

A Review of the Implementation of a Physiotherapy-led Spine Triage Clinic of 200 Patients in a Tertiary Centre

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Introduction / Objectives Lower back pain and neck pain are common issues managed by physicians in both primary and tertiary care centres. The vast majority of cases are managed conservatively with analgesia and physiotherapy, with only a minority of patients requiring surgical intervention. With an increasing load on our healthcare system due to a rise in the elderly population, measures have been put in place to minimise the strain on the healthcare system. This review aims to evaluate the effectiveness of a physiotherapy-led spine triage clinic in our tertiary healthcare institution.

Materials and Methods Patients were selected by primary care physicians for a specialist spine review for clinically diagnosed lumbar or cervical degenerative conditions. All cases were screened through by at least one spine consultant. Specific exclusion criteria included red flags such as inflammatory, malignancy and infective causes of back pain as well as significant neurological deficits on clinical examination. These selected patients attended our physiotherapy-led triage clinic where they were once again screened for red flags, offered simple analgesia and a preliminary session of physiotherapy. Further follow-up plans were determined by a specific workflow and strict guidelines. Every patient case was discussed with a spine consultant to determine concordance rate. Patients were either given open-date appointments, offered further physiotherapy sessions or were offered a physician consult with or without an MRI scan prior. The outcomes from this review include the following: qualitative assessment of patient satisfaction, red-flags identified, follow-up plans, physiotherapy and physician concordance rate, changes in waiting times and cost savings to patients.

Results 200 patients were reviewed at our spinal triage clinic led by four physiotherapists. Patient satisfaction scores were recorded from 87 patients which averaged from 94% to 98%. 3 red flags were identified, 20 were open-dated, 100 were sent for further physiotherapy alone, 80 were offered a physician consult with 21 undergoing an MRI scan prior. All cases were discussed with a spine consultant and there was only one case of non-concordance. >60 day waiting time for primary care and emergency department referrals for the spine department reduced from 68.4% to 17.6% within four months and there was an estimated 48% reduction in consult fees to patients that were discharged after 3 sessions of physiotherapy.

Conclusion Our experience with a physiotherapist led spinal triage clinic has been overwhelmingly positive with high-cost savings, significantly reduced waiting times, high rates of patient satisfaction scores and high concordance rates between physiotherapist and physician. We strongly suggest for other institutions to consider running an allied-health run spinal triage clinic in view of our increasingly overburdened healthcare system seen worldwide.

Perception of Spinal Deformity Among Patients with Adolescent Idiopathic ScoliosisNg M.S.P.¹, Yap K.¹, Blok S.Z.¹, Liu G.², Wong H.K.², Lau L.L.²¹Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore;²Department of Orthopaedic Surgery, National University Hospital, Singapore, Singapore

Introduction Adolescent idiopathic scoliosis (AIS) is the most common form of structural spinal deformity, affecting 1% to 4% of children globally. Patients with AIS are generally pain-free, however, some might be able to perceive their skeletal deformity, thus affecting their self-image. Major Cobb angle, coronal balance and truncanal balance are radiological measurements used to evaluate AIS severity. The threshold of spinal deformity that alters patients' perception of their deformity is not known.

Objectives (1) To determine the correlation of the severity of scoliotic deformity using radiological measurements of major Cobb angle, coronal balance, truncanal balance and curve type with an established validated SRS-22r instrument consisting of an overall score and five domains of self-image, pain, function, mental health and satisfaction. (2) To evaluate other demographic factors such as curve type, gender and age affecting patient perception of scoliotic deformity.

Materials and methods A retrospective analysis of prospectively collected SRS-22r data from 357 consecutive patients between February 2020 and May 2021 was conducted. Inclusion criteria were (1) 11 to 20 years old, (2) no leg length discrepancy, (3) underwent scoliosis screening at our tertiary institution. Each patient completed their SRS-22r questionnaire online prospectively. Standing erect radiographs of the patients were obtained using an EOS Imaging System. Radiological measurements were obtained by one researcher and confirmed by an Orthopaedic spine surgeon.

Results / Discussion Major Cobb angle and truncanal balance had a significant but small negative correlation with SRS-22r. Coronal balance had no significant correlation with SRS-22r. Multiple regression showed that skeletal deformity (as measured by major Cobb angle and truncanal balance) significantly affected self-image but not pain for patients with a major Cobb angle of 51-60° ($R^2=0.265$, $p<.01$), 61-70° ($R^2=0.528$, $p<.01$), and above 70° ($R^2=0.277$, $p<.01$). Skeletal deformity also significantly affected the self-image of patients with a single curve ($R^2=0.117$, $p<.01$), patients who are female ($R^2=0.139$, $p<.01$), and patients who are 14 years old and above ($R^2=0.252$, $p<.01$).

