with minimal tissue damage and a low complication rate.

Keywords: Biportal endoscopic spinal surgery, Cauda equina syndrome, Discectomy, Lumbar herniated disc, Minimally invasive spine surgery

S126

Are surgeries for Lumbar Facet Cysts a Thing of the Past? Evaluating efficacy of Percutaneous Facet Cyst Rupture as a Primary Treatment Modality

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Purpose: Lumbar facet cysts are a common cause of radiculopathy, often necessitating intervention. Percutaneous facet cyst rupture (PFCR) is a minimally invasive treatment option. This study evaluates the efficacy of PFCR in patients, focusing on pain relief and recurrence over a long-term follow-up period.

Materials and Methods: This retrospective study included 55 patients (27 males, 28 females) with acute onset radiculopathy secondary to lumbar facet cysts. Patients were divided into two groups based on facet orientation: 24 with favourable and 31 with unfavourable orientations. Inclusion criteria were acute radiculopathy symptoms within 3-6 months. Exclusion criteria included prior lumbar spine surgery, chronic symptoms, and other active spinal pathologies. Patients were followed up at 3, 6, 12 months post-PFCR, And annually thereafter.

Results: In the favourable orientation group, 23 out of 24 patients experienced complete pain relief with no cyst recurrence at long-term follow-up. One patient required surgery due to persistent pain. In the unfavourable orientation group, 25 out of 31 patients had complete radiculopathy pain

relief, though 10 reported recurrent back pain later in the follow-up. Of the remaining 6 patients, 2 were lost to follow-up, 2 underwent surgery for persistent lumbar canal stenosis symptoms, and 2 had cyst recurrence, necessitating revision PFCR.

Conclusions: PFCR is highly effective for patients with favourable facet orientation, offering sustained pain relief and low recurrence rates. In patients with unfavourable orientation, while initial radiculopathy relief is common, there is a higher incidence of recurrent back pain and cyst recurrence, suggesting the need for closer monitoring and potential additional treatments. Facet orientation is a significant predictor of long-term outcomes in PFCR treatment.

Keywords: Percutaneous facet cyst rupture, Lumbar facet cyst, Radiculopathy, Facet orientation, Minimally invasive spine surgery, Pain relief, Cyst recurrence

Free Paper: MIS (2)

S127

Distance to the Spinal Canal and Vertebral Body From the Insertion Point of Percutaneous Pedicle Screws in the Lumbar Spine: Radiographic Anatomy on Computed Tomography Images for a Safe and Efficient Procedure

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Purpose: PPS insertion needs image guidance, and it is mainly inserted with C-arm guide. Needle is inserted with A-P view by observing shape of pedicle, then depth is checked with lateral view. Too angled needle damages spinal canal (SC), and too deep needle damages abdominal vessels. The knowledge of length of pedicle is useful to efficient PPS insertion. This study analyses the distance from inserting point to SC and vertebral body (VB).

Materials and Methods: 60 cases lumbar CT was analyzed for measurement of L1-5 pedicle. The methods of PPS insertion are from lateral margin of pedicle in A-P view (PL) or from the angle of transverse and superior articular process (TS). The distance to inner wall of pedicle (IW) were determined as PL-A and TS-A. The distances to VB were determined as PL-B and TS-B. This is the longest length to VB, and if needle is inserted this length, it is already in VB.

Results: 600 pedicles were analyzed. The results of PL-A (the mean distance±standard deviation) from the L1 level to the L5 were 17.9±3.0 mm, 18.1±2.9, 18.9±3.1, 18.7±3.4, and 19.9±3.3, respectively meanwhile those of PL-B were 24.1±3.5 mm, 23.2±3.4, 23.0±3.8, 22.1±4.1, and 21.9±3.8. The results of TS-A were 17.9±2.6 mm, 17.6±2.2, 18.0±2.3, 16.3±2.2, and 17.1±2.3, while those of TS-B were 22.8±2.6 mm, 21.6±2.3, 21.2±2.1, 18.6±2.1, and 18.3±2.2. And PL-A, PL-B, TS-A and TS-B of all L1-L5 were 18.7±3.2, 22.9±3.8, 17.4±2.4 and 20.5±2.9 mm, respectively.

Conclusions: Statistically, the probability of being larger than +2SD is 2.3%. PL-A and ST-A in 98% cases were less than 25mm and 22mm, respectively. Briefly, if the needle is inserted this length and doesn´t reach IW, the depth should be checked with lateral view. Results of this study contribute safe and efficient PPS insertion.

Keywords: Distance, Lumbar spine, MIS, Percutaneous pedicle screw, Safety

S128

Clinical and Radiological Comparison of Biportal Endoscopic Interbody Fusion and DLIF-ALIF

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Purpose: The advancement of endoscopic surgery has made biportal endoscopic interbody fusion a viable option. This study aims to compare the benefits and drawbacks of biportal endoscopic fusion with DLIF (Direct Lumbar Interbody Fusion) and ALIF (Anterior Lumbar Interbody Fusion).

Materials and Methods: This analysis included 109 cases: 27 patients who underwent DLIF-ALIF surgery from 2012 to

2021, and 82 patients who underwent biportal endoscopic fusion with large cages from 2020 to 2023. In the DLIF-ALIF group, the male-to-female ratio was 1:1.8, with an average age of 67.4±10.7 years and a follow-up period of 8.7±1.9 years. The biportal endoscopic group had an average age of 65.2±9.9 years and an average follow-up period of 1.6±1.0 years. Clinical outcomes were evaluated using the McNab criteria, assessing changes in intervertebral disc height and segmental vertebral disc angle on pre- and postoperative radiographs. Radiological fusion was evaluated at final follow-up, and surgical complications were compared. Statistical analysis was conducted using the Mann-Whitney U test.

Results: According to McNab criteria, the DLIF-ALIF group results were: excellent in 9, good in 11, fair in 6, and poor in 1 case. The biportal group showed 8 excellent, 60 good, 7 fair, and 6 poor results. For the DLIF-ALIF group, the intervertebral disc height changed from 6.2 mm preoperatively to 8.6 mm postoperatively. Segmental lumbar lordotic angle changed from 3.1 to 6.4 degrees. In the biportal group, disc height changed from 6.8 mm to 8.4 mm, and lordotic angle from 5.8 to 6.8 degrees on average. Although statistically similar, the DLIF-ALIF group showed a greater increase in disc height and lordotic angle. Final radiographic bone union showed 57.6% complete and 32.4% partial union in the DLIF-ALIF group. The biportal group showed 23.5% partial to 76.5% union, with the DLIF-ALIF group showing significantly better bone union. DLIF-ALIF complications included vascular injury, endplate fracture, junctional problems, and incomplete decompression. Biportal complications involved endplate breakage, cage rotation, dura tear, and incomplete decompression.

Conclusions: The DLIF-ALIF group demonstrated superior radiological outcomes, with variations in complication types compared to the biportal approach.

Keywords: Biportal endoscopic fusion, DLIF-ALIF, Radiological measurements

S129

Application of BE-TLIF in Lytic and Degenerative Spondylolistheses- Cases series

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Purpose: Degenerative spondylolisthesis (DS) is a progressive, often debilitating spinal disorder that is among the most common indications for lumbar spine surgery in older adults. In contrast to isthmic spondylolisthesis (IS) which requires a pars defect, DS is an acquired vertebral subluxation with an intact posterior arch, most characteristically involving anterior displacement L4 on L5. The development of degenerative olisthesis begins with desiccation of the intervertebral disc that leads to altered spinal load-bearing dynamics and an increased load on the facet joints, resulting in circumferential segmental pathology including segmental hypermobility and facet arthropathy. Over time, the degenerative cascade leads to the development of symptomatic lumbar spinal stenosis (LSS), degenerative spondylolisthesis, and progressive deformity. Biportal Endoscopic transforaminal lumbar interbody fusion (BE-TLIF) with bilateral percutaneous pedicle screw fixation is an emerging option for low grade spondylolisthesis. In this paper, we compare the short to mid-term surgical outcome of the two different spondylolistheses.

Materials and Methods: From Jan 2021 to December 2023 35 consecutive patients were diagnosed with degenerative and spondylolytic spondylolisthesis who received BE-TLIF were included in this study. All patients were followed up for at least 6 months. The clinical outcomes were evaluated using the visual analog scale (VAS), Oswestry Disability Index, and intra-operative blood loss, olisthesis reduction and post-operative complications, etc.

Results: BE-TLIF performed well in the initial surgical outcome regarding the blood loss, reduction in VAS score, ODI and the days of hospitalization in both groups. BE-TLIF can achieve very good reduction in DS, but not so good in IS. Slightly more complications in the DS group, possibly, due the osteoporosis, female predominant and older age. Due to the different nature history of the two different kinds

of spondylolisthesis, the surgical response was different, especially in the reduction power of the technique.

Conclusionss: The DS generally comes with worse spinal stenosis and more segmental instability. IS came with more foraminal stenosis and more stable motion segments. One should choose wisely regarding the purpose of the surgery. If early recovery and the minimal invasiveness is the major consideration, BE-TLIF performed great in both type of spondylolisthesis. If the correction power is to be concerned, one might need to think twice before using BE-TLIF in IS. Long term follows ups and more cases are necessary for more solid conclusion.

Keywords: Spondylolisthesis, Biportal endoscopy, TLIF, Minimally invasive surgery, Lumbar fusion

S130

In vivo Comparison of Endplate Preparation Quality Between Biportal Endoscopic and Conventional Transforaminal Lumbar Interbody Fusion: An Endoscopic Assessment

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Purpose: Successful spinal fusion heavily depends on adequate endplate preparation in transforaminal lumbar interbody fusion (TLIF). While biportal endoscopic interbody fusion (BEIF) offers enhanced visualization compared to conventional TLIF, the comparative effectiveness of these techniques in endplate preparation remains unclear.

Materials and Methods: In this retrospective study, we compared endplate preparation quality between BEIF (n=10) and conventional TLIF (n=10) in single-level lumbar fusion procedures. Endplate preparation quality was evaluated using standardized 30-degree endoscopic visualization with a 4-point grading system, assessing both ipsilateral and contralateral regions of upper and lower endplates. Clinical outcomes, fusion rates, and complications were assessed at one-year follow-up.

Results: BEIF demonstrated significantly better endplate preparation quality in ipsilateral regions of both upper and lower endplates (p=0.007 and p=0.022, respectively). While BEIF showed superior preparation in contralateral regions, these differences were not statistically significant. Endplate violation rates were lower in the BEIF group (20% vs 30% for upper endplate; 30% vs 50% for lower endplate) but not statistically significant. Both groups achieved comparable clinical outcomes and fusion rates at one-year follow-up (50% vs 70%, p=0.648).

Conclusions: BEIF enables superior endplate preparation quality compared to conventional TLIF, particularly in ipsilateral regions. While both techniques achieved similar clinical outcomes and fusion rates at one-year follow-up, the improved visualization and technical control offered by BEIF represents a potentially valuable advancement in lumbar interbody fusion surgery.

Keywords: Endplate preparation, Biportal endoscopic interbody fusion, Transforaminal lumbar interbody fusion, Lumbar degenerative disease, Minimally invasive spine surgery

Free Paper: MIS (3)

S131

Functional Outcome of Modified Oblique Lateral Interbody Fusion Approach for Degenerative Lumbar Spine Pathology

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Purpose: To assess clinical and radiological outcomes of oblique lateral Inter body fusion technique in single stage single anterior approach with anterolateral screw without going posterior (OLIF-AL)

Materials and Methods:

Type of Study: Retrospective observational

Place of Study: Tertiary Care Hospital in South India

Duration of Study: 2 years (August 2022 to August 2024).

Inclusion criteria:

1. Degenerative spinal diseases,
2. failed conservative management for over 2 months.

Exclusion criteria:

1. L5-S1 level involvement .
2. Higher iliac crest.
3. more than 2 level involvement .
4. presence of congenital deformities.

Parameters observed:

Clinical assessment via VAS score of Back & Leg Pain and Oswestry disability Index score. Operating time and blood loss was also monitored. Radiological assessment of Disc height, Foraminal height, Foraminal Surface Area, Spinal canal Surface area, Segmental lordosis, Lumbar Lordosis, Spinopelvic parameters . Fusion status using Modified Birdwell fusion criteria.

Surgical Technique: Patient in GA, Right lateral approach with left side up, Incision over the involved segment , Retroperitoneal dissection, Discectomy done endplate prepared ,Cage insertion done along with bone graft. Followed by insertion of Anterolateral Pedicle screw and Rod

Results: 45 patients in our study (29 Female,16 Male). Mean age was 54.5 yrs. Most common pathology was Lumbar canal stenosis. Most common level fused was L4-L5 level. We observed about 30% in operation time and significant reduction in blood loss. Average preoperative VAS score for back pain and leg pain was 4.6 and 5.9 will was reduced to 2.3 and 1.8 at final follow up. Average ODI score decreased from 48.8% to 24.0%. Disc height increased from mean of 8.6 mm to 13.4 mm. Foraminal height increased from mean of 17mm to 22 mm. Average increase in foraminal area by 30%. Average Preop Spinal canal surface area improves from 39.43 mm^2 to 84 mm^2. Segmental lordotic angle increased from mean of 10.1 degree to 15.2 degree. All patient has matched their Lumbar Lordosis and Pelvic Incidence .Modified Birdwell fusion criteria at final follow up was Grade I. Complication in 3 patients, which was approach related injury to psoas muscle (Hip flexor weakness) which improved completely over the period of 3 months.

Conclusions: Single stage single anterior approach OLIF for degenerative lumbar diseases showed favourably clinical and radiological outcome . It helps avoids various complications of second procedure in standard OLIF. Overall OLIF with anterolateral screw is safer faster and efficient.

Keywords: Minimally invasive spine surgery, Degenerative lumbar spine disease, Lateral access surgery, Modified OLIF, Large footprint cage

S132

The Adequate Range of Facet Resection in Full Endoscopic PECF (Percutaneous Endoscopic Cervical Foraminotomy)

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Purpose: Recently, substantial cases of cervical foraminal stenosis are solved by PECF(Percutaneous Endoscopic Cervical Foraminotomy) instead of conventional foraminotomy, or ACDF. For adequate decompression of exiting nerve root, partial facetectomy on the index level is necessary. This study aims at recommending the proper range of facet resection for unroofing the exiting nerve roots from the lateral recess to the outer margin of lower pedicle without instability in full endoscopic PECF.

Materials and Methods: Patients underwent PECF for cervical foraminal stenosis in a single center from February 2023 till May 2024 were included. The candidates performed PECF on C4-5, C5-6, C6-7 by full endoscopic foraminotomy were selected to minimize the statistical errors. The width of facet joint was measured on the axial view of MRI at the operated disc level, and the gap between preoperative and postoperative of facet width was calculated by subtracting the latter from the former. The pain improvement of candidates were followed up for 6 months.

Results: A total of 131 patients (male(94), female (37)) were included, and average age was 51.2. 62(47.3%) segments were performed on Rt , 69(52.7%) were on Lt ; 11 cases (8.4%) were performed on C4-5, 66 cases (50.38%) on C5-6, 54 cases (41.22%) on C6-7. The mean value of preoperative facet width was 12.73 mm on pathologic side, 12.85 mm on control side. The average gap of facet width after surgery was 4.618 mm and remnant ratio was 63.922 % on the pathologic side ($p<0.05$). The least remnant ratio (62.077%) was detected on C6-7 level ; 69.621% on C4-5 level, 64.482% on

C5-6 level. Follow up for 6 months showed the improvement of pain (VAS : neck pain 7.3 ->2.7, radiating pain : 7.5 ->1.2) and there were no case requiring reoperation.

Conclusions: In performing PECF using full endoscope, the exiting nerve root should be decompressed from the lateral recess to the lateral margin of lower pedicle by partial facetectomy. The study showed the adequate resection range of facetectomy in PECF is not as large as recommended previously (facet resection width : 4.618 mm, remnant ratio : 63.922%). Proper, not excessive range of facet resection can improve pain and doesn't bring out early segmental instability.

Keywords: Cervical foraminal stenosis, PECF, Full endoscopic spine surgery

S133

XLIF: The Filipino Experience

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Purpose: Extreme Lateral Interbody Fusion (XLIF) is a minimally invasive surgical technique used to treat various spinal disorders, particularly those affecting the lumbar spine. This procedure involves accessing the spine from the side of the body, allowing for the removal of damaged intervertebral discs and the insertion of interbody cages or fusion systems to promote spinal stability and fusion.

In the Philippines, the adoption of XLIF has been increasing, reflecting a global trend towards minimally invasive spinal surgeries. The Asia-Pacific XLIF surgery market, which includes the Philippines, is projected to grow at a compound annual growth rate (CAGR) of 6.5% from 2022 to 2029. This growth is driven by factors such as the rising demand for minimally invasive procedures, technological advancements in medical devices, and an increasing prevalence of spinal diseases.

St. Luke's Medical Center

Results: The advantages of XLIF over traditional lumbar interbody fusion techniques include reduced postoperative pain, shorter hospital stays, and quicker recovery times. By accessing the intervertebral disc through the retroperitoneal space and psoas muscle, XLIF avoids major vessels and visceral organs, potentially reducing complications associated with other surgical approaches. Despite its benefits, XLIF requires careful preoperative imaging to assess the location of anatomical structures, including major retroperitoneal vasculature and lumbar nerve roots, relative to the psoas muscle. This assessment is crucial to minimize the risk of complications during surgery.

Conclusions: XLIF is a promising minimally invasive technique for lumbar interbody fusion in the Philippines, offering several advantages over traditional methods. However, it necessitates meticulous preoperative planning and imaging to ensure patient safety and optimal outcomes.

Keywords: XLIF, Extreme lateral interbody fusion, Lumbar spine, Minimally invasive surgery

S134

Educational Value of a High-definition Three-Dimensional Extracorporeal Telescope (Exoscope) in Lateral Access Spine Surgery

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Purpose: Lateral lumbar interbody fusion (LLIF) is gaining popularity as a minimally invasive surgical option for patients with degenerative lumbar conditions. However, given the minimally invasive nature, surgical trainees and assistants struggle to visualise the procedure from the surgeon's perspective. Hence, this study aims to assess the educational benefits of using an extracorporeal telescope (exoscope) during LLIF.

Materials and Methods: This survey was conducted in Changi General Hospital. All junior surgical doctors (JSDs) and scrub nurses (ScNs) who participated in LLIF cases with and without the usage of an exoscope were included in the survey. They answered a set of seven questions (scored 1 to 5) to evaluate their learning experience when the exoscope was used. The median of the scores were reported with interquartile range (IQR).

Results: A total of 12 participants were included. They reported enhanced visualisation of anatomy during both superficial dissection (median score=4.5, IQR 4-5) and deep dissection (median score=5, IQR 5-5). Similar ratings were given for understanding disc space anatomy (median score= 5, IQR 5-5) and overall appreciation of the surgery (median score=5, IQR 4.25-5). Participants found the exoscope to be more ergonomic for visualizing the surgery (median score= 5, IQR 4-5) and noted significant knowledge improvement in LLIF procedures (median score=5, IQR 4-5). They expressed a strong preference for its use in future LLIF cases (median score=5, IQR 4.25-5).

Conclusions: The exoscope is a valuable asset for lateral access spinal procedures, enhancing the educational experience for JSDs and ScNs.

Keywords: Spine, Lateral, LLIF, OLIF, Exoscope, Education

Invited Lecture VI

S135

The Application of Computerized Navigation and 3D Printed Model in Complex Paediatric Spinal Deformity

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Paediatric spinal deformity is a challenging condition to treat. Significant rotation of spine, vertebral body deformation, dysplastic pedicles or very short pedicles all contribute to the complexity of the disease and therefore, the high operative risks related to instrumentation, release or bony osteotomy. The use of computerised navigation allows precise localisation of entry site and screw tract for pedicle screws to reduce the risks of iatrogenic damage to spinal cord or vessels. It also allows maximizing the length and diameter of the screws so that better purchase could be achieved for deformity correction. On the other hand, preoperative virtual surgery planning software could be combined with the computerized navigation machine so that accurate osteotomy could be performed intra-operatively. With availability of high quality one to one 3D printed spine models, surgeons could better appreciate the exact anatomy of deformity and potential difficulty well before the surgery. Simulated surgery could also be performed, so that the surgeon could familiarise with the complex procedure and accurately estimate the postoperative alignment. Computerized navigation and 3D printed bone models are important technological advancements to improve surgical safety and patient outcomes. This is a review and case series demonstrating how these enabling technologies could be utilised in patients with severe deformities.

Keywords: Pediatric, Spine, Surgical navigation, 3D printing

Free Paper: MIS (4)

S136

UBE ExLLIF with Large Cage by UBEST Technique - Results from our Early Experience

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Purpose: UBE-assisted fusion is a recognized treatment option for patients with lumbar degenerative disease characterized by instability. The use of large footprint OLIF interbody cages improves segmental stability, restores lordosis, and equalizes stress distribution across the vertebral end plates. However, OLIF comes with several drawbacks, such as requiring a staged procedure, potential complications from the anterior approach, and a lack of direct visualization of neural structures. By employing the UBE ExLLIF (Extreme Lateral Large Cage Lumbar Interbody Fusion) technique, we can address these challenges while preserving the advantages of minimal invasiveness. Our study aimed to evaluate the clinical and radiological outcomes of the UBE ExLLIF procedure.