Conclusion In our cohort, patients only started perceiving their scoliotic deformity when their major Cobb angle is above 50°. Patients who have a single curve were more likely to perceive their deformity than those with a double curve. Female patients and those who were 14 years old and above are more likely to perceive their deformity. Lastly, there was no clear relationship between pain and scoliosis.

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Effects of Socio Economic Indicators on Length of Stay Post Transforaminal Lumbar Interbody Fusion(TLIF) Procedures

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Introduction We present a study on effects of socioeconomic indicators on Length Of Stay(LOS) post Transforaminal Lumbar Interbody Fusion (TLIF). Socioeconomic (SES) factors indicated are studied in terms of room index at the individual level, based on the tiered housing system in Singapore. Socioeconomic Disadvantage Index1 (SEDI) and Socioeconomic Advantage Index1 (SAI) were used to compare SES at the neighbourhood level. Primary outcome of this study was LOS post TLIF.

Material and Methods 201 patients that underwent TLIF procedures from August 2015 to September 2021 in our institution were included into the study. Postal codes were cross referenced with national database to derive room index (Equation for room index: $\text{Sum total}[\text{number of rooms in a flat} \times \text{number of such flats per block}] / \text{total number of units in a block}$). SEDI and SAI indices were obtained from local studies. For individual analysis, patients were stratified based on room index (Room index less than 4 versus more than equal to 4). For neighbourhood analysis, patients were stratified based on less than/equal to versus more than median SEDI and SAI scores. These stratified populations were then propensity score matched at a 1:1 ratio based on risk factors for spinal fractures including comorbidities, previous spinal operations, obesity, BMI and malnutrition.

Results 92 (45.8%) of our total cohort were female patients and overall median LOS was 4 days (Interquartile range: [3.00, 6.00]). When Room index values were compared, no significant differences were noted in terms of LOS, intra-operative variables and post-operative complications. There were no significant differences noted in LOS when compared based on unmatched analysis of neighbourhood SES indices. Individuals from neighbourhoods with higher SAI scores had a numerical trend towards shorter LOS (4.00 [3.00, 7.50] vs 3.00 [2.00, 5.00], $p=0.102$). Similar non-significant findings with trends towards those with higher Disadvantage scores having longer LOS were noted (4.00 [3.00, 8.00] vs 3.00 [2.00, 5.50], $p=0.070$). Most notably, after matching this population based on SAI scores ($n=73:73$), there was a significant difference with those with higher SAI scores having shorter LOS (4.00 [3.00, 8.00] vs 3.00 [2.00, 5.00], $p=0.047$).

Improved Productivity using Deep Learning assisted Reporting for MRI Lumbar Spine

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Introduction Lumbar spine MRI studies are widely used for back pain assessment. Interpretation involves grading lumbar spinal stenosis, which is repetitive and time consuming. Deep learning (DL) could provide faster and more consistent interpretation. The aim of the study is to assess the speed and interobserver agreement of radiologists for reporting lumbar spinal stenosis with and without DL assistance.

Materials and Methods In this retrospective study, a DL model designed to assist radiologists in the interpretation of spinal canal, lateral recess, and neural foraminal stenoses on lumbar spine MRI scans was utilized. Randomly selected lumbar spine MRI studies obtained in patients with back pain who were 18 years and older over a 3-year period, from September 2015 to September 2018, were included in an internal test data set. Studies with instrumentation and scoliosis were excluded. Eight radiologists, each with 2–13 years of experience in spine MRI interpretation, reviewed studies with and without DL model assistance with a 1-month washout period. Time to diagnosis (seconds) and interobserver agreement (using Gwet k) were assessed for stenosis grading for each radiologist with and without the DL model and compared with an external musculoskeletal radiologist (with 32 years of experience) as the reference standard.

Results Overall, 444 images in 25 patients (mean age, 51 years 6 20 [SD]; 14 women) were evaluated in a test data set. DL-assisted radiologists had a reduced interpretation time per spine MRI study from a mean of 124–274 seconds (SD, 25–88 seconds) to 47–71 seconds (SD, 24–29 seconds) ($P, .001$). DL-assisted radiologists had either superior or equivalent interobserver agreement for all stenosis gradings compared with unassisted radiologists. DL-assisted general and in-training radiologists improved their interobserver agreement for four-class neural foraminal stenosis, with k values of 0.71 and 0.70 (with DL) versus 0.39 and 0.39 (without DL), respectively (both $P, .001$).