Materials and Methods:
Study place: Tertiary Care Hospital in South India
Duration of Study: December 2023 to September 2024
Inclusion criteria: Patient with lumbar degenerative disease with instability not responding to conservative treatment
Exclusion: Infections, Trauma, Tumours
Parameters observed: VAS (Leg & Back), ODI
Radiological Parameters: Disc height, Foraminal height, Spinal canal area, Fusion (Modified Birdwell Criteria), Cage Subsidence
Surgical Technique: Patient under GA in prone position, UBE decompression through lateral portals. Inferior and superior articular process osteotomy extending the Kambin's triangle. Discectomy and insertion of bone grafts and OLIF cage under endoscopic visualisation followed by percutaneous pedicle screw fixation
Results: 7 patients (4 Females, 3 Males) with average age of 47.3 yrs were included. Most common level fused was L4-L5. Average preoperative VAS-Back was 8.1 which improved to 3.4 at 9 months postop, Average preopoperative VAS-Leg was 9.4 which improved to 1.6 at 9 months postop, Average preopoperative and 9 months postop ODI score was 81.3 and 20.5 respectively. Average disc height increased from 9.6 mm to 14.4 mm, average forminal height increased from 17.3 mm to 22.5 mm and spinal canal area increased from 39.42 mm^2 to 86.11 mm^2 at 9 months post surgery. Average fusion rate at 9 months postop was Grade II as per Modified Bridwell Fusion criteria. One patient had transient numbness which recovered after 3 weeks. No cage subsidence or other complications were recorded in our study
Conclusions: UBE ExLLIF, featuring a large footprint cage, offers notably enhanced functional and radiological results for patients suffering from lumbar degenerative disease. This technique can be viewed as a secure and effective method for spinal decompression and fusion, as it integrates the benefits of direct decompression of neural elements with a minimally invasive approach
Keywords: UBE, Interbody fusion, OLIF cage, Large footprint cage

S137

Biportal Endoscopic Lumbosacral Inclinatory Extraoraminal Approach for Delayed L5 Root Palsy after Malunion of Vertically Unstable Sacral Alar Fracture

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Purpose: A vertically unstable sacral alar fracture (VUSAF) accompanied by a posterior pelvic ring injury typically results from high-energy trauma and often cause causes severe neurological deficits in a substantial proportion of patients. Furthermore, callus formation from the malunion of VUSAF can directly entrap the L5 spinal nerve in the extraforaminal area. However, accessing the entrapment site is often challenging in this condition because the sacral alar and posterior superior iliac spine (PSIS) are displaced in an anterosuperior direction. This study aims to introduce a biportal endoscopic lumbosacral inclinatory foraminal approach (BE-LIEA) to address these challenges.
Materials and methods: This technical case report describes two patients who developed delayed L5 spinal nerve palsy due to malunion of VUSAF. Under general anesthesia, the patient was positioned in the prone, with the surgeon operating from the side opposite the lesion. Two vertical skin incisions, each 0.8 cm length, were made just inside the medial margin of L5 and S1 pedicles. Endoscopic visualization was achieved to identify the tip of the S1 superior articular process, the lateral aspect of pars interarticularis, and the inferior margin of L5 pedicle and transverse process. L5 spinal nerve decompression was performed from the intervertebral foramen to its entry into the retroperitoneal space while avoiding interference from the PSIS. Clinical outcomes including visual analog scale, Oswestry disability index (ODI), and recovery of extensor hallucis longus (EHL) power were evaluated for postoperative one year.
Results: Both patients experienced significant improvement in leg radiating pain immediately after surgery compared to

baseline ($p<0.001$). Notable improvement in ODI scores was observed one month postoperatively ($p<0.001$). Additionally, the strength of the EHL power improved from grade 1 to grade 3 at three months postoperatively in both patients. No specific complications were noted.

Conclusions: BE-LIEA appears is expected to be a feasible method to overcome the challenges of conventional surgeries in cases of malunion of VUSAF.

Keywords: Biportal endoscopy, Inclinatory extraforaminal approach, Delayed L5 root palsy, Malunion, Vertically unstable sacral alar fracture

S138

Exploring the Efficacy of Minimally Invasive Spine Fixation in Thoracolumbar Spinal Injuries

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Purpose: Traumatic thoracolumbar fractures are common, and surgical fixation is a well-established treatment option, with the aim to achieve spinal stability and preserve neurological function. Pedicle screw fixation using a minimally invasive spine (MIS) surgical approach has emerged as an alternative approach for the treatment of thoracolumbar fractures. The aim of this study is to collect data regarding epidemiology, management, and outcomes of patients treated with MIS pedicle screw fixation for traumatic thoracolumbar fractures in our spine surgical department.

Materials and Methods: This was a retrospective cohort study including all patients who underwent MIS fixation from July 2021 to June 2024.

Results: A total of 38 patients were included, 23 males and 15 females; the mean age was 38 years. The majority of injuries were from falls. In 12 cases, the fracture involved a thoracic vertebra and in 10 cases a lumbar vertebra and 16 cases thoracolumbar. 40% (n=15) of the patients presented with a neurological deficit on admission and 75% (n=11) of those showed postoperative improvement in their neurology. The average length of hospital stay was 6 days. MIS fixation achieved a satisfactory regional sagittal angle (RSA) postoperatively in all patients. The vast majority of patients had no or mild postoperative pain and achieved a good functional outcome.

Conclusions: MIS fixation is a safe surgical option with comparable outcomes to open surgery and a potential reduction in perioperative morbidity. MIS surgery achieves a rapid and significant improvement in pain score, functional outcome, Frankel Grade, and RSA.

Keywords: MISS, Frankel grade, ASIA grading

S139

Lateral Lumbar Interbody Fusion with a Bone Defect in Vertebral Body: Autobone Overlapping Technique

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Purpose: In cases where significant loss of the vertebral body occurs such as Kummell's disease, corpectomy may be considered. However, this surgical approach has certain drawbacks, including surgical risks. We aim to introduce a novel surgical technique, the autobone overlapping (ABO) technique, which utilizes minimally invasive surgery and autobone grafting to provide a relatively simple and safe alternative.

Materials and Methods: The procedure was performed on five patients diagnosed with fractures involving more than 50% of the lumbar spine vertebral body, as confirmed by preoperative plain radiographs and computed tomography (CT). Postoperatively, plain radiographs and CT scans were used to confirm graft positioning and cage fixation. Clinical outcomes were evaluated using a visual analogue scale (VAS) for axial and radiating pain.

Results: In elderly patients with a mean age of 78.6 years, the technique demonstrated a short operation time, minimal estimated blood loss, and a mean hospital stay of fewer than 10 days, indicating rapid postoperative recovery. There were no surgery-related complications, no admissions to the intensive care unit, or mortality within three months postoperatively.

Conclusions: This novel surgical technique offers a new

alternative to corpectomy for cases of severe lumbar vertebral bone loss. This study serves as a pilot study to prepare for further radiological and clinical evaluations of this technique.

Keywords: Vertebral body defect, Kummell's disease, Minimally invasive surgery

Free Paper: Tumor

S140

Which Scoring System Best Predicts Long-term Survival in Patients with Spinal Metastasis in the Era of Targeted Systemic Treatment?

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Purpose: Predicting the prognosis of spinal metastasis is vital for surgical decisions, yet the effectiveness of existing scoring systems in identifying long-term survival remains unclear. This study aim to evaluate the accuracy of eight scoring systems, including the Tomita, modified Tokuhashi, modified Bauer, Rades, Oswestry Spinal Risk index (OSRI), Lei, New England Spinal Metastasis Score, and Skeletal Oncology Research Group (SORG) nomogram, for predicting long-term survival of patients with spinal metastasis.

Materials and Methods: 456 cases were finally included. Prognostic scores were compared with survival outcomes. Receiver operating characteristic (ROC) curves were analyzed for the entire cohort and across three distinct time periods to evaluate the area under the curve (AUC) for 1-year and 2-year survival, alongside Harrell's C-statistic.

Results: The mean patient age was 58.9 years, and the median survival time was 8.6 months. For the entire cohort, the SORG nomogram, OSRI, and modified Tokuhashi scores yielded Harrell's C-index values of 0.64, 0.63, and 0.62, respectively. For 1-year survival prediction, the SORG nomogram, OSRI, and modified Tokuhashi score demonstrated moderate discriminative power, with AUC values of 0.72, 0.71, and 0.70, respectively. Similarly, for 2-year survival prediction, the modified Tokuhashi score, SORG nomogram, and OSRI also revealed moderate discriminative power, with AUC values of 0.73, 0.72, and 0.70, respectively. For patients who underwent surgery in the most recent period, OSRI demonstrated the highest predictive accuracy for 1-year survival, with a Harrell's C-index of 0.63 and an AUC of 0.68, and 2-year survival, with a Harrell's C-index of 0.63 and an AUC of 0.64.

Conclusions: Most scoring systems exhibited low discriminative power, with only the SORG nomogram, OSRI, and modified Tokuhashi scores demonstrating moderate power for predicting long-term survival. In the most recent period, the OSRI demonstrated the highest predictive accuracy for both 1-year and 2-year survival.

Keywords: Spinal metastasis, Prognostic model, Scoring system, Long-term survival, Good prognosis

S141

Treatment Approach for Bilsky Grade 2 Metastatic Epidural Spinal Cord Compression Based on Radiation Therapy Failure Risk

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Purpose: Metastatic epidural spinal cord compression (MESCC) poses a significant risk of neurological deficits if not promptly treated. Bilsky grade 2 MESCC represents a clinical dilemma, as guidelines for selecting between radiation therapy (RT) and surgery are not well defined. This study was conducted to evaluate the efficacy of RT as the initial treatment for Bilsky grade 2 MESCC and to identify risk factors predictive of RT failure.

Materials and Methods: A cohort of 151 patients diagnosed with Bilsky grade 2 MESCC were retrospectively reviewed, subdivided into an initial RT group (n=127) and a surgery group (n=24). Primary outcomes included treatment success rates and factors associated with RT failure. Secondary outcomes were changes in ambulatory status, neurological

function, and survival between RT-success and RT-failure subgroups. Patient demographics, treatment outcomes, and risk factors for RT failure were evaluated. Spinal Instability Neoplastic Score (SINS) and clinical outcomes were compared across treatment groups. Logistic regression analysis was used to identify predictors of RT failure.

Results: RT was effective in 85.8% (109/127) of cases, with 14.2% (18/127) requiring subsequent surgery due to symptom progression. The mean SINS was significantly higher in the RT-failure group (9.6±3.2) than in the RT-success group (7.4±2.8; p=0.003). A SINS score >8 was linked to increased risk of RT failure. Patients undergoing surgery at presentation tended to be younger and exhibited more frequent neurological deficits. No significant differences in final ambulatory status or survival were observed between RT-success and RT-failure subgroups.

Conclusions: RT may be a suitable initial option for Bilsky grade 2 MESCC patients without neurological deficits or severe mechanical pain. Patients with a SINS >8, indicating greater spinal instability, have a higher risk of RT failure and may benefit from initial surgical intervention.

Keywords: Bilsky grade 2, Metastatic epidural spinal cord compression, Radiation therapy, Spinal instability, Spinal metastases

S142

Machine Learning versus Logistic Regression: Predicting One-Year Survival in Patients with Spinal Metastasis Undergoing Surgery

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Purpose: Prognostic scoring systems traditionally used for predicting survival in spinal metastasis patients often show limited accuracy. Machine learning (ML) may enhance predictive performance, but comparative studies with conventional models are lacking. This study aim to compare the predictive power of ML models versus logistic regression for estimating 1-year survival in patients surgically treated for spinal metastasis.

Materials and Methods: All variables from eight prognostic systems, demographic data, laboratory values, neurological status, and treatment-related factors were collected. Data preprocessing included one-hot encoding and scaling with MinMaxScaler. Feature selection combined Optuna-based and exhaustive search strategies. Logistic regression, Random Forest (RF), Support Vector Machine (SVM), and Extreme Gradient Boosting (XGBoost) models were optimized using nested cross-validation and hyperparameter tuning via Optuna. Model performance was evaluated using ROC-AUC, sensitivity, specificity, and negative predictive value (NPV), with confidence intervals derived from 2000 bootstrap samples.

Results: RF (AUC=0.96) and XGBoost (AUC=0.94) demonstrated superior predictive accuracy compared to logistic regression (AUC=0.84) and SVM (AUC=0.84). RF showed sensitivity, specificity, and NPV of 87.2%, 61.5%, and 65.7%, respectively, while XGBoost yielded sensitivity, specificity, and NPV of 84.3%, 61.5%, and 64.3%, respectively. Feature selection consistently identified age, albumin levels, neurological status (Frankel grade), and primary tumor type (Lei classification) as significant predictors.

Conclusions: ML models, particularly RF and XGBoost, substantially improved the accuracy of 1-year survival prediction in spinal metastasis patients compared to logistic regression. Rigorous feature selection and hyperparameter optimization were essential for achieving high predictive performance (AUC ≥0.9). Integration of targeted treatment strategies and biomarkers, such as albumin, is recommended for future predictive models to enhance clinical decision-making.

S143

Realtime Vertebral Artery Visualization Using Microscope-based Augmented Reality Navigation in Cervical Dumbbell-type Spinal Cord Tumor Resection

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Purpose: Cervical dumbbell-type spinal cord tumors (SCT) are often occupying lesions that compress the vertebral artery (VA). Intraoperative VA injury is one of the mortal complications. In our hospital, microscope-based AR navigation has been implemented for preoperative planning and intraoperative real-time projection onto microscopes for cervical dumbbell-type SCT surgery since April 2022. Purpose of this study is to review the procedure for applying the navigation to cervical dumbbell-type SCT surgeries and summarize its usefulness and pitfalls in clinical practice.

Materials and Methods: The medical records of 9 patients (4 male, 5 female) who presented with myelopathy or radiculopathy due to cervical dumbbell-type SCT and underwent tumor resection from April 2022 to July 2024 were retrospectively reviewed in the study. Each patient underwent magnetic resonance imaging (MRI) and contrast-enhanced computed tomography (CT) to evaluate the level of the tumor, Eden classification, location, and the superior side of the VA, which is defined as more than twice the diameter of the contralateral side. 3D virtual images of the tumor, spinal cord, and ipsilateral VA were created from the preoperative CT and MRI on a workstation before surgery. After intraoperative surface registration using a navigation platform, 3D virtual images were overlaid as AR images in the surgical microscope. The following information was corrected: operative time, estimated blood loss (EBL), the amount of postoperative drainage, hemoglobin level, and postoperative complications.

Results: Mean age of 9 patients were 58.8 (38 to 72) years old. Eden classification was 4 type 2, 4 type 3, and 1 type 4. Final pathological diagnosis for all cases were schwannoma. The mean operation time was 370.9 minutes, with an intraoperative EBL of 120.8 ml. The mean total blood loss, the sum of intraoperative EBL and postoperative drainage, was 280.8 ml. The mean hemoglobin level was 13.9 mg/dl preoperatively, 12.6 mg/dl the day after surgery, and 13.0 mg/dl on the seventh postoperative day. There were no cases that required blood transfusion, and no complications such as VA injury, postoperative hematoma, infection, or cerebrospinal fluid leakage.

Conclusions: In the present study, there were no unexpected hemorrhagic complications, including intraoperative VA injury. AR navigation enabled real-time display of anatomical structures in 3D, which may have been helpful in avoiding serious intraoperative complications such as vascular injuries, especially in the revision surgery where anatomical landmarks were unclear. The use of AR navigation was considered helpful for safe cervical dumbbell-type SCT resection.

Keywords: Cervical spine, Dumbbell-type spinal cord tumor, Vertebral artery injury, Microscopic spine surgery, Augmented reality navigation

Symposium (IV) MIS: Practice-Based Session 1: Present and Future of Endoscopic Spinal Surgery

S144

Current Status of Spinal Endoscopy in Korea

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Background and Introduction: Endoscopic spine surgery has continuously evolved since its inception in the 1970s. The transforaminal and interlaminar approaches were developed in the 1990s, and since the 2010s, biportal endoscopic spine surgery (BESS) has gained attention for its advantages over conventional microscopic techniques. BESS allows greater surgical flexibility and enhanced visualization, contributing

to its rapid global adoption.

Main Body: Since the first publication on BESS in 2016, the number of related research articles has increased significantly, with over 150 published in 2024 alone. In Korea, the widespread promotion of BESS through social media, medical advertising, and academic discussions has accelerated its popularity. High-quality studies have demonstrated its efficacy, and recent multicenter randomized controlled trials (RCTs) have further validated its safety and effectiveness. BESS has a relatively low entry barrier, as it utilizes existing arthroscopic instruments without requiring additional specialized equipment, reducing costs and simplifying the surgical setup. Consequently, the number of endoscopic spine surgeries in Korea has been growing by approximately 20% annually since 2019. This trend has extended internationally, with surgeons from Southeast Asia and China traveling to Korea to learn BESS techniques. In the United States, interest in BESS is also rising, marked by the establishment of the World UBE Symposium and cadaveric training workshops.

Conclusions: BESS is becoming a new standard in minimally invasive spine surgery based on solid clinical evidence and international expansion. With ongoing high-level research, its role will continue to strengthen. The integration of navigation and robotic technologies is expected to further enhance its precision and efficiency, positioning BESS as a viable alternative to conventional microscopic techniques with increasing global adoption.

Keywords: Degenerative spinal disease, Lumbar disc herniation, Spinal stenosis, Biportal endoscopic spine surgery, Endoscopic surgical procedure

S145

Application of Navigation and Endoscopy

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Background and Introduction: Endoscopic spine surgery (ESS) is a minimally invasive surgical technique that provides similar efficacy and safety to conventional surgery while causing low surgical invasiveness. According to recent bibliometric analyses, South Korea, China and the United States account for nearly three-quarters of all publications on ESS. Notably, South Korea leads the field of biportal endoscopic surgery, as evidenced by the fact that the top 10 most-cited papers on biportal endoscopic surgery have been published by Korean researchers. However, in the field of image-guided surgical technology, the United States and China are at the forefront of innovation. ESS is rapidly evolving from treating disc herniation and spinal stenosis to incorporating endoscopic fusion with technological advancements such as navigation, robotics, and augmented reality (AR).

Main Body: The application of navigation technology in spine surgery has been shown to improve the accuracy of pedicle screw placement in degenerative lumbar disease and spinal deformity surgery while minimizing radiation exposure for the surgical team. Recently, navigation technology has also been developed for minimally invasive decompressive procedures such as decompressive laminotomy and foraminotomy, which have been applied to both full-endoscopic uniportal techniques and biportal endoscopic techniques. Navigation-assisted endoscopic surgery enhances surgical accuracy and minimizes radiation exposure during surgical incision planning and the establishment of surgical orientation. This technology is particularly useful for revision surgery and more complex interbody fusion procedures. These navigation technologies are already commercially available based on O-arm, 3D C-arm, and 2D C-arm systems. Furthermore, systems utilizing augmented reality are currently under development. The advancement of these technologies is expected to simplify surgical procedures and improve spatial efficiency in endoscopic spine surgery.

Conclusions: Although robotics and augmented reality are not yet widely adopted in ESS, the recent introduction of electromagnetic-based navigation technology is expected to enhance surgical accuracy while minimizing radiation exposure in ESS.

Keywords: Navigation technology, Endoscopic spine surgery, Surgical accuracy, Radiation exposure

S146

Application of Robot with Endoscopy

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Background and Introduction: Endoscopic spine surgery (ESS) is a cutting-edge minimally invasive technique that treats spinal disorders through tiny incisions with minimal tissue disruption. Despite its advantages, ESS is challenged by a steep learning curve, prolonged operative times, and significant radiation exposure due to repeated fluoroscopic imaging. To address these limitations, robotic systems and advanced navigation technologies have been integrated into ESS, offering potential improvements in surgical precision and patient safety.

Main Body: Robotic assistance in ESS transforms the surgical workflow by using preoperative three-dimensional imaging data to create a detailed surgical plan. This plan guides the robotic arm along a precise trajectory, reducing the need for multiple needle passes and minimizing reliance on fluoroscopy. The result is a significant reduction in radiation exposure, benefiting both patients and surgical teams. One of the primary advantages of robotic systems is their ability to enhance the accuracy of critical tasks such as pedicle screw placement. Studies have demonstrated that robotic guidance achieves higher accuracy compared to freehand techniques, which is especially important in the narrow and delicate corridors of ESS. Additionally, the stability provided by robotic systems helps reduce tremor and surgeon fatigue, ensuring consistent execution of the preoperative plan. The integration of augmented reality (AR) and artificial intelligence (AI) further augments these benefits. AR overlays surgical plans and anatomical landmarks onto the surgeon's field of view, improving real-time orientation and situational awareness. AI algorithms assist in generating optimal surgical trajectories and may eventually enable semi-autonomous execution of routine tasks, thereby reducing cognitive load on surgeons. While the initial acquisition cost of robotic platforms is high, their long-term benefits include reduced revision surgeries, shorter hospital stays, and improved workflow efficiency. High-volume centers, in particular, may realize cost savings as the fixed expenses of the system are distributed across a greater number of procedures. Moreover, as surgical teams gain experience with robotic systems, the overall operative time and need for intraoperative adjustments decrease, leading to more predictable outcomes.

Conclusions: Robotic assistance in ESS offers promising solutions to many challenges of traditional minimally invasive spine surgery. By improving surgical accuracy, stability, and reducing radiation exposure, robotics enhance overall patient safety and efficiency. The further integration of AR and AI is expected to expand these benefits, paving the way for future innovations in ESS. Despite the high initial costs and learning curve, the potential clinical and economic advantages strongly support the continued adoption of robotic systems in endoscopic spine surgery.

Keywords: Robotic assistance, Endoscopic spine surgery, Minimally invasive, Navigation, Augmented reality, Artificial intelligence, Pedicle screw accuracy, Radiation reduction

Symposium (IV) MIS: Practice-Based Session 2: Advance MIS-Spine Surgery

S147

Biportal Endoscopic Cervical Laminectomy for Cervical Myelopathy

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Background and Introduction: Cervical myelopathy caused by degenerative changes or trauma is a serious condition that can impair the quality of daily life and can lead to paralysis of the limbs and gait. Depending on the location of the lesion, the method of surgery may vary, but the basic principle is to widen the space in the severely compressed spinal cord through decompression. Previously, cervical disc removal and fusion or laminectomy and screw fixation were the main surgical methods used in most patients. With the recent

introduction of bilateral endoscopic techniques, endoscopic laminectomy has become possible in patients with cervical myelopathy. I would like to report the technique for cervical laminectomy using bidirectional endoscopy.