Conclusion Radiologists who were assisted by deep learning for interpretation of lumbar spinal stenosis on MRI scans showed a marked reduction in reporting time and superior or equivalent interobserver agreement for all stenosis gradings compared with radiologists who were unassisted by deep learning.

Outcomes and Complications of Surgery for Symptomatic Spinal Metastases; A Comparison between Patients Aged ≥ 70 and <70

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Introduction Advances in oncological treatment have resulted in increased life expectancies for cancer patients. This combined with an aging population has led to a consistent increase in elderly patients presenting with spinal metastases. Physicians may be deterred from operating on these patients due to fears of poorer outcomes and increased complications because elderly patients have more comorbidities which puts them at a greater risk than other age groups. This concern about increased mortality and morbidity in the elderly can potentially lead to suboptimal surgical treatment in elderly cancer patients. In this study, we aim to compare the outcomes of surgical treatment of spinal metastases in patients aged ≥ 70 -yrs and patients aged <70 -yrs.

Materials and Methods This is a retrospective study of patients who underwent surgical treatment for spinal metastases between January 2005 to December 2021. These patients were divided into two groups age <70 years and ≥ 70 years. Outcomes studied included post-operative neurological status, ambulatory status, medical and surgical complications and the need for readmission after surgery.

Results 383 patients met the criteria for inclusion of which 79 (20.6%) were ≥ 70 -yrs. Age ≥ 70 -yrs patients had significantly poorer ECOG score 3-4 ($p=0.0017$), CCI ($p<0.001$). There was no significant difference in modified Tokuhashi score and prognostic

subgroup between patients aged ≥ 70 -yrs and < 70 -yrs. There was no significant difference in the location of tumour operated, type of surgery, surgical approach, number of levels instrumented and decompressed between both groups. There was no significant difference in post-operative neurology, ambulatory status, and survival between both groups. Patients ≥ 70 -yrs were more likely to have medical complications (53.2% vs 50.8%) ($p=0.528$) and require readmission within 1-month post discharge (33.3% vs 29.6%) ($p=0.800$), although both were not statistically significant.

Conclusion ≥ 70 -yrs patients have comparable improvement in neurological status, ambulatory status and survival compared to younger patients. However, there is a significant complication and readmission rate. Age should not be a contraindication to surgery in spinal metastases and patients should be treated on an individual basis in a multidisciplinary setting.

FREE PAPER SESSION 1 – 18 March 2023, 13:00 to 13:50

Technical Note in Uniportal Endoscopy in Cauda Equina Syndrome Patients with Highly Compromised Spinal Canal KAVISHWAR R; WU PH, GEORGE R

Background Traditionally open wide laminectomy and discectomy has been advocated in treatment of cauda equina syndrome caused by lumbar disc herniation. Our aim was to evaluate technical feasibility of uniportal endoscopy in treatment of cauda equina syndrome.

Methods Nine patients with CES underwent uniportal decompression and discectomy from December 2020 to December 2022 and data was collected prospectively. This is a prospective cohort study with retrospective evaluation. Patients diagnosed with impending cauda equina syndrome and cauda equina syndrome were operated within 6 hours of presentation to hospital. Visual Analogue Score (VAS), Oswestery Disability Index (ODI) and Bladder/Bowel score were used to measure the outcome.

Results lysis showed VAS scores for leg pain and back pain significantly decreased from preoperative scores of 8.22 and 4.66 to postoperative (Day 1) scores of 0.66 and 2.55 which was stastically significant ($p < 0.05$). ODI scores improved from preoperative 26.11 to postoperative 7 (Day 1). Eight patients had early recovery (1 week) of bladder and bowel functions and one patient had delayed recovery (within one year). None of the patient had residual bowel/bladder deficit. Based on Macnab's criteria outcomes were excellent in all the patients at final follow-up.

Conclusion Uniportal endoscopy is effective method of treatment in cauda equina syndrome with some technical challenges. With early surgical endoscopic intervention cauda equina syndrome patients recover well in hands of experienced surgeon.