Main Body: Thirteen patients who underwent laminectomy under bidirectional spinal endoscopy due to cervical myelopathy were included. Neck Disability Index (NDI) and Visual analogue Scale were examined as clinical outcomes, NDI improved from 41.2±6.1 preoperatively to 13.5±4.3 postoperatively, neck VAS improved from 5.1±1.5 to 2.1±1.1 postoperatively, and arm VAS improved from 8.2±0.5 to 1.3±0.4.

Conclusions: Laminectomy using biportal endoscopic technique is a good surgical technique that can replace conventional tubular laminectomy and laminoplasty

Keywords: Cervical myelopathy, Biportal endoscopy

S148

Full Endoscope Assisted Lumbar Interbody Fusion

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Background and Introduction: Recently, substantial spine surgeons prefer endoscopic surgeries to conventional surgeries. Especially, full endoscope can serve lots of benefits to surgeons and patients as well, including minimal skin, muscle injury, less bleeding, improved postoperative pain, and early rehabilitation. Full endoscopic spine surgery has developed swiftly, up to endoscope assisted lumbar interbody fusion. There are two different approaches for full endoscope assisted lumbar interbody fusion, One is posterolateral approach which is applied more widely for degenerative diseases including lumbar spinal stenosis, the other is trans-Kambin approach. Posterolateral technique aims at direct decompression of neural tissues, however trans-Kambin technique is suitable for indirect decompression sparing facet joints.

Main Body (2 Different approaches)

1. Posterolateral approach

Skin incision for posterolateral approach is about 2.5-3.0 cm long longitudinally, located above the index facet joints. After, fasciotomy on Multifidus muscle, subperiosteal dissection is needed to reveal facet joints and interlaminar windows. The procedures consist of facetectomy, laminectomy, disc preparation, bone graft, and cage insertion, such as conventional TLIF. For the candidates with severe central spinal stenosis, this technique is proper for direct decompression of spinal canal. Especially, through posterolateral approach, spinal stenosis with hypertrophied and buckled facet can be solved by ipsilateral total facetectomy and ULBD. Also, suitable amount of autogenous bone can be obtained and be used for fusion material. However, it needs longer operation time prepared to trans- Kambin technique, due to the time for facetectomy and ULBD.

2. Trans-Kambin approach

Skin incision for trans-Kambin approach is also 2.5-3.0 cm long londitudinally, but situated along the trajectory into the trans-Kambin triangle of the index segment. Fasciotomy and dissection from the lateral aspect of Erector spinae group is needed to access the target site without needless muscle injury. The procedures are composed of protection of exiting nerve root, disc preparation, bone graft, cage insertion, and if needed, resection of SAP. Patients showing foraminal stenosis, posterior decompressed state, and low grade spondylolisthesis are appropriate candidates of trans-Kambin technique. It has merits of sparing bony structures, lees bleeding, and shorter operation time. But, it has limits to be applied for the lowest segments, or deep seated L5-6, L5-S1 level anatomically.

Conclusions: Endoscopic spine surgery has lots of merits compared to conventional spinal surgery including minimal invasiveness, less bleeding, early rehabilitation. Recently, surgical techniques applying spine endoscope has developed swiftly, up to endoscope assisted lumbar interbody fusion. There are 2 different approaches for endoscope assisted interbody fusion by full endoscope. One is posterolateral approach for direct decompression, and the other is Trans-Kambin approach for indirect decompression. Each technique has proper indications and relative contraindications. If the suitable technique is applied or combined for the candidates, preferable outcomes can be obtained.

Keywords: Endoscope assisted lumbar interbody fusion, Posterolateral approach, Trans-Kambin approach

S149

LLIF

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Background and Introduction: The rate of lumbar surgery in the aging society is steadily increasing over time, with benefits in reducing pain and improving quality of life for patients with degenerative lumbar disease. Among various surgical procedures treating degenerative lumbar disease, lateral lumbar interbody fusion including lateral lumbar ineterbody fusion(LLIF) and oblique lumbar interbody fusion(OLIF) is a widely accepted. Recently, the use of OLIF has been increasing in the treatment of lumbar degenerative diseases, and the indications for OLIF are expanding due to recent developments in stereotactic navigation and robotics.

Main Body: OLIF is very effective surgical technique for degenerative disc disease, spinal stenosis, and spondylolisthesis, and previous studies have reported favorable outcomes following OLIF in these conditions. However, recent studies have reported favorable radiological and clinical outcomes following indirect compression even in severe spinal stenosis. Lumbar facet cyst (LFC), an indicator of segmental instability, is commonly found in degenerative spondylolisthesis. According to a recent prospective study, 75% of LFCs were reduced immediately following OLIF, while all LFCs were resolved in the postoperative 1-year MRI. Thus, OLIF for LFC may produce favorable outcomes in patients with segmental instability. Additionally, OLIF is expanding its indication for adult spinal deformity, infection, and revisional surgeries. Recently, the use of intraoperative stereotactic navigation systems and robotic assistance in OLIF has increased. From a technical point of view, the navigation system does not require the true lateral position of the patient, and the side tilting of the table can be adjusted for each surgical step. Furthermore, OLIF and posteior instrumentation can be performed in a single-position (not dual-position surgery; lateral decubitus, then prone) using navigation system with or without robotics. The results of single-position surgery in the literature are promising because it has a significantly shorter operation time and less blood loss than dual-position surgery.

Conclusions: OLIF is a safe and effective surgical option for treating a variety of lumbar degenerative diseases with a favorable radiological and clinical outcomes. The indications for OLIF are expanding with the application of recent technical advancements, including stereotactic navigation systems and robotics.

Keywords: Lateral lumbar interbody fusion, Oblique lumbar interbody fusion

Invited Lecture VIII

S150

Cervical Deformity Surgery: A thoughtful Approach to Level Selection

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Background and Introduction: Cervical deformity surgery demands a meticulous, evidence-based strategy for fusion level selection to mitigate complications such as distal junctional kyphosis (DJK) and achieve durable alignment restoration. This lecture delineates a structured paradigm for level selection, integrating principles of DJK prevention, bone health optimization, and alignment precision. Key tenets include rigorous preoperative assessment of sagittal and coronal alignment targets (e.g., C2–C7 lordosis, T1 slope–cervical lordosis mismatch), with emphasis on avoiding undercorrection to minimize residual biomechanical strain.

Main Body: Critical emphasis is placed on lower instrumented vertebra (LIV) selection, guided by rules to avert endpoints within kyphotic segments, proximity to major deformity corrections, or regions of subjacent deformity. Upper instrumented vertebra (UIV) strategies prioritize robust fixation, advocating for C2 utilization (leveraging triple-screw fixation) in proximal constructs, supplemented by anterior-posterior hybrid approaches or subaxial pedicle screws for subaxial UIV placement. Occipital fusion is

discouraged unless temporary fixation is warranted.
Surgical strategies are discussed in the context of optimizing bone quality through adjuvant therapies (e.g., teriparatide, abaloparatide) to enhance fusion potential. Alignment objectives are reinforced as non-negotiable, with attention to global spinal harmony and compensatory mechanisms. Techniques such as staged osteotomies and anterior-posterior releases are contextualized to address rigid deformities while respecting biomechanical thresholds.
Conclusions: Supported by clinical data, this framework correlates thoughtful level selection with reduced rates of DJK, pseudarthrosis, and reoperation, while improving functional outcomes. The lecture concludes with a call for adoption of standardized alignment targets, predictive modeling, and personalized surgical planning to advance cervical deformity care. Attendees will gain actionable insights to refine decision-making, balancing stability, mobility, and patient-specific anatomy in this complex surgical arena.

Free Paper: Trauma

S151

Initial Clinical Experience with Spine Jack in Thoracolumbar Vertebral Compression Fractures: A Comparative Analysis with Kyphoplasty

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Purpose: Thoracolumbar vertebral compression fractures (VCFs) are a leading cause of kyphosis and related biomechanical complications, often resulting in chronic back pain and reduced function. Kyphoplasty has been widely used as a minimally invasive intervention to provide pain relief and restore vertebral height. Spine jack, a newer technique, introduces mechanical distraction, offering a potentially enhanced vertebral restoration. This study aims to compare these two effective treatments for thoracolumbar fractures.
Materials and Methods: This study analyzed 30 patients with thoracolumbar VCFs treated using spine jack (n=10) or kyphoplasty (n=20). Back pain (VAS score) and Oswestry Disability Index (ODI) were assessed preoperatively and immediately postoperatively. Radiological outcomes, including vertebral height, segmental angle, and sagittal vertical axis (SVA), were measured on lateral X-rays. Complications, such as cement leakage and adjacent fractures, were recorded. Continuous variables were analyzed using t-tests, and categorical variables using chi-square tests. Statistical significance was set at $p<0.05$.
Results: Both spine jack and kyphoplasty were effective in reducing pain and improving function, with significant improvements in VAS and ODI scores. Spine jack demonstrated superior vertebral height restoration (85% vs. 72%, p=0.03) and segmental angle correction (12° vs. 9°, p=0.032). Complication rates were low and comparable between groups.
Conclusions: Spine jack and kyphoplasty are effective for thoracolumbar VCFs, with spine jack offering superior radiological outcomes in select cases. Further studies can explore their complementary roles in managing these fractures.
Keywords: Thoracolumbar compression fractures, Spine Jack, Kyphoplasty, Vertebral height restoration, Minimally invasive spine surgery

S152

Comparative Outcomes of Autologous Iliac Bone Strut Graft vs. Titanium Mesh Cage in Anterior Corpectomy for Thoracolumbar Burst Fractures

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Purpose: Thoracolumbar burst fractures are often associated with instability or neurological deficits. For highly unstable burst fractures, anterior corpectomy with decompression and reconstruction, combined with posterior fixation, is an established treatment approach. Traditionally, autologous iliac bone strut grafts have been used for reconstruction

after anterior corpectomy; however, titanium mesh cages are increasingly favored as they reduce donor site morbidity.
The study aims to compare the radiological outcomes of autologous iliac bone strut graft and titanium mesh cage in reconstruction for thoracolumbar burst fractures.

Materials and Methods: We conducted a retrospective review of 57 patients who underwent anterior reconstruction with posterior fixation for thoracolumbar burst fractures between September 2013 and July 2024. Of these, 36 patients received autologous iliac bone strut grafts (Group A), while the remaining 21 received titanium mesh cages, and radiological outcomes were compared between the two groups.

Results: The preoperative segmental kyphotic angle in group A was 11.7±12.2 degrees, decreasing to 1.3±10.9 degrees at the last follow-up. In group B, it measured 9.9±12.6 degrees preoperatively and improved to -1.4±10.4 degrees at the last follow-up. There was no difference in the change in kyphotic angle before and after surgery between the two groups (p=0.76). The fusion rate tended to be higher in Group 2, but there was no statistical difference (83.3% vs. 95.2%, p=0.243).

Conclusions: In anterior surgery for thoracolumbar burst fractures, both autologous iliac bone grafts and titanium mesh cages demonstrated effective kyphosis correction. Titanium mesh cage provides immediate structural stability after surgery, and its fusion rate is comparable to that of autologous bone, making it a good alternative.

Keywords: Thoracolumbar fractures, Anterior corpectomy, Mesh cage

S153

Atypical H-Sacral Fracture with Bilateral Gluteal Morel Lavallee: Case Report and Literature Review

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Purpose: Sacral-pelvic injuries involve posterior pelvic and spinopelvic instability coupled with poor soft tissue conditions pose management concern.

Materials and Methods: A 41-year male motorcycle rider was involved in a collision, fell and was run over by another motorcyclist. He presented to emergency department in severe pain and difficulty in moving bilateral lower limb. Plain radiographs were deceiving, subsequent CT scan revealed a vertical shear as evident as ipsilateral superior and inferior rami fracture, ipsilateral vertical sacral fracture, Isler subtype 2b, AO A2 and a contralateral sacroiliac (SI) disruption. Fortunately, there was no neurological injury. Intraoperatively, we noted extensive bilateral gluteal morel lavallee. Bilateral lumbopelvic fusion, L4-S2AI was performed, and wound was closed with application of an incisional negative pressure dressing.

Results: High energy trauma can lead to complex spinopelvic injuries which are challenging due to their configuration and soft tissue condition. Lehman et al lumbosacral injury classification system (LSICS) attempt to address the approach to lumbosacral injury did not gain much popularity. The AO classification is universally applied for sacral fractures but does not address lumbo-sacral joint instability. However, Isler's subtypes of lumbo-sacral joint instability complement the AO classification to address lumbosacral integrity. We classified the injury as an atypical "H" fracture due to the involvement of the contralateral SI joint disruption which completes the "H", a type of spinopelvic dissociation. Based on literature review, this is the first time the configuration has been described as such. Chonnipa Siriarchawawat et al proposed a surgical comprehensive guide to unstable sacral fractures. Based recommended guides a bilateral lumbopelvic fusion spanning from L4 to S2-AI was performed. The debridement and negative pressure dressing is also a recommendation for morel Lavallee.

Conclusions: Unstable sacral fractures are rare and might require a combined classification to allow more comprehensive understanding of the injury to achieve the best medical result.

S154

Compression Rate Progression of Osteoporotic Vertebral Compression Fracture in Conservative Treatment

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Purpose: Osteoporotic vertebral compression fracture (OVCF) treatment aims to reduce pain and prevent further compression, but compression often progresses during conservative treatment. However, studies on factors affecting compression rate progression and the timing when compression progresses the most are insufficient. We analyzed whether there were any factors affecting the progression of the compression rate and also investigated the period when the compression rate progressed the most, and analyzed the correlation with clinical outcomes.

Materials and Methods: One hundred twenty-two patients with OVCF, followed for more than six months, were included. Factors such as age, gender, fracture level, bone mineral density (BMD), body mass index (BMI), osteoporosis medication, initial compression rate, fracture location, and pelvic incidence were assessed. Compression rates were measured initially and at 1, 2, 3, and 6 months. The correlation between these factors and compression rate progression of more than 50% was analyzed using univariate and multivariable Cox regression analysis. Compression rate progression over time was evaluated using a repeated measures general linear model, and clinical outcomes were assessed via paired t-test.

Results: Univariate analysis showed that an initial compression rate of less than 30% was significantly associated with progression (p=0.001). Multivariable Cox regression confirmed this association (p=0.013, Hazard ratio=3.018, 95% Confidence Interval 1.265-7.200). The most significant compression rate progression occurred within the first month of follow-up (p=0.038). At the final follow-up, both VAS for back pain (p=0.009) and ODI (p=0.026) were significantly higher in the compression rate progression group.

Conclusions: An initial compression rate of less than 30% was associated with a higher correlation of compression rate progression, particularly within the first month after injury. These findings suggest that clinicians should consider more frequent monitoring and potentially more aggressive management for OVCF patients presenting with initial compression rates less than 30%, particularly during the first month after injury. Compression rate progression was correlated with poorer clinical outcomes in terms of pain and quality of life.

Keywords: Osteoporotic vertebral compression fracture, Conservative treatment, Compression rate progression

Free Paper: Miscellaneous

S155

Defining Optimal Post-void Residual Volume Thresholds for Predicting Delayed Postoperative Urinary Retention in Spinal Surgery

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Purpose: This study aimed to determine clinically relevant initial PVR thresholds for predicting delayed POUR after spinal surgery, particularly for cases with PVR volumes below 300 mL. Gender specific thresholds were also assessed to refine postoperative voiding protocols and improve patient outcomes.

Materials and Methods : This study included 310 patients aged 18 years or older who underwent elective thoracolumbar spinal surgery with intraoperative Foley catheterization between January 2021 and December 2023. Outcome measures: The primary outcome was the occurrence of delayed POUR, defined as PVR exceeding 300 mL after postoperative voiding care protocols concluded. All patients underwent bladder scan after Foley catheter removal to measure PVR volumes. Receiver operating characteristic (ROC) curve analysis identified optimal PVR thresholds for predicting delayed POUR, with gender-specific analyses to identify appropriate cut-off values.

Results: The overall incidence of delayed POUR was 12.3%,

with 38 patients experiencing symptoms after an initial PVR of <300 mL. ROC analysis identified a cohort-wide cut-off of 160 mL, with an area under the curve (AUC) of 0.74, indicating moderate predictive power for delayed POUR. Gender-specific cut-off values were determined as 61 mL for males (AUC=0.68) and 101 mL for females (AUC=0.77), supporting the need for tailored thresholds based on gender.

Conclusions: This study established optimized PVR thresholds of 160 mL overall, 61mL for males, and 101 mL for females as reliable markers for predicting delayed POUR in patients undergoing spinal surgery. These findings support a gender-sensitive approach to postoperative urinary management and provide evidence for refining existing voiding care protocols to improve patient outcomes.

Keywords: Postoperative urinary retention, Post-void residual volume, Complication, Postoperative management, ERAS

S156

Impact of Smoking, Diabetes, and Exercise on Dementia Risk in Women with Osteoporosis : A Nationwide Cohort Study

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Purpose: To assess osteoporosis as a risk factor for dementia in the general population using nationwide dataset.

Materials and Methods: This study included 261,343 women aged 66 years who participated in the National Screening Program for Transitional Ages for Koreans and underwent their first medical checkup between January 2013 and December 2016. Participants were categorized into three groups based on bone mineral density (BMD): normal BMD, osteopenia, and osteoporosis. We investigated participants' demographic characteristics and chronic comorbidities that could affect dementia incidence. The hazard ratios (HRs) for dementia in patients with osteoporosis and osteopenia were calculated and adjusted based on several risk factors.

Results: Despite adjusting for demographic characteristics and chronic comorbidities, the risk of dementia was 1.24-fold higher in the osteoporosis group than in the normal BMD group. Regarding Alzheimer's disease and vascular dementia, the risk was 1.23- and 1.35-fold higher in the osteoporosis group, respectively. Notably, participants with osteoporosis who smoked had a 1.94-fold higher HR than that of nonsmoking participants with normal BMD; participants with diabetes mellitus (DM) had a 1.97-fold higher HR than that of participants with normal BMD without DM. The HR for participants with osteoporosis who exercised regularly was 1.03, whereas it was 1.26 for those who did not exercise.

Conclusions: This population-based cohort study demonstrates that having osteoporosis significantly increases dementia risk, which is amplified by smoking and diabetes but reduced by regular exercise.

Keywords: Osteoporosis, Dementia, Diabetes mellitus, Smoking, Exercise

S157

Vanadium Allergy in Spine Surgery: An Emerging Concern in Metal Hypersensitivity

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Purpose: Vanadium, a transition metal commonly use as an alloying element in titanium-based spinal implants, has been implicated in metal hypersensitivity reactions. While nickel and cobalt allergies are well-documented, vanadium hypersensitivity remains poorly understood. Vanadium has been associated with delayed-type hypersensitivity reactions, manifesting as back pain with chronic inflammation appearing like possible infections, implant loosening and failure of fusion construct. We presented a case of a patient with vanadium allergy who underwent lumbar spinal fusion and the steps we took for his revision surgery.

Material and Methods: We performed a literature search and present a narrative review, examining the role of vanadium in hypersensitivity reactions in spinal fusion surgeries and recommendations of management of the challenges faced in patients with this condition.

Results: We propose a guideline on diagnostic approaches, including patch testing and lymphocyte transformation

testing for evaluating allergies to vanadium. While titanium alloys are often considered hypoallergenic, emerging evidence suggests that vanadium-containing implants may still provoke immune responses in sensitized individuals. We also explored hypoallergenic alternatives such as carbon fiber reinforced polyetheretherketone (PEEK) devices as a viable option for at-risk patients and the challenges faced with their use.

Conclusions: Vanadium hypersensitivity remains an under-recognized entity in spinal surgery when compared to other more common metal allergies. Further research is needed to establish standardized diagnostic protocols and evaluate the long term safety of these implants. Surgeons should maintain a high index of suspicion for metal allergy in patients presenting with unexplained post-operative symptoms and consider alternative implant materials when necessary.

Keywords: Spinal fusion, metal allergy, Vanadium allergy, Carbon fiber reinforced PEEK

S158

Comparative Analysis of Clinical and Radiographic Outcomes Between Posterior and Posterolateral Extraforaminal Epidural Injections in Cervical Radiculopathy Patients

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Purpose: Selective cervical nerve root block through the anterolateral approach has been associated with severe complications, including hypotension, vertebral artery injury and cerebrovascular accident. To reduce these risks, the posterior approach has been introduced. However, there is ongoing debate regarding differences in clinical and radiographic outcomes between various posterior injection techniques. This study aims to compare the clinical efficacy and radiological accuracy of direct dorsal and posterolateral extraforaminal epidural injections performed under fluoroscopic guidance in cervical radiculopathy patients.

Materials and Methods: Ninety-eight patients diagnosed with cervical radiculopathy underwent extraforaminal epidural injections via the posterior or posterolateral approach under fluoroscopy, totaling 152 procedures. For the posterior approach, the spinal needle was inserted along the outer margin of the facet joint under fluoroscopic guidance. In contrast, for the posterolateral approach, the needle puncture site was positioned approximately 5 cm lateral to the facet joint near the trapezius margin. The needle was advanced along the anterior surface of the superior articular process (SAP) to the midpoint of the SAP. After contrast dye confirmed the nerve root pathway, a solution of dexamethasone 2.5 mg, bupivacaine 5 mg, and normal saline 3 ml was injected at each level. Clinical outcomes were assessed using the Visual Analogue Scale (VAS) for neck pain (NP) and arm pain (AP) and the Neck Disability Index (NDI) pre-procedure, and at 1- and 3-month follow-ups.