Thorough Comparative Analysis of Stand-alone Cage and Anterior Cervical Plate for Anterior Cervical Discectomy and Fusion (ACDF) in the Treatment of Cervical Degenerative Disease: A Systematic Review and Meta-analysis

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Introduction Although recognized as an effective procedure for Cervical Degenerative Disease (CDD), there has been a debate between the methods of Anterior Cervical Discectomy and Fusion (ACDF). Anterior Cervical Plate (ACP) provides stability to the fusion construct; however, some complications have been reported, such as dysphagia, adjacent disc disease, and soft tissue injury. To overcome these complications, stand-alone cage (SAC) was later introduced. Through this study, we aim to thoroughly describe and objectively compare the efficacy between the two procedures in detail.

Methods A systematic search was conducted based on PRISMA guidelines to identify relevant studies through PubMed, Google Scholar, and Cochrane Database. A total of 14 studies (960 patients) were included in the meta-analysis. Twenty outcomes were compared between the two procedures clinically and radiologically.

Results ACP and SAC are comparable in terms of dysphasia rate, loss of segmental angle, loss of disc height, Odom's criteria, Robinson's criteria, hospital stay, JOA, NDI, VAS, and fusion time. However, SAC is superior in terms of shorter operation time, less blood loss, lower dysphagia rate, and lower rate of adjacent level disease, whereas ACP is advantageous in terms of lower subsidence rate, better maintenance of cervical global angle, segmental angle, and disc height, as well as higher fusion rate.

Conclusion The two procedures can both be used in patients with CDD, though in patients with multilevel pathologies it might be more beneficial to choose ACP where it provides better mechanical stability. However, in patients with comorbidities, anemia, or swelling problems, it may be more beneficial to use SAC instead as it offers less complication rate.

Atypical Spinal Tuberculosis of Upper Thoracic Spine with Total Neurologic Recovery after Cervicothoracic Junction Approach: A Rare Report

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Introduction Spinal tuberculosis infection is one of the most common extrapulmonary manifestation of the disease. Upper thoracic involvement of this affliction is rare, attributing only less than 5% of all cases. Diagnosis is established based on combination of clinical, radiologic feature, microbiologic findings, histopathologic features, and antituberculosis drug response. This paper reports an atypical presentation of spinal tuberculosis, featuring unconventional peculiarity.

Case Report Twenty-year-old male presents with increasing weakness of both legs and decreased sensation from Th3 and below dermatome from 20 days prior, and now is unable to walk, however with no back pain nor kyphotic deformity. Plain radiograph reveals severe compression on Th2, while MRI scan demonstrate granulomatous mass around Th1-Th3, but with intact intervertebral disc. Patient is then underwent antituberculosis therapy 2 weeks before the surgery, and is continued until 9 months. Laboratory examination resulted in normal ESR and CRP value, with slightly increased leukocyte count. The surgical exploration reveals granulomatous mass on the anterolateral side of Th2 spinal canal, but without any abscess nor disc destruction. The spine

is the debrided and stabilized with lateral mass and pedicle screw from C6-Th4, and the spinal canal is decompressed with laminectomy at Th2. Within three months after the surgery, motor strength and sensory function are fully recovered without any residual deficit. The PCR result of the granulomatous mass turns out negative, however the histopathologic examination reveals characteristic caseating necrosis, indicating tuberculosis origin of the pathology.

Discussion The patient in this case exhibits an atypical presentation of spinal tuberculosis. Neurologic deficit without any pain nor kyphotic deformity, upper thoracic involvement, and normal inflammatory marker. Radiologic examination reveals typical destruction of vertebral body, surrounded by granulomatous mass, with preservation of intervertebral disc. The surgical exploration unable to detect any abscess formation, and only shows granulomatous mass near the spinal canal, an unusual presentation of this affliction, similar to tubercular granuloma, however with the presence of corpus destruction. Negative PCR test from excised mass in this patient proves that it does not warrant exclusion of tuberculosis as the etiology. Characteristic caseous necrosis histopathologic appearance, coupled with improvement of neurological deficit after the administration of antituberculosis drug confirms the diagnosis.

Conclusion Spinal tuberculosis is a challenging disease to be diagnosed and managed. Atypical presentation should be diagnosed and treated with a more holistic approach, to prevent misdiagnosis and mistreatment. Utilizing sharp history taking, coupled with specific diagnostic instruments are crucial to establish diagnosis of spinal tuberculosis, thus proper treatment then can be given.

Surgical Management of Paediatric Spinal Tuberculosis: A 7-year Experience

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Background 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 paediatrics' spinal tuberculosis are not clearly evaluated. This study aims to evaluate the outcomes of surgical management of paediatrics' spinal tuberculosis.