Results: Among the 152 procedures, 65 were performed via the posterior approach and 87 via the posterolateral approach. The most treated level was C5-6 (58 procedures), followed by C6-7 (46), C7-T1 (28), and C4-5 (20). The nerve detection rate was significantly higher in the posterolateral approach (91.6%) compared to the posterior approach (77.3%), particularly at lower cervical levels ($p<0.01$). Both groups experienced significant pain reduction, with VAS scores improving from NP 5.7 to 3.5 and AP 6.5 to 2.3 at 1 month, sustained at 3 months. There was no significant difference in pain improvement between the groups. Adverse effects included dizziness (17.2%), transient pain or numbness (9.3%), and sympathetic blockade (8.4%). No severe complications were observed.

Conclusions: Extraforaminal epidural injection via the posterolateral approach is a safe and effective treatment for cervical radiculopathy, providing significant pain relief without major complications. The posterolateral approach demonstrated superior nerve root detection, particularly at lower cervical levels, and may offer improved procedural accuracy.

Keywords: Cervical spine, Root block, Selective cervical nerve root block, Posterior approach, Steroid injection

Vidio Session: Cervical

En Bloc Extensive Dome-Like Laminoplasty for Severe C2-3 Cord Compression

Kyung Chung Kang

Korea

Full-Endoscopic Cervical Foraminal Decompression: How to Do?

Taeksoo Jeon

Korea

Vidio Session: Lumbar

Oblique Lumbar Interbody Fusion: Essential Technical Tips and Surgical Considerations

Byung-Ho Lee

Korea

Endoscopic Decompression of L5 Far-out Syndrome

In Seok Son

Korea

Vidio Session: MIS

Endoscopic Lumbar Fusion

Sang-Min Park

Korea

Navigation-Based Spine Surgery

Jiwon Kwon

Korea

Vidio Session: Deformity

Posterior Vertebral Column Resection

Se-Jun Park

Korea

Pedicle Subtraction Osteotomy

Hojoong Kim

Korea

Vidio Session: Tumor

Lamina Recapping Technique in Spinal Cord Tumor

Yunjin Nam

Korea

Anterior Vertebral Column Resection in Chondrosarcoma

Jaehwan Cho

Korea

e-Poster

E001

Clinical Significance, Challenges, and Management Strategies of Incidental Extraspinal Findings in Cervical Spine MRI: A Retrospective Analysis of 2,286 Cases

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Purpose: The study aims to evaluate the prevalence and clinical significance of incidental extraspinal findings (IESFs) in cervical spine magnetic resonance imaging (MRI) and to emphasize the importance of systematic review protocols for improved diagnostic accuracy and patient outcomes.

Materials and Methods: A retrospective review was conducted on 2,286 non-contrast cervical spine MRI cases performed between January 2019 and July 2024 at a university hospital. Patients included were those presenting with symptoms of cervical radiculopathy or myelopathy without a history of malignancy or cervical spine surgery. IESFs were categorized into thyroid nodules, lymphadenopathy, soft tissue tumors, brain lesions, and other head and neck lesions. Statistical analyses were performed to assess associations between IESFs and patient demographics such as age and gender, with significance set at $p<0.05$.

Results: Among 2,286 MRI cases, 103 IESFs (4.5%) were identified. Thyroid nodules were the most common finding (n=64, 2.0%), followed by lymphadenopathy (n=16, 0.5%), soft tissue tumors (n=4, 0.1%), brain lesions (n=6, 0.2%), and other head and neck lesions (n=13, 0.4%). Females were more likely to have IESFs (64.4% vs. 35.6%; $p<0.001$), and the mean age of patients with IESFs was significantly higher (58.4 years vs. 54.7 years; $p=0.033$). Of the 94 patients with follow-up data, malignant lesions were confirmed in 7 cases (7.4%), including 5 thyroid nodules and 2 lymphadenopathy cases. Additionally, 3 non-malignant lesions required surgical intervention (1 pituitary adenoma, 1 parathyroid adenoma, and 1 nasal cavity mass requiring excisional biopsy). Missed IESFs during the initial review were noted in 4 cases.

Conclusions: This study highlights the importance of systematic review protocols for identifying incidental findings in cervical spine MRI. IESFs, particularly in older patients and females, often require further investigation, including the potential for surgical intervention or malignancy detection. Implementing standardized checklists and advanced technologies such as artificial intelligence can enhance diagnostic accuracy, improve patient care, and reduce medicolegal risks. Prospective studies with standardized follow-up are recommended to validate these findings.

Keywords: Incidental extraspinal findings (IESFs), Cervical spine MRI, Thyroid nodules, Radiology oversight, Systematic imaging review

E002

Endoscopic Decompression for Radiculopathy in Scoliosis

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Purpose: Adult degenerative scoliosis is a spinal deformity resulting in an unbalanced spine, the further progression of

which results in associated conditions such as disc herniation, ligament hypertrophy and facet ossification. Patients with scoliosis hence often suffer from both axial back pain as well as radicular pain. Our paper aims to show that endoscopic decompression is a potential minimally invasive surgical option which can help with radicular pain in patients with scoliosis.

Materials and Methods: Case series of two middle aged patients with severe scoliosis who underwent minimally invasive endoscopic decompression of the affected levels without fusion.

Results: The patients report good relief of their radicular pain postoperatively, although the axial back pain remained.

Conclusions: Endoscopic decompression is a potential surgical option which should be considered for the management of radicular pain in patients with scoliosis.

Keywords: Scoliosis, Adult spinal deformity, Minimally invasive spine surgery, Endoscopic decompression, Radiculopathy

E003

Functional Outcome of Percutaneous Transforaminal Endoscopic Lumbar Discectomy in Pivd: Our Early Report

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Purpose: To evaluate the clinical outcome and complication rates of Transforaminal endoscopic lumbar discectomy (TELD) in prolapsed intervertebral disc (PIVD)

Materials and Methods: Prospective study of 21 patients who underwent TELD was done from January 2023 to April 2024. VAS, ODI and modified Macnab Scores were evaluated with minimum follow up of 6 months

Results: Out of 21 cases, 19 were PIVD at L4-5 level and 2 cases were at L5-S1 level. There was statistically significant reduction in VAS score in both back pain and leg pain at 1, 3, and 6 months when compared with preoperative VAS scores ($p<0.05$). The mean preoperative ODI score was 52.38±10.08 while the mean postoperative ODI scores were 14.38±5.21, 7.00±3.34 and 3.57±2.63 at 1, 3 and 6 months respectively and the differences were statistically significant ($p < 0.05$). In modified Macnab criteria, 90.47% had excellent outcome while 9.52% had good outcome.

Conclusions: Transforaminal endoscopic lumbar discectomy is highly effective surgery and gives excellent results with appropriate planning and approach.

Keywords: Transforaminal, PIVD, ODI, Modified macnab score

E004

The Effect of Surgical Correction of Adolescent Idiopathic Scoliosis on Pelvic Obliquity

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Purpose: Adolescent idiopathic scoliosis (AIS), the most common type of scoliosis affects 2-4% of adolescent aged 10-18. Pelvic obliquity (PO) is often observed in AIS patients and can significantly impact spinopelvic harmony,which is critical for successful surgical outcomes. This study evaluates the impact of corrective surgery on PO in 141 AIS patients over a one year follow up.

Materials and Methods: It is a retrospective study carried out in a single institution (January 2020-December 2021). Total of 141 AIS patients undergoing posterior spinal fusion (PSF) were analyzed with preoperative and postoperative radiographic measurements of PO using the Osebold method and transilium Pelvis height Difference (TPHD). Nonparametric tests (Wilcoxon's signed rank test and Mann Whitney U test) were performed to compare the data obtained and compare differences in the age distribution respectively. Reliability was assessed using intraclass correlation coefficients (ICC)

Results: In our study, cases were predominantly female (93%) with mean age of 17 years. 68% of cases had preoperative PO, predominantly right upward obliquity. 67% had mild leg length discrepancy (LLD<30 mm).There was a significant decrease in the major Cobb's angle immediately after PSF

with correction rate of nearly 60%. Excellent interobserver and intraobserver reliability for limb length, Osebold, TPHD and Cobb's angle measurements were observed. In standing radiographs, Osebold degrees and Transilium Pelvic Height Difference (TPHD) were significantly decreased after PSF in both immediate as well as 1 year postoperative data compared to preoperative data ($p<0.001$). Also, there was a significant decrease in TPHD between immediate and 1-year post-op data ($p<0.05$), but the difference in Osebold degrees between immediate and 1-year post-op data was insignificant. On the contrary, a significant increase in pelvic obliquity was observed after PSF in supine radiographs.

Conclusions: Surgical correction effectively reduces PO in AIS patients, with long term spinopelvic harmony depending on surgical precision and postoperative rehabilitation. Future research should explore specific mechanisms of PO and optimize surgical strategies for better outcomes.

Keywords: Adolescent idiopathic scoliosis, Pelvic obliquity, Osebold, Transilium pelvis height difference, Posterior spinal fusion

E005

Outcomes of Transforaminal Epidural Steroid Injection in Patients with Lower Limb Radiculopathy

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Purpose: To study the outcome of the transforaminal Epidural Steroid Injection in patient with Lower Limb Radiculopathy.

Materials and Methods: This descriptive study was conducted at the North Okalarpa Teaching and general Hospital, Department of Orthopaedics,University of Medicine 2 Yangon Myanmar for 18 month duration (October 2015 to May 2017). Total 162 patients were admitted and 30 patients (18.51%) were treated with TFESI. Patient's conditions were assessed with Visual Analog scale (VAS) for pain and Oswestry disability Index (ODI) before procedure. After injection, outcomes were assessed with VAS for pain and satisfaction and ODI using proforma and regular follow up to 32 weeks.

Results: Eight male (26.66%) and 22 female (73.34%) were participated in this study. Regular follow ups were done up to 32 weeks. During study period 2 patients (6.66%) were unresponsive to treatment and changed to surgical treatment (Decompression procedure). Mean VAS for short term was 3.87 (60% improvement) and mean VAS for long term was 2.78 (73.3% improvement). In terms of ODI, mean ODI for short term was 20.96 (66.6% improvement) and for long term mean ODI was 15.73 (60% improvement). For patient satisfaction of treatment, it was very good and excellent 86.66% for short term and 93.33% for long term. There was no major complication of treatment.

Conclusions: TFESI is effective for radiculopathy with good outcome result in both short term and long term. It is more effective in younger age group in short term ($p=0.002$).

Keywords: Transforaminal, Epidural steroid injection, Radiculapthy, VAS, ODI

E006

Cauda Equina Syndrome Treated with Two Level Endoscopic Discectomy

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Purpose: Cauda equina syndrome(CES) is an urgent condition which requires emergent attention. Lumbar disc herniation (LDH) is the most common cause and it may result in life-changing implications if not acted upon immediately when suspected. Treatment is commonly done via an open discectomy but we present a case that was treated with transforaminal endoscopic decompression.

Materials and Methods: We present a case of cauda equina syndrome due to two level lumbar disc herniation in a 27 year old female with a BMI of 45.5 kg/m². She presented with a 2 weeks history of worsening lower back pain with visual analogue scale (VAS) of 7 associated with bilateral lower limb radicular pain, sacral numbness and loss of bowel and bladder continence for 3 days. On examination she had intact motor power of the lower limbs but reduced perianal sensation and lax anal tone. Magnetic resonance imaging revealed L3/4 central disc extrusion and L4/5 left paracentral

disc extrusion causing spinal stenosis. Percutaneous endoscopic lumbar discectomy (PELD) of L3/4 and L4/5 levels was done via a transforaminal approach. Sequestrated disc over L3/4 level and disc over L4/5 level was removed. Posterior aspect of L3/4 and L4/5 discs removed until epidural space was visualised.

Results: Postoperatively, lower limb radicular pain improved and noted improvement in sacral numbness. At 4 weeks postoperatively, she was pain free, with restoration of bowel and bladder function. She has no recurrence at one year postoperatively.

Conclusions: Minimally-invasive decompression is an effective approach for LDH with fewer complications compared to conventional laminectomy. In recent years, due to its rapid recovery, PELD has been accepted as one of the minimally invasive methods effective for the treatment of LDH and its use for cases with cauda equina syndrome despite being controversial is a possible option.

Keyword : Lumbar disc herniation, Cauda equina syndrome, Endoscopic discectomy

E007

Clinical Outcome Study of Primary Intra-spinal Tumour at Yangon Orthopaedic Hospital

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Purpose: Intraspinal tumours are rare central nervous system neoplasms. There is no reported clinical outcomes of intra-spinal tumours in Myanmar. We present here the cases 27 patients with intra-spinal tumours treated surgically in our hospital and their short term clinical outcomes.

Materials and Methods: We conducted a retrospective review of 27 patients with intraspinal tumours who underwent surgical treatment in our institution between June 2020 and December 2021. Their age, sex, initial presentation, tumour location, level of affected vertebral column, histological diagnosis and clinical outcomes were reviewed and analyzed up-to 6 months.

Results: Of these 27 patients,15 (67%) were men and 12 (33%) were women. The mean age was 56.3 years (range 13 to 72 years). All of these were primary tumours, we excluded metastatic tumours. The histological diagnosis of the primary tumour included 15 (55.55%) neurofibromas,7 (25.92%) schwannomas, 4 (14.81%) meningiomas,1 (3.7%) ependymomas. The most common site of the tumour is thoracic. The most common clinical presentation of the primary spinal tumours was pain (92.5%). Most of the patients with nerve sheath cell tumours (schwannomas and neurofibromas) had symptoms of sensory disturbance and pain. All of the patients with meningiomas had symptoms associated with cord compression. Mean VAS score of back pain were reduced after operation and successively reduce to nearly 0 at 3 months follow up. Mean MRC grading of radiculopathy was also increased by one grading at 3 months follow up and nearly normal function at 6 months follow up. In myelopathy cases most of the cases were not significantly improved at 3 months follow up, but at 6 months follow up most of the cases regained to useful functional scale (i.e., Frankel D,E).

Conclusions: Back pain and roots compression symptoms were the most common presentations in patients with intraspinal tumours. Surgery is the “gold standard” in the treatment of spinal cord tumours. Complete removal of the lesion is the first goal. Postoperative results are dependent on the surgeon’s experience, but also on the preoperative neurological status and histology types.

Conclusion : Back pain and roots compression symptoms were the most common presentations in patients with intraspinal tumours. Surgery is the “gold standard” in the treatment of spinal cord tumours. Complete removal of the lesion is the first goal. Postoperative results are dependent on the surgeon’s experience, but also on the preoperative neurological status and histology types.

Keywords: Intra-spinal tumours, Myanmar, Yangon orthopedic hospital

E008

Actinomyces Thoracic Spondylitis: A Rare Occurrence in Spine Infection

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Purpose: We report a case with rare occurrence in spine infection and the diagnostic challenges encountered during treatment.

Materials and Methods: A 45-year-old male with no known comorbidity, presented to us with gradual onset of upper back pain for 3 weeks and weakness over bilateral lower limbs. Patient has no history of closed contact with tuberculosis patients. Neurology assessment revealed Frankel D with neurological level at T2. The blood infective markers were raised, however blood culture was negative. Tuberculosis workup on sputum smear and Mantoux test were negative. MRI whole spine noted T3 and T4 spondylitis with epidural, prevertebral and paravertebral lesions/collection causing cord compression from T2/3 to T5/6 levels. The collection appeared to be lobulated and septated. The vertebral height and disc space were preserved. During admission, there was deterioration of neurology from Frankel D to Frankel C. Therefore, emergency posterior decompression T2 to T6 and stabilization from C7 to T6 performed. Intra-operative findings revealed purulent discharge and granulating tissue seen overlying the dura. Tissue and pus cultures were negative after 3 days of incubation. Histopathological examination showed suppurative granulomatous inflammation with few bacterial colonies of filamentous bacteria, suggestive of Actinomyces species. Intravenous penicillin was initiated and completed 12 weeks of antibiotic therapy. Neurological recovery were observed after 2 months post operation, from Frankel C to Frankel D.

Results: Actinomyces infection has close resemblance with tuberculosis as seen in the MRI scan where septated and lobulated collection observed over paravertebral region. However, the presence of lung infiltrative lesions may be suggestive of malignancy as well. As there was no lesions involving the vertebral column, trans-esophageal endoscopic biopsy was performed by surgical colleagues to obtain tissue sample. Furthermore, due to the insidious nature of actinomyces infection, extended period of culture incubation is required for at least 10 days and up to 21 days. Hence the rare detection rate, as the tissue samples are commonly discarded after negative growth for more than 72 hours. This hinders appropriate targeted antibiotic therapy and duration of treatment.

Conclusions: Despite being part of the normal flora of oral cavity, gastrointestinal and vaginal tracts, reported incidence of infection related to it is scarce. This may be explained by the diagnostic challenges that leads to underdetection. Therefore, extending period of incubation of intra-operative samples should be considered.

Keywords: Actinomyces, Rare, Spine infection

E009

Full Endoscopic en bloc Flavectomy Technique for Lumbar Spinal Stenosis: A technical Note

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Purpose: Lumbar spinal stenosis is a common condition in the elderly population and a leading cause of pain and disability. With minimally invasive spine surgery techniques like full endoscopic spine surgery, adequate spinal decompression can be achieved with less collateral damage to the normal anatomical structures. En bloc ligamentum flavum excision has been described in literature. We present our technique of full endoscopic stenosis decompression using an en bloc ligamentum flavum excision method.

Materials and Methods: We present the surgical technique of full endoscopic en bloc flavectomy performed in a series of 7 patients. A uniportal endoscope was used to perform the decompression. The key steps of our technique are circumferential laminotomy, en bloc flavectomy and clean up of remaining debris to ensure adequate nerve root decompression.

Results: Uniportal en bloc ligamentum flavum resection is feasible however it is more technically demanding due to the very steep learning curve. Compared to piecemeal resection, en bloc flavectomy makes decompression more efficient because you minimize the repeated entry and exit of surgical

instruments when clearing the soft tissue debris. Risk of dural tears and irrigation pressure related complications are also limited because the flavum is left intact as protective covering and it is only removed towards the end of the decompression procedure. Compared to bi-portal technique, our method is more challenging because of instrument movement limitations.

Conclusions: Full endoscopic en bloc ligamentum flavum excision is a safe, effective and reproducible method for treatment of lumbar spinal stenosis. The single portal access allows for minimal soft tissue collateral damage. Our method may be more technically demanding compared to bi-portal en bloc ligamentum flavum excision method.

Keywords: Full endoscopic, En bloc flavectomy, Stenosis

E010

Unraveling Spinopelvic Dissociation: Insights from 7 Cases Treated in a Year at Malacca General Hospital

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Purpose: Our institution's experience shows that spinopelvic dissociation is not uncommon and can be fixed in a non-specialty center through our preferred construct, requiring less instrumentation, less technically demanding while maintaining good stability for early mobilization and comparative outcome.

Materials and Methods: We present a case series of 7 patients treated in our hospital from 2023 to 2024 for spinopelvic dissociation. Fractures were classified according to the Young-Burgess classification. They were treated with spinopelvic fixation utilising pedicle screws over L4-L5 and iliac screws, along with rods, iliac connectors and cross-links. Open reduction and internal fixation of the symphysis pubis using reconstruction plates were also carried out in 4 patients out of the 7 patients. Postoperative functional outcomes were assessed using pain score, weight bearing and unaided ambulation.

Results: All of our patients were involved in high-energy motor-vehicle accidents or falls from height. There were 4 males and 3 females, with a mean age of 23.4 years. Based on the Young-Burgess Classification, 1 patient had antero-posterior compression injury (APC III), 5 patients had lateral compression injuries (LC III), and 1 had a vertical shear (VS) injury. Pelvic ring instability was present in all fractures, requiring fixation. All of our patients had no neurological deficits before or after surgery. The average time from trauma to spinopelvic fixation was 10.2 days, however initial pelvic external fixations were done within the first 24 hours. All of our patients were able to ambulate without aid by a mean time of 6 weeks, but there were also other associated long bone fractures and intra-abdominal injuries to be accounted for.

Conclusions: Spinopelvic dissociations are associated with high-energy trauma. Spinopelvic fixation provides the most stable construct, technically less demanding, and cost effective while allowing comparable functional outcomes to other methods.

Keywords: Dislocation, Fractures, Sacroiliac joint, Spinopelvic fixation

E011

Functional Outcome of Minimally Invasive Anterior Surgery for Anterior Spinal Disease

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Purpose: To assess the functional outcome of Minimally Invasive Anterior Surgery without Jigs or retractor system for Anterior Spinal Disease.

Materials and Methods:

Type of Study: Retrospective Observational study

Study duration: December 2022 to December 2024

Study place: Tertiary Care Hospital in South India

Inclusion criteria:

Isolated Anterior Spinal Disease: Tuberculosis of Spine, Traumatic Anterior Vertebral body Collapse >50 %

Exclusion criteria:

Spinal Metastasis, Pathology involving Posterior Column of Spine.