Methodology A retrospective study was conducted between January 1, 2015, and December 31, 2022. 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 5.3±1.3 years. Mean sagittal parameter was improved from 69.7±5.7 degree preoperative to 18.3±5.6 degree 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.

Conclusion Surgical intervention in children with spinal tuberculosis not only restores the sagittal parameter of spine but also provides good clinical outcome.

The Effect of Bisphosphonates Administration after Spinal Decompression Stabilization and Fusion, Does it Enhanced Spinal Fusion? A Systematic Review and Meta-analysis

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Introduction Spinal fusions are used in multiple spinal conditions especially in geriatric populations, hence worrying clinicians regarding the outcome of the procedure. Bisphosphonates can inhibit osteoclastic activity hence decreasing bone turnover rate. It is suggested that bisphosphonate may improve the spinal fusion surgery outcome by its mechanism.

Methods A systematic review and meta-analysis were conducted according to PRISMA guidelines. A literature search on bisphosphonate administration and spinal fusion was searched within PubMed, Google Scholar, and Cochrane Library. There are five studies included in this systematic review and meta-analysis.

Results From subgroup analysis in evaluating fusion rate, no significant difference between the bisphosphonate and no-bisphosphonate group (mean difference 0.73 (-0.52, 1.96); 95% CI, P = 0.25) and (mean difference -0.76 (-2.02, 0.49); 95% CI, =0.23). Screw loosening also appears to be statistically not different between the two groups, (mean difference -0.76 (-2.02, 0.49); 95% CI, P < 0.23); (mean difference 1.75 (-0.87, 4.38); 95% CI, P < 0.19). However, the administration of bisphosphonate does significantly reduce vertebral fracture at the fusion segments or adjacent (M-H, Fixed, 95% CI -0.07 (-0.17, 0.03); I² = 0%, P = 0.16).

Discussion Spinal fusion surgery has increased by 239.2% despite only a small increase in the elderly population. This systematic review and meta-analysis aimed to assess the effect of bisphosphonates, commonly prescribed for osteoporosis, on spinal fusion surgery outcomes. The study found mixed results, with some studies reporting an improvement in fusion rate while others reported no significant differences. The study has limitations, including the inclusion of non-prospective RCTs and significant heterogeneity among the included studies. Future studies with more standardized methods of assessment are needed to clarify the effect of bisphosphonates on spinal fusion surgery outcomes.

Conclusion The administration of bisphosphonates appears to not significantly improve spinal fusion compared to controls. Although, bisphosphonates use was associated with decreasing odds of vertebral fractures compared to controls that underwent spinal fusion surgery.

Deep Learning Model for Grading Metastatic Epidural Spinal Cord Compression on Staging CT

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Introduction Metastatic epidural spinal cord compression (MESCC) is a devastating complication of advanced cancer. MRI is the current gold standard imaging test, but it is expensive and unsuitable for screening. Staging CTs are commonly performed for cancer diagnosis and treatment follow-up, allowing for early diagnosis of MESCC. Deep learning (DL) models for automated MESCC classification on staging CT were developed to aid diagnosis.

Materials and Methods Retrospective collection of staging CTs and corresponding MRI-spine from patients with suspected MESCC was conducted from September 2007 to September 2020. Exclusion criteria were scans with instrumentation, no intravenous contrast, extensive motion artefacts and non-thoracic coverage. The internal CT dataset split was 84% for training/validation; 16% for testing. External CT test set from a different institution was utilised. Internal training and validation sets were labelled by radiologists with spine imaging specialization and used to develop a DL model for MESCC classification on CT. A spine imaging specialist labelled the staging CT test sets (axial portal venous phase images) in conjunction with matched MRI-spine (axial T2-weighted images) to serve as reference. MESCC was classified using modified Bilsky scale; normal/no epidural disease, low-grade (epidural disease with no contact of spinal cord) and high-grade (spinal cord contact or compression). Evaluation of DL model performance using both test sets were independently reviewed by four radiologists; two spine specialists and two body radiologists with experience in oncological CT assessment. Inter-rater agreement (Gwet's kappa) and sensitivity/specificity/AUCs were calculated.

Results 420 CT scans were evaluated from 225 patients (mean age=60 \pm 11.9[SD]); 354 (84%) CTs were used for training/validation and 66 (16%) CTs for internal testing. External test set consisted of 43 CT scans from 32 patients (mean age=60 \pm 13[SD]). DL model showed near-perfect inter-rater agreement for three-class MESCC grading with kappas of 0.87 (p <0.001) and 0.84 (p <0.001) on internal and external test sets, respectively. On internal test set, DL model inter-rater agreement (κ =0.87) was superior to a spine imaging specialist (κ =0.80) and a body radiologist (κ =0.72) (both p <0.001). The DL model kappa of 0.84 on the external test set was also superior to the body radiologist (κ =0.72) (p <0.001). For detection of high-grade MESCC, DL model showed high kappa/sensitivity/specificity/AUC of 0.94/93.4/95.47/0.94 on the internal test set and 0.95/96.6/96.0/0.96 on the external test set, respectively.