Parameters observed: Operating time, Blood Loss, Postoperative ICU Care, Residual Respiratory issues, Incisional Hernia
Functional outcome: VAS score for Back Pain, ODI Score
Radiological outcome: Focal and Segmental Cobb's angle, Cage Subsidence, Fusion status via Birdwell Fusion Criteria
Surgical Technique: Patient under General Anesthesia, Right lateral approach with left side up. An Incision made centering the involved Segment, then via Extrapleural or retroperitoneal or combined approach involved desired segment is reached and retraction in done using rubberized Hohmann retractor. Desired debridement or Corpectomy is done followed by Cage and Bone grafting and anterolateral pedicle screw and rod insertion is done.
Results: 10 patients (6 Female, 4 male) in our series. Average age 60 yrs. 5 patients had Spinal Tuberculosis and 5 patients had Traumatic Vertebral body fracture. Average Operating time was 60 mins. Average blood loss was 250 ml. In Spinal Tuberculosis group average Preoperative VAS was 8 which improves to 2 at last follow up and average Preop ODI was 83 which improve to 21 at last follow-up. In Traumatic Vertebra fracture group average Preop VAS was 8 which improves to 1 at last follow upand average Preop ODI was 76 which improve to 17 at last follow-up. In radiological parameter Traumatic Vertebral Body fracture has significant improvement of Focal Cobb's angle from initial average Preop value of 17 degress to average Postop value of 8 degrees. Similar in Spinal Tuberculosis group initial average pre-op focal cobb's was 12 degrees which improves to 7 degrees. All the patients achieved their desired Segmental sagittal balance according to the level involved. In our series all patients achieved Grade I fusion according to Birdwell Fusion criteria. None of the patient required Postoperative ICU care, none had any Residual respiratory issues, none had any incisional hernia. No cage Subsidence observed till last follow up.
Conclusions: Minimally invasive Anterior Spine Surgery is feasible, effective and safe for patients with various anterior spinal pathologies. In our modification no jigs or retractor system were used and routine Hohmann retractors tip were blunted by rubber tip making it cost effective also.
Keywords: Minimally invasive spine surgery, Anterior spine surgery, No jigs & retractor system, Spinal tuberculosis, Spinal vertebral body fracture

E012

Navigation in Cervical Spine Surgery

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Purpose: To evaluate the accuracy of navigation in cervical spine surgery.
Materials and Methods: From 2021.01 to 2024.12. O arm navigation was used during the surgery. There are totally 109 pedicle screws in 32 patients who were included using navigation in cervical spine surgery. Including endoscopic surgery, kyphosis correction surgery and revision cervical spine surgery.
Results: The 109 pedicle screws were evaluated by CT or intraoperation O arm scan, no screw revision was required after the surgery. There are 3 screws found breaching in anterior during the surgery. No major complication, vessel or nerve injury during the surgeries.
Conclusions: Navigation in cervical spine surgery could be safe and can be used for all types of cervical spine conditions.
Keywords: Navigation, Cervical spine surgery

E013

Effectiveness of PICO Dressing in Managing Spinal Wound Complications

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Purpose: Wound complications after spinal surgery remain a significant concern and are associated with prolonged hospital stays, higher healthcare costs, and adverse effects on patient outcomes. Negative pressure wound therapy (NPWT) has emerged as one of the effective interventions to address these complications. A single-use, portable NPWT system such as the PICO dressing has been popularized due to its user-friendly application and clinical effectiveness. This study aims to evaluate the use of PICO dressings in treating postoperative spine patients who developed surgical site

infection, its effect on surgical wound healing, and avoidance of repeat debridement.

Materials and Methods: This was a single-centre retrospective review of eleven patients, ten males and one female, with a mean age of 51 from 2022 to 2024. The cohort comprised five patients with high-energy spine trauma, three spinal metastases, two spinal infections, and one degenerative spine disease. PICO dressings were applied in two scenarios: after initial surgical debridement (n=4) and immediately following bedside wound inspection upon noticing wound discharges (n=7). The primary outcomes were wound healing and avoidance of repeated surgical debridement.

Results: All 11 patients' wounds healed following the application of PICO dressings and avoided repeat surgical debridement. Among four patients who received PICO dressings after initial debridement, wounds healed after at least two cycles of PICO dressing with no repeat surgical debridement. Of the seven patients without initial debridement, two were able to be discharged home with PICO dressing, five were observed in the ward, and all wounds healed with a maximum of 2 cycles of PICO dressing. All patients were treated with either inpatient intravenous antibiotic or oral antibiotics if they were discharged home. These findings demonstrate the effectiveness of PICO dressings as an adjunct in managing spinal wound complications and avoiding repeat invasive surgical debridement. The system's ability to create a sealed, negative-pressure environment likely contributed to reduced exudate, improved wound edge apposition, and prevention of infection. The study was limited by its small sample size and retrospective design, but it deserves further investigation.

Conclusions: PICO dressings are practical, effective and useful adjuncts in managing surgical wound complications in spinal surgery, facilitating wound healing, and avoiding the need for repeat surgical debridement.

Keywords: Spine surgery, Surgical site infection, Wound management, Wound dressing, Wound healing

E014

Is Anterior Cervical Discectomy and Fusion (ACDF) a Reasonable First Choice for Giant Cervical Disc Herniation?

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Purpose: Giant cervical disc herniation (GCDH) was defined as a herniated intervertebral disc that accounted for more than 50% of the spinal canal. Giant cervical disc herniation (GCDG) can cause various symptoms. In particular, if it causes myelopathy including motor nerve paralysis symptoms, immediate surgical treatment is required. In general, Anterior Cervical Discectomy and Fusion (ACDF) is the first surgical treatment to consider for cervical disc herniation. However, if the size is large or other lesions such as spinal stenosis, OPLL, etc. are present, or if there is disc migration, decompression may be insufficient, and in such cases, paralysis may progress after ACDF surgery. We think that there are some cases where myelopathy symptoms worsen after ACDF is performed first. Therefore, it is thought that performing posterior Laminoplasty first and then ACDF should be considered.

Materials and Methods: A 45-year-old female patient presented with symptoms of inability to write, falling and staggering, paralysis of the right arm, right hand clumsiness, triceps, and biceps weakness for a month. MRI showed severe cord compression due to GCDH at C5-6. Surgical treatment was performed due to severe pain and worsening symptoms. First, posterior decompression and Open-door Laminoplasty (OLP) (2022.12.12) for C5 and C6 were performed as the first surgery. Two days later, C5-6 Anterior Cervical Discectomy and Fusion (ACDF) (2022.12.14) was performed as the second surgery.

Results: The MRI performed after the first posterior surgery showed cord decompression, but anterior cord compression due to the disc remained. The MRI performed after the second ACDF confirmed that this part was also completely removed. After the first surgery, the right hand numbness symptoms significantly improved, but some symptoms remained. After one month after the second surgery, there was a significant improvement, and after five months, most

of the discomfort symptoms were completely resolved.

Conclusions: Among patients with GCDH, there are cases where migration disc remains after ACDF surgery, or myelopathy motor symptoms worsen due to manipulation or neck extension during surgery. In some cases, it is thought to be safer to perform OLP first and then ACDF after thoroughly evaluating before surgery to check for 1. Lhermitte's sign, 2. Neck extension provocation test, and 3. Herniated intervertebral disc that accounted for more than 50% of the spinal canal on MRI images.

Keywords: Anterior cervical discectomy and fusion, Open-door laminoplasty, Cervical disc herniation, Giant cervical disc herniation, Surgical results

E015

Epidural PRP Injection: An Alternative Treatment of Spinal Pain

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Purpose: Prolapsed intervertebral disc (PID) is a common cause of low back pain, back pain, neck pain and radiculopathy, which significantly affect quality of life. Traditional treatments include conservative treatment, physiotherapy, epidural steroid injection and surgery. Recently, platelet rich plasma (PRP) has emerged as a potential therapeutic option due to its regenerative property. This study aims to evaluate the efficacy and safety of epidural PRP injections in patients with prolapsed intervertebral discs, degenerative disc disease and spinal arthropathy, regarding pain relief, functional improvement, and reduction of the size of herniated disc in some cases.

Materials and Methods: 2000 patients with symptomatic prolapsed intervertebral disc were selected. Diagnosis was confirmed by MRI. 20 ml autologous PRP was injected in epidural area of the affected disc level. Total 3 doses were given, in 1 month interval. Clinical outcomes were assessed using the Visual Analog Scale (VAS) for pain. Repeat MRIs were done after completion of treatment in some cases.

Results: Patients receiving epidural PRP showed significant improvement in functionality and VAS score. Post treatment MRI in some cases showed a reduction in herniated disc size.

Conclusions: Epidural autologous PRP injections appear to be a safe and effective treatment for a range of spinal disorders, providing significant pain relief and functional improvement. This biologic therapy could be a great alternative to invasive treatments, with the capability of tissue healing and regeneration. Further studies with longer-term follow-up are recommended.

Keywords: Epidural, PRP, Biologic therapy, Autologous

E016

Functional Outcome of ACDF with Stand Alone Cage and Bone Graft in Degenerative Cervical Disc Prolapse with Neurological Deficits

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Purpose: Degenerative conditions of cervical spine are one of the significant diseases in relatively older age groups. It creates disabilities for the patient, and a burden for family and the society as well.Thus, the surgical treatment is worthwhile. ACDF with the Stand-alone cage is relatively a feasible implant that allows sufficient stability after decompression for treatment of cervical degenerative disc disease. This study is to evaluate the clinico-radiological outcomes in the patients undergone anterior cervical discectomy and fusion (ACDF) with stand alone cage and bone graft in patients with Degenerative cervical spondylotic myelopathy or radiculopathy for cervical disc prolapse of single or multiple level.

Materials and Methods: This Prospective interventional study included a total of 32 cases were included in the study from July 2023 to June 2024 through non-randomized purposive sampling. All the patients were between 20 to 75 years of age and operated (ACDF) with Stand-Alone Anchored Spacer in cervical degenerative disc disease. The postoperative outcome was assessed by NDI and JOA score.Postoperative follow up was conducted at 1st, 3rd and 6th month.

Results: The mean age was found 53.41±12.17 years with male dominancy (68.75%). Most of them were service holder (31.25%) and the most common presentation was

radiculopathy (43.8%). The most commonly affected level was C5/6 (43.8%). Dysphagia rate was 12.5% after 2 weeks and no dysphagia after 3months. Evaluation of outcome 6 months after operation showed that mean NDI score 13.8±1.5, JOA score 14.7±1.3 and Bridwell Grade-I fusion 92.85% with excellent outcome clinically, functionally and radiologically.

Conclusions: ACDF is one of the best surgical treatment for cervical disc diseases.Stand-alone cages acts as a spacer that improves its outcome, Because it is a safe and reliable implant for the treatment in terms of fusion and stability in cervical degenerative disc disease with neurological symptoms.

Keywords: ACDF, Stand-alone cage, Cervical myelopathy

E017

Biportal Endoscopic Transforaminal Lumbar Interbody Fusion Using Double Cages for Degenerative Spondylolisthesis Grade 2 with Calcified Disc

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Abstract: There are many types of minimally invasive lumbar interbody fusion procedures. Among them is biportal endoscopic transforaminal lumbar interbody fusion (BETLIF). BETLIF with double cages has been used in lumbar fusion surgery to minimize tissue trauma and improve the fusion rate due to its ability to facilitate better endplate preparation under an endoscope and provide a larger cage footprint. However, special techniques are required to perform this procedure. In our institute, we adopted biportal endoscopic transforaminal lumbar interbody fusion (BETLIF) using double cages with percutaneous instrumentation. Here, we describe our surgical techniques for BETLIF using double cages for degenerative spondylolisthesis grade 2 with calcified disc and discuss the advantages and pitfalls of this procedure.

Keywords: Minimally invasive lumbar interbody fusion, Biportal endoscopic transforaminal lumbar interbody fusion, Spondylolisthesis grade 2, Surgical technique

E018

The Effect of Preoperative Embolization on Intraoperative Bleeding in Posterior Stabilization of Thoracolumbar Spine Fractures

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**Vascular Surgeon, Prof RD Kandou, General Hospital North Sulawesi. Indonesia*

Abstract: Trauma to the thoracolumbar spine frequently results in fractures that require posterior stabilization surgery, often accompanied by significant intraoperative bleeding. This study evaluates the impact of preoperative embolization on reducing intraoperative bleeding during posterior stabilization surgery. Utilizing a quasi-experimental design, we compared two groups of patients: those undergoing embolization within 24-48 hours before surgery and those without embolization. Results showed a significant reduction in bleeding volume in the embolization group, with an average blood loss of 283.3 mL compared to 583.3 mL in the control group ($p<0.05$). This study underscores the efficacy of embolization as a preoperative intervention to minimize surgical bleeding, potentially improving outcomes in thoracolumbar spine surgeries.

Introduction: Trauma-related thoracolumbar fractures represent a significant clinical challenge, particularly in high-impact injuries. These fractures are often complicated by severe intraoperative bleeding, which can increase morbidity, prolong surgical time, and heighten the need for transfusions. Preoperative embolization has emerged as a promising intervention to address this issue. Embolization involves the selective occlusion of blood vessels, reducing blood supply to targeted areas while preserving essential vascular structures. While embolization is well-documented in oncologic and trauma settings, its application in thoracolumbar spine fractures remains underexplored. This study investigates the efficacy of preoperative embolization in reducing intraoperative blood loss during posterior stabilization surgeries for thoracolumbar fractures.

Methodology: Study Design

A quasi-experimental study was conducted at RSUP Prof. Dr. R. D. Kandou Manado between June 2021 and May 2022. Patients with thoracolumbar fractures undergoing posterior stabilization were divided into two groups: the embolization group (n=3) and the control group (n=15).

Participants Inclusion Criteria:

1. Patients with thoracolumbar fractures undergoing posterior stabilization.
2. Agreement to participate in the study.

Exclusion Criteria:

1. Patients with tumors, infections, or coagulopathies.
2. Patients with other significant vascular conditions.

Intervention: The embolization group underwent selective arterial occlusion 24-48 hours preoperatively using polyvinyl alcohol (PVA) particles (250-355 microns). Embolization targeted radicular arteries at one or two levels proximal to the fracture site.

Data Collection: Intraoperative blood loss was measured using an autotransfusion device. Patient demographics, complications, and embolization outcomes were recorded.

Statistical Analysis: Data were analyzed using SPSS. A one-tailed t-test was employed to evaluate differences in blood loss between groups. Significance was set at $p<0.05$.

Results: Patient Characteristics

A total of 18 patients were included: 11 males (61%) and 7 females (39%), with an average age of 52 years (range: 25-74). The embolization group comprised three patients, while 15 patients were assigned to the control group.

Blood Loss: The embolization group experienced significantly less intraoperative blood loss (mean: 283.3 mL) compared to the control group (mean: 583.3 mL). Maximum and minimum blood loss values for the embolization group were 450 mL and 200 mL, respectively, compared to 750 mL and 400 mL in the control group.

Complications: One patient in the embolization group experienced transient muscle weakness in the lower extremities, resolving within one week. No other major complications were observed.

Discussion: Efficacy of Embolization

Preoperative embolization effectively reduced intraoperative blood loss by occluding radicular arteries supplying the thoracolumbar spine. These findings align with previous studies demonstrating embolization's role in minimizing surgical bleeding in various procedures.

Mechanisms and Challenges: The reduction in blood loss can be attributed to the selective occlusion of radicular arteries, supplemented by the collateral vascular supply from the spinal posterior arteries. However, embolization's efficacy is influenced by anatomical variability and the extent of collateral circulation.

Limitations: This study's primary limitation is the small sample size, particularly in the embolization group. Larger, randomized studies are needed to confirm these findings. Additionally, the risk of embolic migration causing neurological deficits warrants careful technique and material selection.

Conclusions: Preoperative embolization significantly reduces intraoperative blood loss in posterior stabilization of thoracolumbar fractures. This intervention offers a safe and effective strategy to optimize surgical outcomes. Further research is needed to refine embolization protocols and explore long-term outcomes.

E019

Contralateral Foraminal Area Increases Significantly After Minimally Invasive Transforaminal Lumbar Interbody Fusion Using Biplanar Expandable Cage

Yee Gen Lim, David Shaoen Sim, Arellano Pasion Dizon, Chuen Jye Yeoh, Lei Jiang, Zhixing Marcus Ling

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Introduction: Biplanar expandable (BE) cages have been designed for Minimally Invasive Transforaminal Lumbar Interbody Fusion (MIS-TLIF) to improve restoration of disc height.

Purpose: Investigate change in radiographic parameters after MIS-TLIF with BE cages.

Methods: Retrospective study on consecutive patients who underwent 1-level or 2-level MIS-TLIF utilizing BE cages for degenerative lumbar spine conditions. Intraoperative 3D imaging performed before and after MIS-TLIF were analyzed to calculate change in radiographic parameters including posterior and anterior disc height, listhesis, segmental lordosis, ipsilateral and contralateral foraminal area.

Results: 12 patients underwent MIS-TLIF with BE cages. five 1-level TLIF and seven 2-level TLIF were performed with a total of 19 fused segments. There was significant statistical improvement in posterior disc height (+2.7±1.2 mm; p<0.001), anterior disc height (+2.6±3.1 mm; p<0.001), listhesis, segmental lordosis (+3.2±2.6°, p<0.001), ipsilateral l (41.3±17.5 mm² ; p<0.001) and contralateral foraminal area (29.1±16.7 mm² ; p<0.001). Ipsilateral and contralateral foraminal area increased by 41% and 31% respectively.

Conclusions: Utilizing biplanar expandable cage in MIS-TLIF can lead to significant improvement in radiographic parameters, including increase in contralateral foraminal area.

Keywords: Minimally invasive, Transforaminal lumbar interbody fusion, Biplanar expandable cage

E020

Efficacy, Safety, and Reliability of the Single Anterior Approach for Sub axial Cervical Spine Dislocation

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Purpose: Though there is ongoing controversy regarding the best treatment option for cervical spine dislocation (CSD), anterior cervical surgery with direct decompression is becoming widely accepted. However, managing all cases of subaxial CSD entirely by a single anterior approach is rarely seen in the published literature.

Materials and Methods: The study comprised patients with subaxial CSD who underwent surgical stabilization utilizing a single anterior approach. Most of the CSD was reduced and anterior cervical discectomy and fusion (ACDF) were performed. Anterior cervical corpectomy and fusion (ACCF) were done in unreduced dislocations. The patient's neurological condition, radiological findings, and functional outcomes were assessed. SPSS version 25.0 (IBM Corp., Armonk, NY) was used for statistical analysis.

Results: The total number of operated cases was 64, with an average of 42 months of follow-up. The mean age was 34.50±11.92 years. The most prevalent level of injury was C5/C6 (57.7%). Reduction was achieved in 92.2% of cases; only 7.8% of patients needed corpectomy. The typical operative time was 84.25±9.55 minutes, with an average blood loss of 112.12±25.27 ml. All cases except complete spinal cord injury (CSI) were improved neurologically (87.63%). The mean Neck Disability Index (NDI) was 11.14±11.43, and the pre-operative mean Visual Analog Scale (VAS) (VAS) was finally improved to 2.05±0.98 ($p < 0.05$). In all cases, fusion was achieved. The most common complication was transient dysphagia (23.4%). After surgery, no patient developed or aggravated a neurological impairment. Implant failure was not observed at the final follow-up except for two cases where screws were pulled out partially.

Conclusions: Based on the results of this study, a single anterior approach is a safe and effective procedure for subaxial CSD treatment with favorable radiological, neurological, and functional outcomes.

Keywords: Traumatic cervical spine injury, Anterior cervical corpectomy and fusion (ACCF), Subaxial cervical spine dislocation (CSD), Anterior cervical discectomy and fusion (ACDF), Single anterior approach

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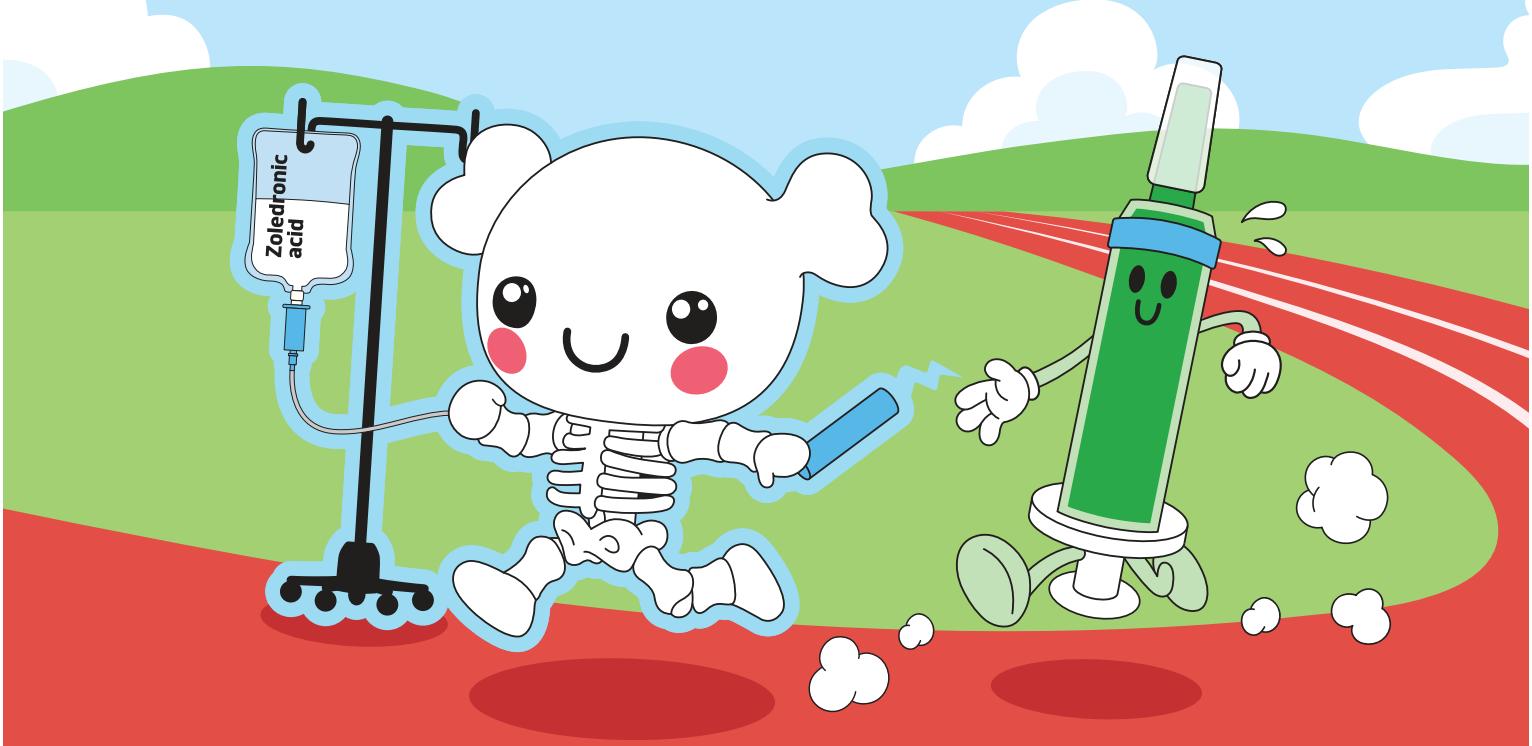

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[제품명] 탈리제®정 **[주성분]** 미르가발린베실산염 **[효능·효과]** 신경병증성 통증의 치료 **[용법·용량]** 이 약은 식사와 관계 없이 경구 투여한다. 이 약은 주로 신장으로 배설되므로, 신기능이 저하된 환자에 대해서는 용량이 조절되어야 한다. 이 약은 보통 시작 용량으로 1회 5mg을 1일 2회 경구 투여 할 수 있다. 이 후 1회 투여량으로서 5mg씩 최소 1주일 이상 간격을 두고 단계적으로 증량하여 최대 1회 15mg을 1일 2회까지 경구 투여 할 수 있다. **[사용상의 주의사항] 1. 다음 환자에는 투여하지 말 것.** 이 약 및 이 약의 구성성분에 과민 반응이 있는 환자 **2. 다음 환자에는 신중히 투여할 것.** 1) 당뇨환자: 최근 미로가발린의 투여로 체중이 증가된 당뇨환자는 혈당강하제의 용량 조정이 필요할 수 있다. 2) 신기능 장애환자 3) 고령자(만 65세 이상) 4) 임부 및 수유부 **3. 이상반응** 1) 이 약으로 치료하는 동안 발생할 수 있는 이상반응이 발생할 수 있다. 자세한 사항은 제품 정보를 참고해 주세요. 이상반응이 나타나는 경우 이 약 복용을 중지하는 등, 필요에 따라 적절한 조치를 취해야 한다. 2) 기타 주의사항 (1) 한국, 일본, 타이완 등을 포함한 아시아에서 실시된 다 국가, 위약 대조 임상시험에서, 이 약을 투여 받은 시험대상자 1,378명 중 5명(0.36%, 자살행동: 1명, 자살중동: 4명)과 위약을 투여 받은 시 험대상자 869명 중 4명(0.46%, 자살중동)에서 자살 관련 이상사례가 보고되었다. (2)일본을 포함한 아시아에서 실시한 다국가, 위약 대조 임상시험에서 사망사례는, 이 약을 투여받은 시험대상자 1,378명 중 3명(0.22 %), 위약을 투여 받은 시험대상자 869명에서는 없었다. **4. 일반적 주의** 1) 어지러움, 졸음 및 의식소실: 넘어져서 골절 등을 일으킬 수 있는 어지러움, 졸음 및 의식소실이 나타날 수 있다. 이 약을 복용하는 환자는 주의 깊게 모니터링 되어야 하고 이상이 관찰되는 경우 이 약 복용 중지 또는 감량 등의 적절한 조치를 취해야 한다. 이 약은 어지러움, 졸음, 및 의식 소실 등을 초래할 수 있으므로 이 약으로 치료 받는 환자에게는 자동차 운전 등 잠재적으로 위험한 기계를 조작하지 않도록 주의를 주어야 한다. 특히 고령자에서는 이러한 증상으로 낙상을 초래하여 골절 등으로 이어질 수 있으므로 주의를 기울여야 한다. 2) 간 기능 장애(AST(GOT) 상승 및 ALT(GPT) 상승 등)가 나타날 수 있으므로 이 약을 복용하는 환자는 주의 깊게 모니터링 되어야 한다. 천신 권태감이나 식욕 부진 등의 초기 증상을 포함한 이상이 관찰되는 경우 이 약 복용을 중지하고 적절한 조치를 취해야 한다. 3) 이 약의 복용으로 체중이 증가할 수 있으므로 비만에 주의를 기울여야 한다. 비만의 정후가 발견될 경우 식이요법 및/또는 운동요법 같은 적절한 조치를 취해야 한다. 특히, 체중증가는 투여용량의 증량 또는 장기간 투여와 관련이 있을 수 있으므로 정기적으로 체중을 측정한다. 4) 신경병증성 통증에 대하여 이 약은 원인 치료요법(causal therapy)이 아닌 보조치료요법(supportive therapy)이라는 점에 유의해야 한다. 따라서 신경병증성 통증의 원인이 되는 기저 질환의 진단 및 치료를 병행하여 실시하고, 이 약을 만연하게 사용하지 않도록 한다. 5) 갑작스러운 투여 중단에 의해 불면증, 오심, 설사, 식욕 저하 등의 금단 증상이 나타날 수 있으므로, 이 약의 투여를 중단할 경우 복용량을 점차 줄이는 등 신중을 기해야 한다. 6) 이 약의 투여로 인해 약시, 시력 흐림, 복시 등의 장애가 나타날 가능성이 있으므로 진찰 시에 눈의 장애에 관해 문진을 하는 등 주의를 기울이고, 이상이 관찰되는 경우 적절한 처치를 한다. 7) 이 약의 유효성은 당뇨병성 말초 신경병증 환자, 대상 포진 후 신경통 환자 및 중추신경병증성 통증 환자를 대상으로 한 임상시험에서 입증되었다. 다른 신경병증성 통증에 대한 유효성은 평가되지 않았다. **[개정년월일]** 2022년 6월 20일 **[제조원]** TAIYO Pharma Tech Co., Ltd. Takatsuki Plant
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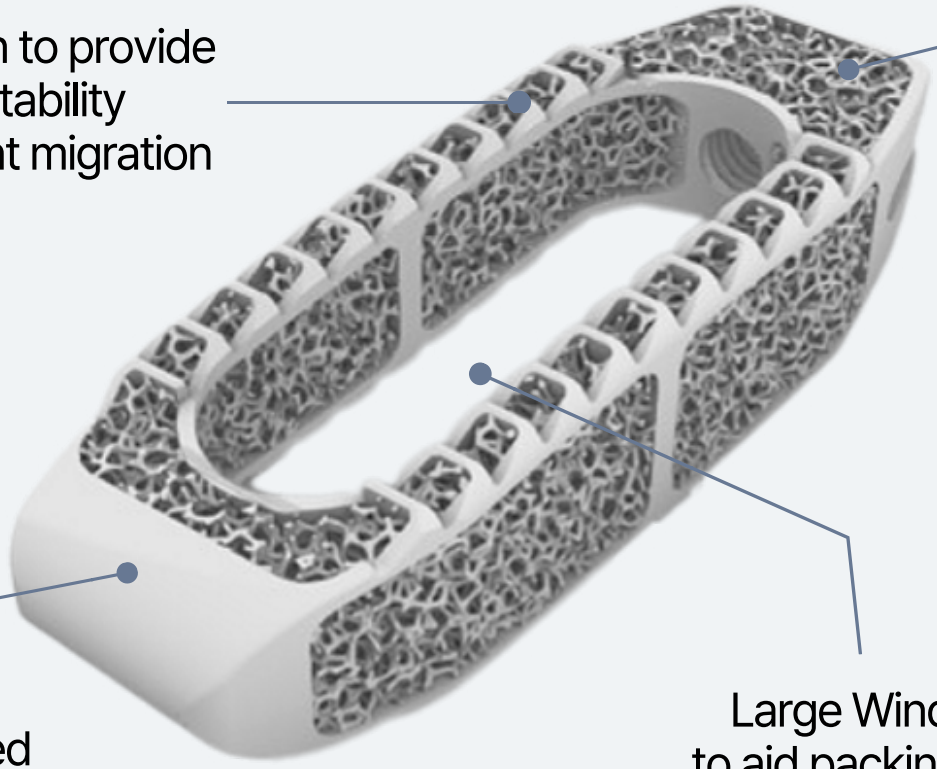

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울트라셋®이알서방정 (트라마돌염산염 75 mg, 아세트아미노펜 650 mg) 최근 변경일자 : 2024-01-03

울트라셋®이알세미서방정 (트라마돌염산염 37.5 mg, 아세트아미노펜 325 mg) 최근 변경일자 : 2024-01-03

[효능·효과] 울트라셋®정, 울트라셋®세미정 : 중등도-중증의 급만성 통증, 울트라셋®이알서방정, 울트라셋®이알세미서방정 : 중등도-중증의만성통증 **[용법·용량]** 울트라셋®정, 울트라셋®세미정 : 성인 : 초회용량은 환자의 통증 정도 및 치료 반응에 따라 조절. 초회용량으로 울트라셋®정은 2정, 울트라셋®세미정은 4정 투여를 권장, 그 이후 투여간격은 최소 6시간으로 하되, 울트라셋®정은 1일 8정, 울트라셋®세미정은 1일 16정을 초과하지 않도록 함. 이 약을 필요 이상 장기간 투여하지 않도록 하며, 질병의 특성 및 심한 정도로 인해 장기간 투여가 필요한 경우, 정기적인 모니터링을 실시하며 이 약의 지속투여 여부를 확인하도록 함. 노인 : 통상적인 성인 용량을 투여하도록 하되, 75세 이상의 노인에게 트라마돌을 경구 투여 시 트라마돌의 소실반감기가 17% 증가하였으므로 최소 6시간 이상 간격으로 이 약을 투여하도록 함. 울트라셋®이알세미서방정, 울트라셋®이알서방정 : 성인: 용량은 환자의 통증 정도 및 치료 반응에 따라 조절. 초회용량으로 울트라셋®이알세미서방정은 2정, 울트라셋®이알서방정은 1정 투여를 권장, 그 이후 투여 간격은 최소 12시간 이상으로 하되, 1일 울트라셋®이알세미서방정은 8정, 울트라셋®이알서방정은 4정을 초과하지 않도록 함. 이 약을 필요 이상 장기간 투여하지 않도록 하며, 질병의 특성 및 심한 정도로 인해 장기간 투여가 필요한 경우, 정기적인 모니터링을 실시하며 이 약의 지속투여 여부를 확인하도록 한다. 이 약의 투여 시 구역, 구토, 가려움증, 변비, 어지러움, 졸음 등이 나타날 수 있으므로 환자의 반응을 면밀히 관찰하고 적절히 조절한다. 노인의 경우 통상적인 성인 용량을 투여하도록 함. 단, 75세 이상의 노인에게 트라마돌을 경구 투여 시 트라마돌의 소실반감기가 17% 증가하였으므로 최소 12시간 이상 간격으로 이 약을 투여하도록 함. 이 약은 12세 미만 소아에게 투여 금기 **[사용상의 주의사항] [경고]** 1) 매일 세찬 이상 정기적으로 술을 마시는 사람이 이 약이나 다른 해열진통제를 복용해야 할 경우 반드시 의사 또는 약사와 상의해야 함 2) 아세트아미노펜을 복용한 환자에서 매우 드물게 급성 전신성 발진성 농포증(급성 전신성 발진성 고름물집증)(AGEP), 스티븐스존슨 증후군(SJS), 독성 표피 괴사용해(TEN)와 같은 중대한 피부반응이 보고됨. 이 약 투여 후 피부발진이나 다른 과민반응의 징후가 나타나면 즉시 복용을 중단하도록 함. 3) 트라마돌을 권장용량 범위내에서 투여 받은 환자에서 발작이 보고됨. 권장용량 이상 투여 시 발작의 위험은 증가한다는 것으로 나타남. 트라마돌을 선택적 세로토닌 재흡 억제제, 삼환계 항우울제 (TCAs) 및 다른 삼환계 약물, 다른 마약류 등의 약물과 병용 시 발작의 위험은 증가됨. 트라마돌은 MAO (Monoamine Oxidase) 억제제, 신경이완제, 발작 역치를 낮출 수 있는 약물 등과 병용 시 발작의 위험을 증가시킬 수 있음. 뇌전증환자, 발작 병력자 또는 발작에 대한 위험인자 (머리 상해, 대사장애, 알코올 또는 약물 금단 환자, 중추신경계 감염)가 있는 환자에서 경련발생의 위험이 증가될 수 있음. 4) 트라마돌 투약 환자에서 드물게 치명적인 아나필락시양 반응이 보고됨 5) 급성 및 중증 기관지 천식 환자를 마약성 진통제로 치료하면 생명을 위협하는 호흡저하의 위험이 증가됨. 이 약을 해당 환자군에 투여할 때 모니터링이 가능하거나 심폐소생 장비가 구비된 곳에서 투여되어야만 함. 이 약을 호흡 억제 위험이 있는 환자에게 투여 시 주의하도록 하며, 다른 비마약성 진통제 사용을 고려하도록 한다. 6) 트라마돌과 알코올 또는 벤조디아제핀계 약물을 포함하는 중추신경계억제제의 병용 투여는 깊은 진정, 호흡억제, 혼수 및 사망을 초래할 수 있다. 이러한 위험성 때문에, 이 약과중추신경억제제의 병용투여는 적절한 대체 치료방법이 없는 환자의 경우에 한하여 처방하도록 한다. 이 약과 중추신경억제제의 병용투여가 결정되면 최저유효용량으로 최단기간 처방하도록 하고 호흡억제 및 진정의 징후와 증상에 대해 환자를 면밀히 추적 관찰하도록 한다. 7) 두개골내압이 증가된 환자나 머리상해 환자에서 이약의 투여는 마약성 진통제의 호흡억제 효과로 이산화탄소 저류와 2차적인 뇌척수액의 압력 증가로 인해 이러한 증상이 심각하게 나타날 수 있다. 8) 트라마돌은 모르핀형(μ-opioid)의 정신적, 육체적 의존성을 유발할 수 있다. 9) 간독성: 이 약에는 아세트아미노펜 및 트라마돌이 함유되어 있다. 아세트아미노펜은 때로 간이식 및 사망을 초래하는 급성 간부전과 관련이 있으며, 대부분의 간손상은 다른 아세트아미노펜 제품과 함께 복용하여 일일 4,000밀리그램을 초과하였을 때와 관련이 있으므로 사용시 주의한다. 특히 간장애 환자는 반드시 의사와 상의한 후 복용하여야 한다. 10)CYP2D6 초고속 대사자인 환자는 다른 환자들에 비해 트라마돌을 그 활성대사체 (M1)로 보다 빠르고 완전하게 대사시킬 수 있다. 이 빠른 대사는 예상보다 더 높은 혈청 M1 농도를 초래할 수 있고 이는 호흡 억제 위험을 증가시킬 수 있다. CYP2D6 초고속대사자로 알려진 환자에 대해서는 대체 약제, 용량 감소 및/또는 트라마돌 과량 복용 징후 (예: 호흡 억제)에 대한 모니터링의 빈도 증가 등을 권고한다. 11) 생명에 치명적인 호흡 억제 및 사망이 트라마돌을 투여한 소아에서 발생하였다. 일부 보고된 사례들은 소아가 편도절제술 및/또는 아데노이드절제술을 받은 후에 발생하였으며, CYP2D6 다형성으로 인한 트라마돌의 초고속 대사자인 것으로 입증되었다. 이 약은 12세 미만 소아 및 편도절제술 및/또는 아데노이드절제술을 받은 18세 미만 소아에게 투여하지 않는다. 이 약은 트라마돌의 호흡 억제 효과에 대한 민감성을 증가시키는 또 다른 위험인자를 갖고 있는 12세~18세 소아에게 투여를 피한다. 12) 이 약은 수면무호흡증후군(중추수면무호흡 포함)과 저산소증(수면 관련 저산소증 포함)을 야기할 수 있으며, 발생 위험은 용량 의존적으로 증가한다. 수면무호흡증 발생 혹은 기존 증상 악화 여부를 지속적으로 평가해야 하며, 이 경우 약물 용량을 서서히 감량 혹은 중단하는 것을 고려해야 한다. 13) 이 약의 사용 시 매우 드물게 저나트륨혈증이 보고되었으며, 대체로 고령자 및/또는 저나트륨혈증을 초래할 수 있는 약물을 병용하고 있는 경우 등 취약 위험요인이 있는 환자에서 보고되었다. 몇몇의 보고에서 이 저나트륨혈증은 항이뇨호르몬분비이상증후군 (SIADH) 의 결과인 것으로 나타났으며 이 약의 중단과 적절한 치료 (예: 수분 제한) 로 회복되었다. 취약 위험 요인이 있는 환자에 대해서는 이 약의 치료 동안 저나트륨혈증의 징후 및 증상에 대한 모니터링을 권고한다. 14) 위장관 상태: 담도계의 이상이나 담낭 수술 이력이 있는 환자에 대해서는 급성 췌장염 발병 가능성에 대한 모니터링을 해야한다. **[투여금기]** 1) 이 약의 성분에 과민성이 있는 환자 2) 알코올, 수면제, 중추작용진통제, 마약성 진통제 또는 향정신성 약물 등 중추신경계 작용약물 중독 환자 3) 심한호흡억제상태 환자 4) 두부손상, 뇌의 병변이 있는 경우로 의식혼탁의 위험이 있는 환자 5) MAO억제제를 투여 받고 있는 환자 또는 최근 14일 이내에 투약한 경험이 있는 환자 6) 소화성궤양, 심한 혈액이상 환자 7) 심한 간장애, 심한 신장애, 심한 심기능부전 환자 8) 수유부 9) 12세 미만의 소아 10) 편도절제술 및/또는 아데노이드절제술을 받은 18세 미만 소아에서 수술 후 관리 11) 아스피린 천식 또는 그 병력이 있는 환자 12) 모니터링 장비 또는 심폐소생장비가 구비되지 않은 곳에서의 급성 및 중증 기관지 천식 환자 13) 약물로 조절되지 않는 뇌전증 환자 [신중투여] 1) 모르핀 병용 또는 반복투여 환자 2) 마약성 진통제, 마취제, 최면제, 페노치아진, 신경안정제, 진정제 등과 같은 중추신경계 억제제 복용 환자 3) 담도질환 환자 4) 간장애 환자 5) 신장애 환자 6) 음주 환자 7) 마약성 진통제에 과민증 환자 8) 뇌전증 환자 또는 발작 발생가능성이 있는 환자 9) 속상태, 원인모를 이유로 인한 의식 변화상태 환자 **[저장방법]** 울트라셋®정, 울트라셋®세미정: 밀폐용기, 실온(1-30℃)에 보관, 울트라셋® 이알서방정, 울트라셋® 이알세미서방정: 기밀용기, 실온(1-30℃)에 보관 [제조수입자] 한국얀센, **[판매자]** SK케미칼 **※ 상세 정보는 한국얀센 홈페이지의 허가사항 전문을 참고하여 주시기 바랍니다.**

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리리카® 프레가발린

오직 환자를 위한 오리지널 프레가발린, 리리카

OrigiNal LYRICA의 가치

ONLY*

신경병증성 통증 치료제 국내 처방량 부분 판매 1위[1]
(UBIST D1 Sales 2022년 2월부터 2024년 1월까지 기준)

투여 1주차 부터 나타난 위약 대비 유의한 통증감소 효과[2]
(리리카를 투여 받은 당뇨병성 말초신경병증성 통증 환자 기준)

다양한 국내/외 가이드라인†에서
신경병증성 통증 1차 치료제 중 하나로 권고된 리리카[3-12]

안전성 프로파일 확인[13]

* **ONLY**는 Original Lyrica의 약어입니다. ※ 단, 리리카® CR 서방정의 경우 말초 신경병증성 통증의 치료에 한합니다.[14]

† **Abbreviations: AAN**, American Academy of Neurology; **ADA**, American Diabetes Association; **CPS**, Canadian Pain Society; **EFNS**, European Federation of Neurological Societies; **ESMO**, European Society for Medical Oncology; **IASP**, International Association for the Study of Pain; **JSPC**, Japan Society of Pain Clinicians; **KSSS**, Korean Society of Spine Surgery; **NICE**, National Institute for Health and Care Excellence; **KDA**, Korean Diabetes Association.

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[수입자/판매자] 비아트리스 코리아㈜
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Tel: 02-6411-6200 Fax: 02-6411-6201 제품 의학정보 문의 Tel: 02-6411-6200
E-mail: Viatris-Korea-MI@viatris.com Website: www.viatris.co.kr

[판매자] SK 케미칼
[13494] 경기도 성남시 분당구 판교로310 (삼평동)
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QR코드를 스캔해주세요!

KR-LYR-2025-00033~2Feb2028

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Bioactive Collagen Hemostat

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다림티센의 독자적인 트롬빈 안정화 기술로 트롬빈 용액을 준비하는 과정 없이 주사기를 결합하여 혼합하는 최소한의 조작만으로 사용 준비가 가능합니다.

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Flowable한 제품으로 불규칙한 표면이나 접근이 어려운 부위에 적용이 가능합니다.

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사용기한: 제조일로부터 2년
저장방법: 1°C - 25°C
용량: 3ml / 6ml

dalim (주)다림양행

판매원: (주)다림양행
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Eperisone 75mg + Aceclofenac 100mg

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cf. UBIST data 2022년 처방조제액 기준

치료제의 명가 – 명문제약(주)

DRUG INFORMATION

【제품명】 에페신에이스정 **【보험코드】** 649808060 **【보험약가】** 378원/정 **【성분 • 함량】** 1정 중, 에페리손염산염 75mg, 아세클로페낙 100mg **【성상】** 흰색 내지 거의 흰색의 원형 서방성 필름코팅정 **【효능 • 효과】** 근골격계 근육 연축 증상을 동반한 급성 요통 환자의 통증 완화 **【용법 • 용량】** ○ 성인 : 1일 2회, 1회 1정 식후 경구 투여한다. 이 약은 분쇄하거나 분할 또는 씹지 않고 전체를 복용한다. 이상반응을 최소화하기 위하여 최단 기간 동안 투여해야 한다. ○ 간장애 환자 : 투여용량 감량이 필요한 간장애 환자 초기 치료 시, 이 약의 투여가 권장되지 않는다. ○ 고령자 : 고령자 중 투여용량의 감량이 필요한 경우에는, 이 약의 투여가 권장되지 않는다. **【저장방법】** 기밀용기, 실온보관(1~30℃) **【사용기간】** 제조일로부터 36개월 **【포장단위】** 30정/병, 100정/병

* 자세한 사항은 제품설명서를 참조하세요.