Conclusion A DL model for detection of MESCC on CT showed comparable or superior inter-rater agreement compared to radiologists on internal and external testing. This model could provide earlier diagnosis and treatment of MESCC, resulting in improved patient outcomes.

Evaluating 5-year Outcomes of between the use of Coflex compared to Stenofix Device as an Adjunct to Decompression for Symptomatic Lumbar Spinal Stenosis

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Introduction Literature on benefits of interlaminar devices (ILD) compared to decompression alone for symptomatic lumbar spinal stenosis (LSS) is limited past the 2-year timeframe. Additionally, no radiological parameters for quantifying patients with positive surgical outcomes have been correlated.

Aim Assess 5-year outcomes following the use of Coflex compared to Stenofix as adjunct to spinal decompression and determine whether improvement in radiological indices correlate with clinical outcomes.

Materials and Methods A prospective single surgeon cohort study of 116 patients who underwent spinal decompression with or without ILD insertion between 2007 - 2015. Patients with single level symptomatic LSS were offered spinal decompression with either ILD insertion. Exclusion criteria were patients<21 years-age, spondylolysis/lithesis grade-2 or higher, multi-level LSS, previous lumbar surgery and malignancy. Clinical outcomes were assessed preoperatively & up to 5-yrs postoperatively, using the Oswestry disability index(ODI), EuroQoL-5d(Eq5d), VAS and SF-36. Radiological indices were assessed preoperatively and up to 5-yrs postoperatively.

Results 70 patients were allocated; 21 in Stenofix group and 49 in Coflex group. Stenofix group had a significant reduction of anterior disc height at 5 years from 12.5 to 11.2mm (p <0.01) while Coflex group had unsustained improvement postoperatively that reverted to preoperative height at 5-yrs (p =0.34). Stenofix group had unsustained increase in posterior disc height and foraminal height postoperatively that reverted to preoperative height at 5-yrs. Coflex group had significant maintained improvement in posterior disc height from 6.9 to 7.9mm (p =0.01) and foraminal height of 17 to 20.7mm (p =0.03) at 5-yrs. There was significant improvement in posterior disc height favouring Coflex (p <0.01). There was no significant difference in sagittal balance, overall lordosis and sagittal angle of the index level. Both groups had significant improvement post-operatively at all time points for all clinical outcomes. Coflex had greater improvement in SF36-MCS than Stenofix (p <0.01) from 54.5 to 69.5 compared to 48.2 to 51.8 at 5-year postoperative respectively. Coflex had a greater improvement in VAS than Stenofix (p =0.03) from 6.0 to 1.0 compared to 6.2 to 2.3 at 5 years postoperative respectively. There was no significant difference in remaining clinical outcomes between the groups.

Conclusions ILD with spinal decompression in symptomatic LSS up to grade I spondylolisthesis offers good clinical outcomes compared to decompression alone with sustained radiological correction. Our study highlights that in treatment of symptomatic LSS up to grade I spondylolisthesis, Coflex is superior to Stenofix with greater improvement in posterior disc height and clinical outcomes.

Late Total Hip Replacement Instability Post Lumbar Spine Fusion: Not a Spine Surgeon's Problem? A Non-spine Orthopedist's Private Commentary Based on Current Literature Review

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Introduction There is increasing evidence of the interaction between the biomechanics of total hip arthroplasty (THA) and lumbar spinal fusion (LSF) with reference to hip prosthesis stability. However many surgeons in the exclusive field of hip arthroplasty or domain of spine fusion remain uninitiated to the issues at hand. This paper attempts at providing a basic introduction to the spine surgeon in this matter and raises several issues including medicolegal.

Materials and Methods Literature search involving primary search terms "spinopelvic", "hip arthroplasty" "hip replacement", "spine fusion" through Medline and Google search. Relevant papers are selected by the author to formulate a coherent primer of THA and LSF inter-relationship.

Results /Discussion A presentation of the biomechanics of hip joint articulation and dislocation will be followed by its interaction spinopelvic positioning pre- and post- spine fusion. A review of available evidence on hip instability after THA in patients with previous LSF will be discussed, compared with limited evidence of late hip instability after lumbar spine fusion in patients with prior hip arthroplasty. Ironically there may be more patients with existing THA waiting to have LSF rather than the other way around, hence the need to warn of the effects of LSF on the previously stable THA. Remarkably however, LSF after THA appears to be associated with a reduced dislocation rate compared with THA after LSF. Nevertheless, possible solutions to avoid late hip instability post spine surgery will be explored. Predicting spinopelvic parameters after LSF may be helpful. Dual mobility types of THA are proposed to reduce risks of spinopelvic related hip instability, if patient have symptomatic lumbar spine pathology requiring surgery.

Conclusion Raising awareness of hip instability related to spine fusion is an important step in the holistic approach to looking after a person with both hip and lumbar spine pathology.

Implant and Construct Decision Making in Metastatic Spine Tumour Surgery: What are the Important Factors We need to Weigh Pre-operatively?

Si Jian Hui, Joshua Wong, Balamurugan A Vellayappan, James Thomas Patrick Decourcy Hallinan, Jiong Hao Tan, Naresh Kumar

Introduction Metastatic spine disease (MSD) is commonly debilitating secondary to significant pain with/without neurological deficits. Surgical treatment is the mainstay of treatment for most patients who present with neurological deficits, significant radiological compressions or pathological fractures. However, patients with MSD commonly have poor bone quality due to underlying tumour osteolysis, or from prior chemotherapy or radiotherapy. For these group of patients, fusion can be difficult to achieve. Obtaining a stable postoperative stabilisation in these patients is crucial, in the context of recent advances in systemic therapy allowing for increased duration of postoperative survival. Our study aims to answer this question by highlighting factors to be taken into consideration, when deciding on the implant and construct for surgery.

Methods This study was done as an expert opinion by a single senior surgeon with more than 20 years of experience in metastatic spine tumour surgery (MSTS), in a single tertiary spine surgery center.

Discussion We hereby describe the importance of the following factors in pre-operative decision making for the length and type of construct in MSTS namely: the extent of construct, the quality of vertebrae to be instrumented, the choice of implant and the use of cement augmentation. Currently, there is no consensus on the adequacy of the extent of construct, but we recommend long segment fixation of two pedicle screws above the below the symptomatic lesion, with rods being left slightly longer to allow for future extension of instrumentation. The end vertebrae being instrumented also requires two pedicle screws with good purchase, and we have shown how Computed Tomographic scans can be useful to delineate the type of tumour involvement, to allow us to decide if screw insertion can be planned at a vertebrae level involved with metastasis. In cases with poor bone quality, cement augmentation can also be used to improve screw anchorage. In terms of screw design, conical pedicle screws have shown to have increased pullout and bending strength, and Polyether ether ketone (PEEK) screws may be the superior option in those who require Stereotactic Body Radiotherapy (SBRT). A hybrid construct is also feasible, with the construct being expanded by titanium screws for patients with cost issues.

Conclusion MSD will continue to rise in the future. Effective and durable surgical intervention shall be a benchmark for all MSTS surgeons, to improve patient's quality of life and survival post-operatively.

Single Position Prone Oblique Lumbar Interbody Fusion (OLIF) – Case Illustration and Technical Considerations

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Background Oblique lumbar interbody fusion is a powerful method to treat various spinal conditions, and is frequently combined with posterior instrumentation. This is often performed in two positions, with the patient first in lateral then turned prone. Studies have explored the option of single position surgery to improve surgical efficiency and cut operative costs. This has conventionally been performed in lateral, however, there are some limitations involved. This case illustrates employing a single prone position for a patient undergoing oblique lumbar interbody fusion (OLIF) with subsequent posterior decompression and instrumentation. The benefits of this procedure over the conventional techniques are highlighted in this case.

Case presentation We present the case of a 75 years old Female presenting with thoracic myelopathy over T11/12 and concurrent L2-4 spinal stenosis. She underwent OLIF of L2/3 and L3/4, posterior decompression of T11/12 and L2/3, and posterior

instrumented fusion from T10-L4 via a single prone position. We aim to describe the benefits of this approach, and raise up some of the challenges encountered through our experience.

Discussion Single position prone OLIF offers increased benefits compared to the already powerful single position lateral surgery, including allowing for option of posterior decompression when indicated, and surgeon familiarity when inserting pedicle screws. Single position prone OLIF is a novel approach and offers improved efficiency over current surgical options.