Baxter

Floseal

HEMOSTATIC MATRIX

OPERATION HERO

FAST & EASY TO USE[1,2]

KO-AS19-210002

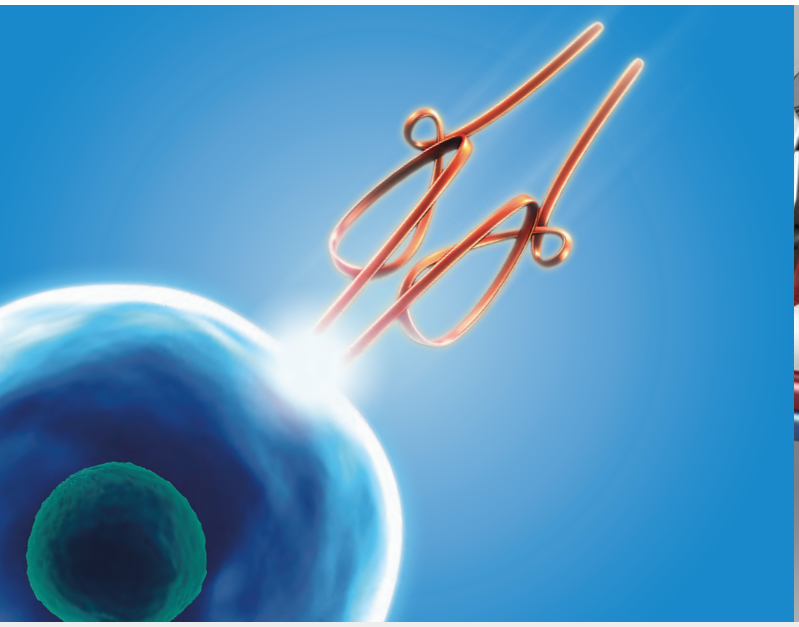
1. Floseal hemostatic matrix 국내 제품 설명서(식품의약품안전처 (https://nedrug.mfds.go.kr) 의약품등 제품정보보장 참조)
2. Tackett, Scott M., et al. "Real-world outcomes of hemostatic matrices in cardiac surgery." Journal of cardiothoracic and vascular anesthesia 28.6 (2014): 1558-1565.

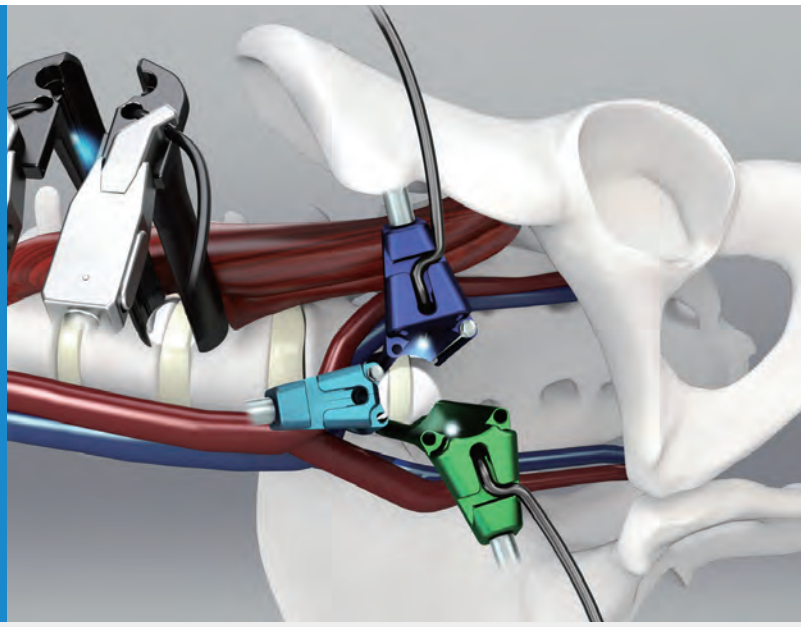
Medtronic

Infuse™ Bone Graft

Trusted.
Proven.
Predictable.

The Premium Product for Autograft Replacement with high osteoinductivity demonstrated safety and effectiveness in multiple clinical trials.





MFDS Official Indication (수허21-274호):

Single Level OLIF
(Oblique Lateral Interbody Fusion)
- Clydesdale™ Spinal System
- Pivox™ Oblique Lateral Spinal System

Single Level ALIF
(Anterior Lumbar Interbody Fusion)
- Perimeter™ Interbody Fusion Device
- Divergence-L™ Interbody Fusion Device

AD-MARCOMM-20220519-01

국내 최초의 Pregabalin 25mg, 50mg[1]

Drug Information[2]

성분 · 함량
Pregabalin 25mg, 50mg, 75mg, 150mg, 300mg

효능 • 효과

1. 성인에서 말초와 중추 신경병증성 통증의 치료
2. 간질 : 성인에서 이차적 전신증상을 동반하거나 동반하지 않은 부분 발작의 보조제
3. 섬유근육통의 치료

용법 • 용량
이 약은 프레가발린으로서 1일 총 투여용량을 1일 2회로 나누어 음식물과 상관없이 경구 투여한다. 이 약은 주로 신장으로 배설되므로, 신기능이 저하된 환자에 대해서는 용량이 조절되어야 한다. 1. 신경병증성 통증 1) 말초 신경병증성 통증(성인): 이 약은 시작용량으로 1일 150mg을 투여할 수 있다. 개개 환자에서의 반응과 내약성에 근거하여 3일 내지 7일 후에 1일 300mg까지 증량할 수 있다. 필요하다면, 이후 7일 간격으로 1일 최대 600 mg까지 증량할 수 있다. 2) 중추 신경병증성 통증(성인): 이 약은 시작용량으로 1일 150mg을 투여할 수 있다. 개개 환자에서의 반응과 내약성에 근거하여 1주일 후에 1일 300mg까지 증량할 수 있다. 추가로 1주일 후에 목표 1일 용량인 600mg까지 증량할 수 있다. 목표 1일 용량에서 내약성을 나타내지 않을 경우 용량 감소가 고려될 수 있다. 2. 간질(성인): 이 약은 시작용량으로 1일 150mg을 투여할 수 있다. 개개 환자에서의 반응과 내약성에 근거하여 일주일 후에 1일 300mg까지 증량할 수 있다. 필요하다면, 이 후 7일 간격으로 1일 최대 600mg까지 증량할 수 있다. 3. 섬유근육통: 이 약의 권장 용량은 1일 300mg~450mg 이다. 이 약은 시작 용량으로 75mg씩 1일 2회(1일 150mg)를 투여하며, 유효성과 내약성에 근거하여 1주일 이내에 150mg씩 1일 2회(1일 300mg) 까지 증량할 수 있다. 1일 300mg의 용량에서 충분한 유익성을 경험하지 못한 환자의 경우에는 1주일 이내에 225mg씩 1일 2회(1일 450mg) 까지 증량할 수 있다. 1일 600mg의 용량에서도 임상 연구가 실시되었으나, 이 용량에서의 부가적인 유익성이나 충분한 내약성에 대한 증거는 없다. 용량 의존적인 이상반응을 고려하면, 1일 450mg을 초과하는 용량 투여는 권장되지 않는다.

사용상의 주의사항
1. 경고 1) 자살충동과 자살행동 (1) 항간질약을 복용한 환자에서 자살충동 또는 자살행동을 보이는 위험성이 증가되므로 항간질약을 치료받은 환자는 자살충동 또는 자살행동, 우울증의 발현 또는 악화 및 기분과 행동의 비정상적 변화에 대하여 모니터링되어야 한다.(2) 항간질약을 처방받는 간질과 다른 많은 질병은 그 자체가 이환 및 사망, 치료기간 동안의 자살충동과 자살행동의 위험성증가와 관련된다. 따라서 처방자는 항간질약 처방시 환자의 치료기간 동안 자살충동 또는 자살행동과 치료될 질병간의 연관성 유무 및 이 약의유효성을 함께 고려한다. 2. 다음 환자에는 투여하지 말 것 1) 프레가발린 또는 이 약의 성분에 과민한 환자 2) 이 약은 유당을 함유하고 있으므로, 갈락토오스 불내성 (galactose intolerance), Lapp 유당분해효소 결핍증 (Lapp lactase deficiency) 또는 포도당-갈락토오스 흡수장애 (glucose-galactose malabsorption) 등의 유전적인 문제가 있는 환자에게는 투여하면 안 된다.

* 기타 자세한 사항은 제품설명서를 참고하십시오.

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에이치케이이노엔 주식회사
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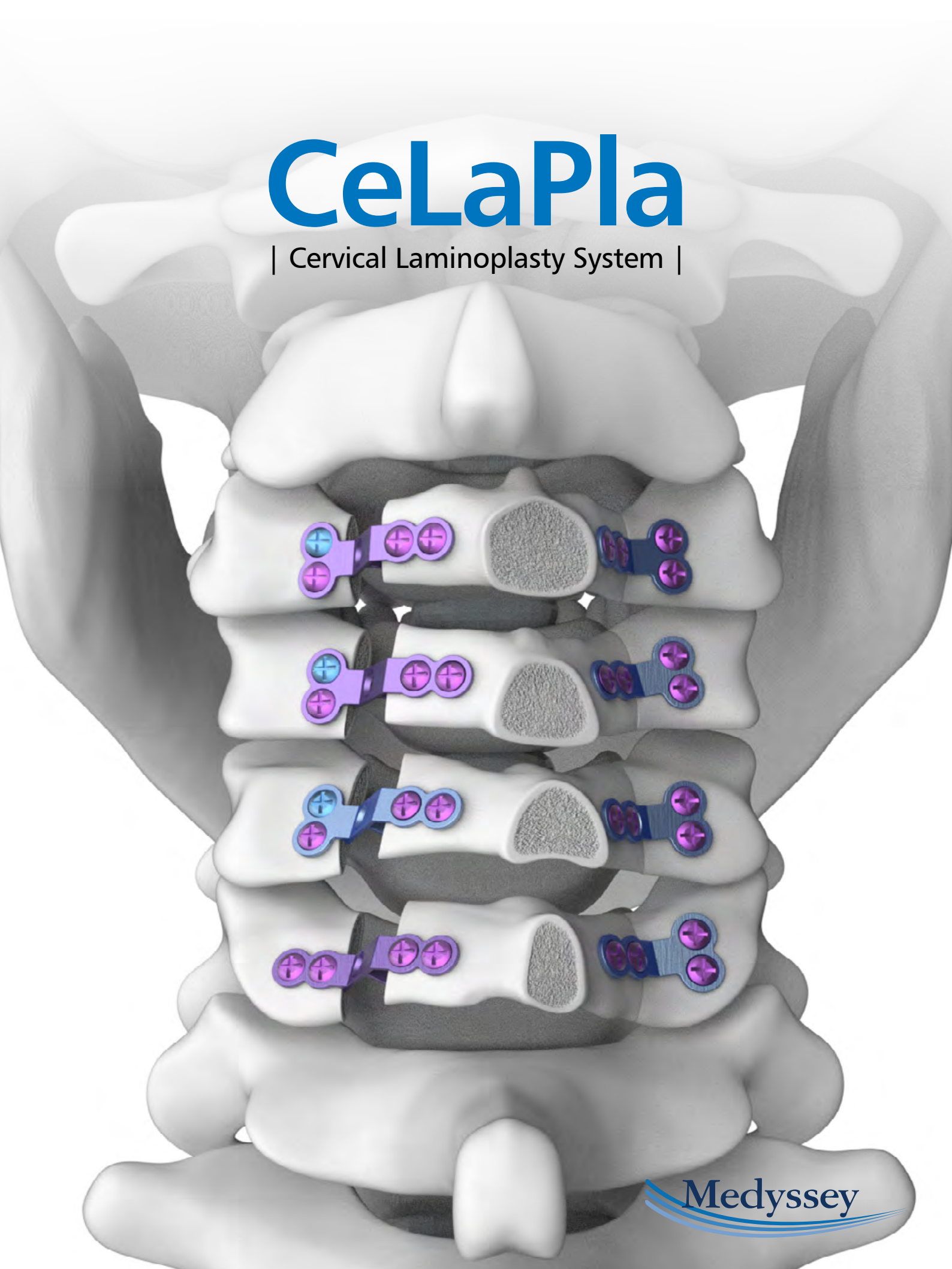
서울 지사: 서울특별시 중구 을지로 100 파인에비뉴 6, 7, 8층
http://www.inno-n.com | Tel. 080-700-8802

230607 KAB-BOLF23-40-01

Reference 1. 「약제 급여 목록 및 급여 상한금액표」보건복지부 고시 제 2017-133호 (2017년 8월 15일 시행) **2.** 카발린캡슐 허가사항

CeLaPla

| Cervical Laminoplasty System |



Medyssey

Powerful hemostasis with cross linked Hyaluronic acid

헤모펜스 헤모스태틱

팽창률 28%

세계 최초 **가교히알루론산**
매트릭스 지혈제

팽창률 28% 가교히알루론산 매트릭스

- **최대 28% 팽창하며 혈액 내 수분을 신속하게 흡수**[1)]
  : 가교히알루론산 겔 팽윤도 300% - 1,500%[2), 3), 4)]
- **가교화 히알루론산 유도체 매트릭스가 포함된 지혈 조성물 특허**[1), 2), 3), 4)]

5000 IU 고함량 트롬빈

- **젤라틴 매트릭스 지혈제 대비 2배 트롬빈 용량 함유**[5)]
- **지혈 성공률 :** 헤모펜스 97%, 젤라틴 매트릭스 96%[6)]
- **지혈 성공시간 :** 헤모펜스 114.0초 vs 젤라틴 매트릭스 122.3초[7)]

Ref. 1) MFDS 허가 신청 자료, 2) 대한민국 공개특허 10-2018-0027126, 3) 미국/일본/러시아 특허 등록 정보, 4) In-house test, 5) 헤모펜스 헤모스태틱, 플로실 헤모스태틱 매트릭스 MFDS 허가, 6) 헤모펜스 허가용 임상 심험자 평가 지혈성공률, 7) 헤모펜스 허가용 임상 단회투여 첫번째 출혈부위 지혈시간

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BMP-2, A NEW DIRECTION

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Release Slowly, Grow Perfectly

NOVOSIS is specifically designed to optimize the therapeutic efficacy and safety offering greater bone forming activity with more sustained and controlled-release of rhBMP-2(recombinant human bone morphogenetic protein-2) and specially designed Hydroxyapatite carrier(SLOREL™).

CGBIO CELL & GROWTH FACTOR BIOTECHNOLOGY

보건의료전문가용

골다공증 치료의 연속성을 위한 순차 치료는 대웅졸레드론산주사액 이 이어받겠습니다.

1년 1회 투여로 남녀 골다공증 치료
2년 1회 투여로 폐경 후 여성 골다공증 예방

대웅제약 대웅졸레드론산 주사액
Zoledronic acid 5mg / 100mL

Ref.> 1. 대웅졸레드론산주사액 5mg/100mL 제품설명서_식약처 허가사항.
2. Anastasilakis AD, et al. *Calcif Tissue Int.* 2024;113(4):469-473.

ZDLJ241016.M
2024-269

Hanmi Pharm. Co., Ltd.

The World's First Combination of SERM+Vitamin D

Rabone D Cap.

(Raloxifene / Cholecalciferol)

Treatment and Prevention of Osteoporosis in Postmenopausal Women

- Long-term prescription without drug holiday by taking 1capsule orally once daily[1)]
- Decrease the risk of vertebral fractures in patients with postmenopausal osteoporosis, due to its ability of slowing the accelerated bone turnover to premenopausal ranges[2)]
- Vitamin D can be taken at the price of Raloxifene as a single drug

[Indications and Usage] Treatment and prevention of osteoporosis in postmenopausal women **[Dosage and Administration]** 1 capsule orally once daily
※Refer to the attached document for detailed us
The cited data are not the result of direct administration of Hanmi Pharmaceutical products.
SERM : selective estrogen receptor modulator.

Reference. 1) Korean Society for Bone and Mineral Research. Physician's Guide for Osteoporosis 2022. 2) Rey JR, Cervino EV, Rentero ML, et al. Raloxifene: mechanism of action, effects on bone tissue, and applicability in clinical traumatology practice. *Open Orthop J.* 2009:3:14-21.

RAB-H-2405-02 HM:Design 2405_01

Daiichi-Sankyo

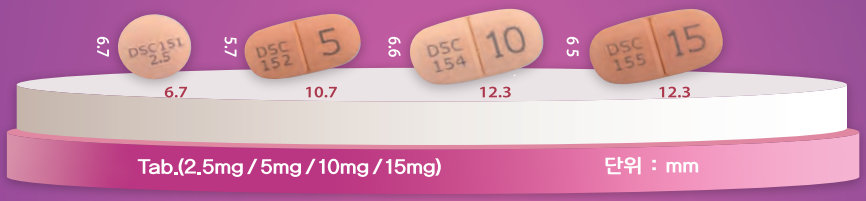
Taleaje® mirogabalin

보건의료전문가용

탈리제®정

Mirogabalin, your choice for Balanced Efficacy & Safety Profile[1-3]

START SMART, TITRATE with CONFIDENCE



제품정보는 QR코드를 통해 확인하세요!

P25-018-2027.01-V1

Study design | 1. This study evaluated the efficacy and safety of mirogabalin, a novel, potent, selective ligand the α2δ subunit of voltage-dependent Ca2+ channels, for the treatment of diabetic peripheral neuropathic pain(DPNP). During this double-blind, multisite, placebo-controlled phase III study, Asian patients aged ≥20 years with type 1 or 2 diabetes and DPNP were randomized 2:1:1:1 to a placebo, mirogabalin 15, 20 or 30mg/day for up to 14 weeks, with a 1-to 2-week titration. The primary endpoint was the change from baseline in average daily pain score(ADPS) at week, defined as a weekly average of daily pain. 2. This study investigated the safety and efficacy of mirogabalin, a novel, potent, selective ligand of the α2δ subunit of voltage-dependent Ca channels, for the treatment of postherpetic neuralgia (PHN). In this multicenter, double-blind, placebo-controlled phase 3 study, Asian patients ≥20 years with PHN were randomized 2:1:1:1 to a placebo, mirogabalin 15, 20 or 30mg/day for up to 14 weeks. The primary efficacy endpoint was the change from baseline in average daily pain score at week 14, defined as a weekly average of daily pain. 3. This randomized, double-blind, multisite, placebo-controlled, phase 3 study investigated mirogabalin efficacy and safety for the treatment of central neuropathic pain in patients with traumatic spinal cord injury. Adult patients were randomized (1:1) to receive placebo or mirogabalin. The primary efficacy endpoint was change from baseline in the weekly average daily pain score (ADPS) at week 14.

Reference | 1. Baba, Masayuki et al. “Mirogabalin for the treatment of diabetic peripheral neuropathic pain: A randomized, double-blind, placebo-controlled phase III study in Asian patients.” Journal of diabetes investigation vol. 10,5 (2019) 2. Kato, Jitsu, et al. "Mirogabalin for the management of postherpetic neuralgia: a randomized, double-blind, placebo-controlled phase 3 study in Asian patients." Pain 160.5 (2019): 1175-1185. 3. Ushida, Takahiro, et al. "Mirogabalin for central neuropathic pain after spinal cord injury: a randomized, double-blind, placebo-controlled, phase 3 study in Asia." Neurology 100.11 (2023): e1193-e1206. 4. 탈리제® 허가사항 5. "탈리제 정제 이미지." 약학정보원

수입판매원 | 한국다이이찌산쿄주식회사 서울특별시 을지로5길 26, 15층(수하동, 센터원빌딩 동관) Tel. 02-3453-3300

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PMO, postmenopausal osteoporosis.

References 1. Camacho PM, et al. *Endocr Pract.* 2020;26(Suppl 1):1-46. 2. Shoback D, et al. *J Clin Endocrinol Metab.* 2020;105(3):587-594. 3. Eastell R, et al. *J Clin Endocrinol Metab.* 2019;104(5):1595-1622. 4. 식품의약품안전처 의약품통합정보시스템. 의약품제품정보 상세보기_이베니티주프리필드시린지(로모소주맙, 유전자재조합) Accessed on 2023-01-09. 5. Food and Drug Administration. Teriparatide prescribing information. 6. Food and Drug Administration. Abaloparatide prescribing information. 7. Langdahl BL, et al. *Lancet.* 2017;390:1585-1594.

Product Information

처방하시기 전 QR 코드 또는 식품의약품안전처 의약품통합정보시스템(https://nedrug.mfds.go.kr)을 통해 상세 제품정보를 참조하시기 바랍니다.

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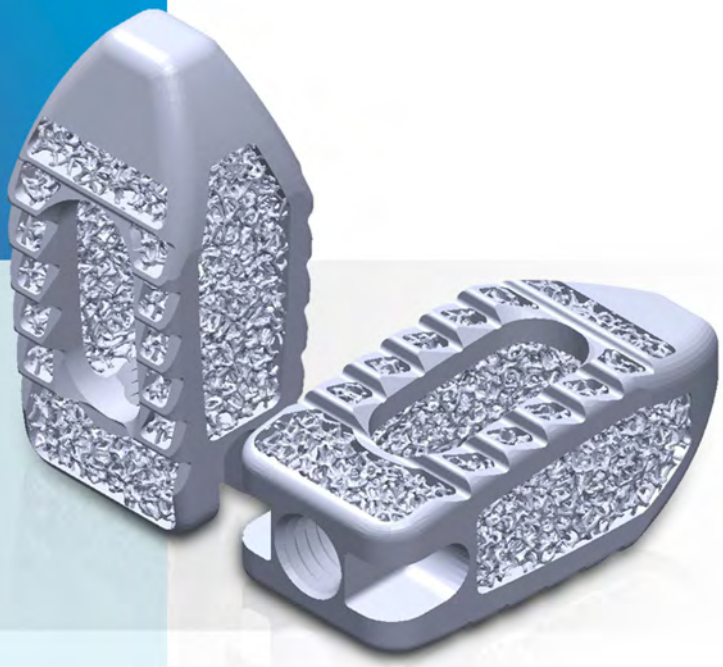

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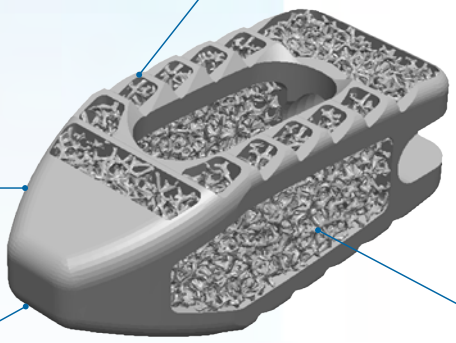

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주 1회, 식사와 관계없이 복용가능[1] Bisphosphonate

악토넬EC정 35mg

(Risedronate Sodium)

장용성 제형 & Chelating agent로

복용 Compliance ↑

음식물과 상호작용 ↓[2]

	악토넬® EC정 35mg[3]	악토넬® 정 35mg[4]	악토넬® 정 150mg[5]
성분·함량	리세드론산나트륨 35mg	리세드론산나트륨 35mg	리세드론산나트륨 150mg
효능·효과	폐경 후 여성의 골다공증 치료	1. 폐경 후 여성의 골다공증 치료와 예방 2. 남성의 골다공증 치료	폐경 후 여성의 골다공증 치료와 예방
용법·용량	**주 1회 식사와 관계없이 경구투여**	주 1회 경구투여 (아침식사 최소 30분 전에 복용하거나 또는 하루 중에 어떤 때라도 음식물이나 음료수의 섭취 전후로 최소 2시간 떨어져서 복용한다)	월 1회 경구투여 (충분한 흡수를 위해 하루 중 처음으로 음식물 또는 물 이외의 음료수를 섭취하기 최소 30분 전에 복용한다)
제품코드	644503330	644503310	644503320

ATT-23L018

Reference

1. 악토넬EC정 허가사항 (23.06월 기준, 의약품안전나라 의약품 정보- 용법용량(성인) : 리세드론산나트륨으로서 1회 35 mg을 주 1회 식사와 관계없이 아침에 경구 투여한다.) **2.** McClung MR et al. Efficacy and safety of a novel delayed-release risedronate 35 mg once-a-week tablet. Osteoporos Int. 2012 Jan;23(1):267-76. **3.**악토넬EC정 35mg 허가사항 (23년 11월 기준) **4.** 악토넬정 35mg 허가사항 (23년 11월 기준) **5.** 악토넬정 150mg 허가사항 (23년 11월 기준)

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- Release levers and buttons are readily accessible
- Blue user touch points are easy to identify

Precision

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The need for reliable, yet low impact retraction has been addressed through the continued innovation of retractor blade designs.

Phantom CS Retractor Blades have been specifically engineered for the retraction of critical anatomical structures as individual as every patient. Short tooth blades, designed for use with a transverse retractor, retract the carotid sheath laterally whereas long tooth blades, retract the esophagus, *longus colli* muscle, and trachea medially. Blunt blades are engineered to retract soft tissue longitudinally.

Phantom CS blades are available in both aluminum and titanium materials. Aluminum blades are fully radiolucent for surgeons that require maximum visualization under fluoroscopy, while titanium blades are semi-radiolucenct under fluoroscopy, yet provide a stronger retraction capability.

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의학적 근거와 특허 받은 기술력으로 오래 잘수록 목이 건강해지는 경추베개

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특히 본제품은 환자의 목상태에 따라서, pillow의 위치를 **머리아래 < 목아래 < 견갑골아래** 부분으로 위치를 이동해 가면서 상부 흉추를 압박하여 경추의 전만 각도를 높이고 **이상적인 척추의 정렬**에 도움을 주는 효과를 얻을 수 있어 환자의 목상태에 따라서 다양한 사용법이 가능함.

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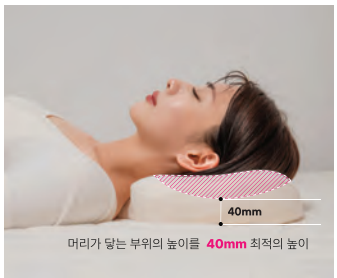

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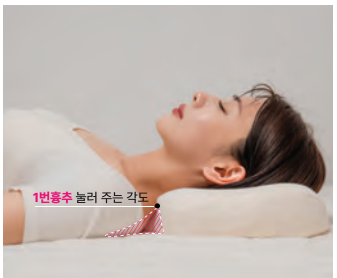

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- 장기투여 효과 확인 [1,2, ii]
- 안전성 프로파일 확인 [1,2]

제품요약정보[3]

전문의약품

【제품명】 조인스정200mg **【원료약품 및 그 분량】** 이 약 1정 중 조인스정 유효성분: 위령선·괄루근·하고초30%에탄올건조엑스(40→1)(별규) …200mg **【효능·효과】** 골관절증(퇴행관절질환), 류마티스관절염의 증상 완화 **【용법·용량】** 성인 : 1회 1정을 1일 3회 경구투여한다. 증상에 따라 적절히 증감한다. **【사용상의 주의사항】** 1. 다음 환자에는 신중히 투여할 것. 1) 감염상태 또는 감염의 원인이 있는 환자(감염에 대한 자체 저항력이 감소될 가능성이 있음을 고려해야 하며, 이런 경우에는 감염의 진행을 억제하는 처치를 취해야 한다.) 2) 임부 또는 임신하고 있을 가능성이 있는 여성 및 수유부 (후략) **【제조자】** 에스케이케미칼(주) 충청북도 청주시 흥덕구 산단로 149 **【판매자】** 에스케이케미칼㈜ 경기도 성남시 분당구 판교로 310

2011. 3. 21. 개정

※처방하시기 전 제품설명서 전문을 참고하십시오. 최신 허가사항에 대한 정보는 '식품의약품 안전처 의약품안전나라 (https://nedrug.mfds.go.kr/index)'에서 확인할 수 있습니다.

References 1. Joong Il Kim et al, Efficacy of JOINS on Cartilage Protection in Knee Osteoarthritis: Prospective Randomized Controlled Trial, knee surg relat res, 2017 sep 1;29(3):217–224, **2.** 조인스정 의약품 재심사 보고서 (2001.7.10~2005.7.9), Data on file SK 케미칼, [Updated 2005.10.07] **3.** 조인스정 허가정보, 의약품안전나라 [Cited 2023.01.20] Available from: https://nedrug.mfds.go.kr/

i) [조인스정의 4상 임상연구] 1년(시험 연장 참여 동의자의 경우 2년)의 RCT 연구에서 무릎 골관절염 환자 76명을 대상으로 MRI를 이용하여 조인스정과 위약의 연골보호효과를 비교하였음.
ii) 조인스정의 4상 임상 결과 상 2년 장기투여 대상자를, 4년간의 시판후 조사결과 상 6개월 이상 장기투여(184명, 전체의 3.09%) 대상자 포함하였음.

JNS-HA11-202301-01

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References
1. Finnerup NB, et al. Pharmacotherapy for neuropathic pain in adults: a systematic review and meta-analysis. Lancet Neurol. 2015 Feb;14(2); 162-73.
2. 뉴론틴®정 제품설명서 개정년월일2024.05.13 **3.** 뉴론틴®캡슐 제품 설명서 개정년월일 2024.09.21

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Yellow layer

- 트롬빈 함유
- 보조적인 지혈효과
- 레보도파 함유
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DRUG INFORMATION

명문아트로다캡슐 50mg **보험코드 :** 649801240 **보험약가 :** 212원/C **성분 • 함량 :** Diacerein 50mg **성상 :** 황갈색의 내용물이 들어있는 상부 – 황색, 하부 – 연황색의 경질 캡슐제
효능 • 효과 : 골(고관절, 슬관절)관절염 (관절증, 퇴행성 관절질환) **용법 • 용량** 디아세레인으로서 1일 50~100mg을 1~2회 분할하여 식후 경구투여 한다. 증상에 따라 적절히 증감한다.
명문아트로다캡슐 25mg **보험코드 :** 649801230 **보험약가 :** 124원/C **성분 • 함량 :** Diacerein 25mg **성상 :** 황갈색의 내용물이 들어있는 상부 – 주황색, 하부 – 흰색의 경질 캡슐제
효능 • 효과 : 골(고관절, 슬관절)관절염 (관절증, 퇴행성 관절질환) **용법 • 용량** 디아세레인으로서 1일 50~100mg을 1~2회 분할하여 식후 경구투여 한다. 증상에 따라 적절히 증감한다.

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- 생화학적 작용이 아닌, 물리적인 보호막 제공합니다.[1]
- 24-48시간 이내에 용해됨.[2]

- 마른 무균 장갑을 끼고 손가락으로 부드러운 상태가 되도록 성형해 줍니다.[1]
- Ostene은 왁스(wax)보다는 껌(gum)또는 퍼티(putty)와 같이 다룰 수 있습니다.[1]
- 활동 혹은 잠복 감염 부위에는 사용하지 않습니다.[1]
- 뼈의 구조적 지지를 위해 사용하지 않습니다.[1]

Reference

1. 흡수성체내용지혈용품 Ostene Bone Hemostasis Material 제품설명서
2. Wellisz T, Armstrong JK, Cambridge J, Fisher TC. Ostene, A New Water-Soluble Bone Hemostasis Agent. J Craniofac Surg. 2006;17:420-25.
3. 흡수성 뼈 지혈제 급여기준 보건복지부, 고시 제2017-152호, 2017.9.1. 시행

흡수성체내용지혈용품 [Ostene Bone Hemostasis Material] [사용목적] 수술 시 뼈의 출혈을 지혈하기 위하여 사용한다. 본 제품은 물리적 보호막을 제공함으로써 수술 시 뼈의 표면으로부터의 출혈을 조절하기 위해 국소적 지혈작용을 한다. 이 작용은 생화학적 사용이 아니다. **[사용시 주의사항]** 1. 본제품은 일회용이므로 재사용 또는 재멸균하지 않는다. 2. 포장이 손상되어 멸균 손실이 있는 제품은 폐기한다. 3. 개봉한 제품은 사용하지 않았더라도 폐기한다. 포장용기의 밀봉이 깨지면 제품 오염의 위험 때문에 재사용할 수 없다. 4. 본 제품은 햇빛을 포함, 직사광선을 피하여 실온에 보관한다. 5. 활동 혹은 잠복 감염 부위에는 사용하지 않는다. 6. 뼈의 구조적 지지를 위해 사용하지 않는다. **[흡수성 뼈 지혈 급여기준]**[3] 1. 수용성 합성물질로 만들어진 뼈 지혈제는 BONE WAX에 비해 뼈 생성 및 골 융합 용이성, 뼈 감염을 방지하는 점 등을 감안하여 별도 산정하되, 만65세 이상의 흉골절개를 시행하는 심장수술에 한하여 사용량을 5g까지 인정함. 2. 상기 1항의 급여대상이외 다음의 경우에 사용하는 치료재료비용은「선별급여 지정 및 실시 등에 관한 기준」에 따라 본인부담률을 80%로 적용함.

- 다 음 -

가. 상기 1항의 만65세 이상의 흉골절개를 시행하는 심장수술에서 인정용량을 초과하여 사용한 경우 나. 만65세 미만의 흉골 절개를 시행하는 심장수술 다. 출혈이 많은 수술인 골반골절수술 라. 비구골절수술 마. 장관골의 관혈적정복술 바. 척추수술 사. 인공관절 삽입술

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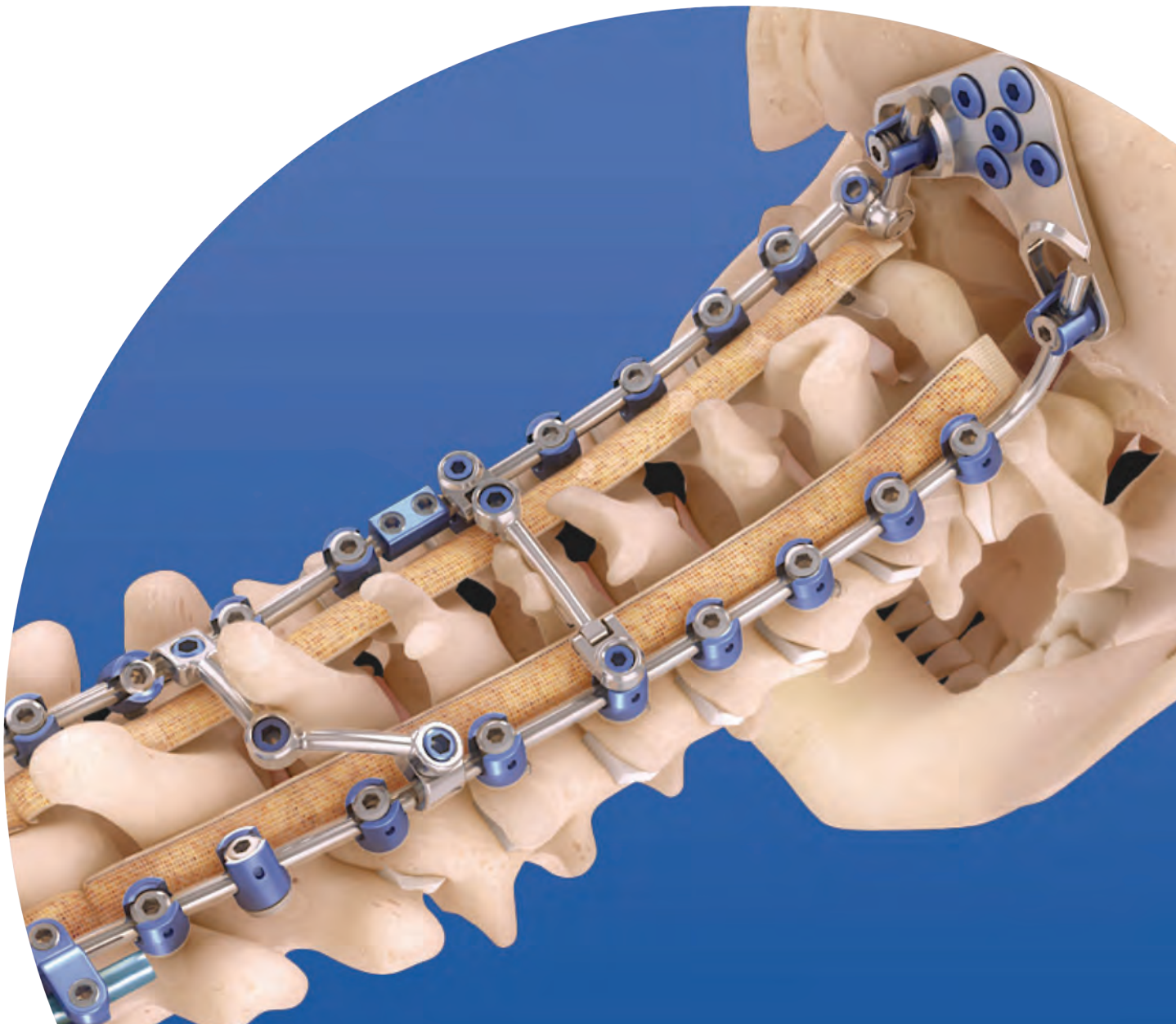

국내 최초의 Pregabalin 25mg, 50mg[1]

Drug Information[2]

성분 · 함량

Pregabalin 25mg, 50mg, 75mg, 150mg, 300mg

효능 • 효과

1. 성인에서 말초와 중추 신경병증성 통증의 치료
2. 간질 : 성인에서 이차적 전신증상을 동반하거나 동반하지 않은 부분 발작의 보조제
3. 섬유근육통의 치료

용법 • 용량

이 약은 프레가발린으로서 1일 총 투여용량을 1일 2회로 나누어 음식물과 상관없이 경구 투여한다. 이 약은 주로 신장으로 배설되므로, 신기능이 저하된 환자에 대해서는 용량이 조절되어야 한다. 1. 신경병증성 통증 1) 말초 신경병증성 통증(성인): 이 약은 시작용량으로 1일 150mg을 투여할 수 있다. 개개 환자에서의 반응과 내약성에 근거하여 3일 내지 7일 후에 1일 300mg까지 증량할 수 있다. 필요하다면, 이후 7일 간격으로 1일 최대 600 mg까지 증량할 수 있다. 2) 중추 신경병증성 통증(성인): 이 약은 시작용량으로 1일 150mg을 투여할 수 있다. 개개 환자에서의 반응과 내약성에 근거하여 1주일 후에 1일 300mg까지 증량할 수 있다. 추가로 1주일 후에 목표 1일 용량인 600mg까지 증량할 수 있다. 목표 1일 용량에서 내약성을 나타내지 않을 경우 용량 감소가 고려될 수 있다. 2. 간질(성인): 이 약은 시작용량으로 1일 150mg을 투여할 수 있다. 개개 환자에서의 반응과 내약성에 근거하여 일주일 후에 1일 300mg까지 증량할 수 있다. 필요하다면, 이 후 7일 간격으로 1일 최대 600mg까지 증량할 수 있다. 3. 섬유근육통: 이 약의 권장 용량은 1일 300mg~450mg 이다. 이 약은 시작 용량으로 75mg씩 1일 2회(1일 150mg)를 투여하며, 유효성과 내약성에 근거하여 1주일 이내에 150mg씩 1일 2회(1일 300mg) 까지 증량할 수 있다. 1일 300mg의 용량에서 충분한 유익성을 경험하지 못한 환자의 경우에는 1주일 이내에 225mg씩 1일 2회(1일 450mg) 까지 증량할 수 있다. 1일 600mg의 용량에서도 임상 연구가 실시되었으나, 이 용량에서의 부가적인 유익성이나 충분한 내약성에 대한 증거는 없다. 용량 의존적인 이상반응을 고려하면, 1일 450mg을 초과하는 용량 투여는 권장되지 않는다.

사용상의 주의사항

1. 경고 1) 자살충동과 자살행동 (1) 항간질약을 복용한 환자에서 자살충동 또는 자살행동을 보이는 위험성이 증가되므로 항간질약을 치료받은 환자는 자살충동 또는 자살행동, 우울증의 발현 또는 악화 및 기분과 행동의 비정상적 변화에 대하여 모니터링되어야 한다.(2) 항간질약을 처방받는 간질과 다른 많은 질병은 그 자체가 이환 및 사망, 치료기간 동안의 자살충동과 자살행동의 위험성증가와 관련된다. 따라서 처방자는 항간질약 처방시 환자의 치료기간 동안 자살충동 또는 자살행동과 치료될 질병간의 연관성 유무 및 이 약의유효성을 함께 고려한다. 2. 다음 환자에는 투여하지 말 것 1) 프레가발린 또는 이 약의 성분에 과민한 환자 2) 이 약은 유당을 함유하고 있으므로, 갈락토오스 불내성 (galactose intolerance), Lapp 유당분해효소 결핍증 (Lapp lactase deficiency) 또는 포도당-갈락토오스 흡수장애 (glucose-galactose malabsorption) 등의 유전적인 문제가 있는 환자에게는 투여하면 안 된다.

* 기타 자세한 사항은 제품설명서를 참고하십시오.

에이치케이이노엔 주식회사

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Reference 1. 「약제 급여 목록 및 급여 상한금액표」보건복지부 고시 제 2017-133호 (2017년 8월 15일 시행) **2.** 카발린캡슐 허가사항

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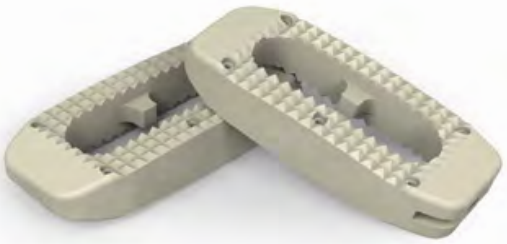

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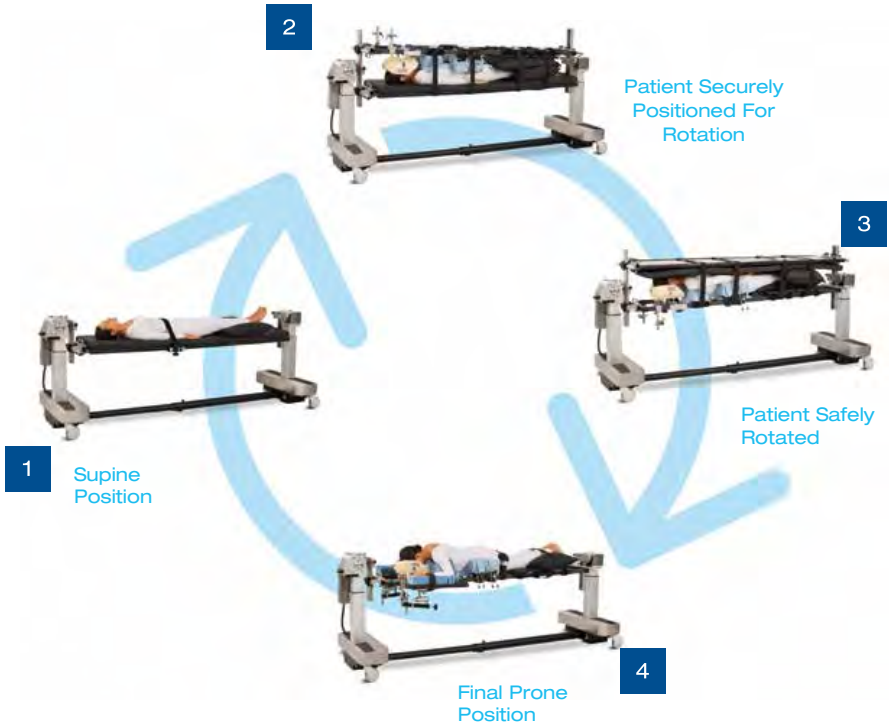

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