FREE PAPER SESSION 2 – 18 March 2023, 08:00 to 09:30

Deep Learning Model for Grading Metastatic Epidural Spinal Cord Compression on Staging CT

Ang Shi Wei, Singapore

Metastatic epidural spinal cord compression (MESCC) is a devastating complication of advanced cancer. Staging CT scans are commonly performed for cancer diagnosis and follow-up, and represent a window of opportunity for earlier diagnosis of MESCC.

Objective To develop a Deep Learning (DL) models for automated MESCC classification on staging CT.

Methods Retrospective collection of staging CT scans and corresponding MRI spines from patients with suspected MESCC was conducted from September 2007 to September 2020. MESCC was classified using a modified Bilsky MESCC scale; normal/no epidural disease, low-grade (epidural disease with no contact of the spinal cord), and high-grade disease (spinal cord contact or compression). Training and test datasets were labelled in consensus by two subspecialised radiologists (6 and 11-years-experience) using the MRI studies as the reference standard. For evaluation of the DL model performance, test sets were independently reviewed by 4 senior readers (3 senior radiologists and 1 consultant spine surgeon) and 4 orthopaedic medical officers of 1 year experience)

Results 420 CT scans from 225 patients (mean age=60 ±11.9[SD]) were evaluated; 354 (84%) CT scans were used for training/validation and 66 (16%) CT scans were used for internal testing. The DL model showed inter-rater agreement of (k=0.879) (p<0.01) when used to evaluate for the presence of normal vs low or high grade MESCC. This was higher than all the readers except ES (radiologist 7 years' experience) (k=0.902) and JT (spine surgeon) (k=0.883). The DL model had high sensitivity (91.82 (89.33- 93.89)) and specificity 92.01 (90.88- 93.04) and AUC (0.919 (0.907- 0.931)) when used to evaluate for normal vs low or high grade MESCC

Conclusion DL models for MESCC classification on CT showed good inter-rater agreement and may be useful for MESCC screening.

Short-term Outcomes of Cervical Spondylotic Amyotrophy Diagnosed and Treated by Multidisciplinary Team

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Department of Rehabilitation Medicine, Deqing People's Hospital (Deqing Campus of Sir Run Run Shaw Hospital affiliated to Medical Collage of Zhejiang University)

Objective To observe the short-term clinical and imaging outcomes of cervical spondylotic amyotrophy (CSA) cases diagnosed and treated by multidisciplinary team (MDT), which were consist of experts from orthopedics, neurology, neurosurgery, and rehabilitation medicine department.

Methods Cases suffered from amyotrophy were picked out and multi-diagnosed by MDT, those were finally diagnosed as CSA accepted anterior cervical discectomy and fusion (ACDF) or anterior cervical corpectomy and fusion (ACCF). After that, systematic rehabilitation were performed, neurotrophin and dehydrant were given. All cases were followed up for at least 6 months. Changes of myodynamia and JOA scales during follow-up were measured to estimate clinical outcomes. Imaging of X-ray, CT scan, and MRI were described to evaluate imaging outcomes.

Results 18 CSA cases were diagnosed and treated by MDT, and followed up for 9.5 months. After decompressed by ACDF or ACCF, these cases stopped progressing, and even achieved some clinical improvements, with their myodynamia improved, and JOA scales increased. Compared with pre-operation imaging, after surgery, alignments of cervical spine were corrected, spinal canal volumes were enlarged, abnormal signal was not observed in MRI imaging.

Conclusions CSA, which is difficult to identified with neurological diseases, should be multi-diagnosed by MDT. Decompression by ACDF or ACCF combined with medicine and rehabilitation is effective by achieving satisfactory clinical and imaging outcomes.

Outcome Comparison Between Percutaneous Vertebroplasty versus Conservative Treatment in Osteoporotic Vertebral Compression Fracture: A Systematic Review and Meta Analysis

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Introduction The growing number of elderly patients with osteoporosis results in high occurrences of osteoporotic vertebral compression fracture (OVCFs), leading to chronic backpain, progressive kyphotic deformity, poor quality of life and survival. There

are inconclusive results on treatment choice between minimally invasive surgical percutaneous vertebroplasty (PVP) and conservative treatment (CT). This study aims to evaluate the efficacy and safety between PVP and CT in OVCFs.

Methods We searched 3 databases through 2018 for randomized controlled trial comparing PVP and CT in OVCFs. Primary outcomes include: pain relief outcome at 1 week, 1 month and 3 months; quality of life outcome with EuroQOL and Roland Morris Questionnaire; and presence of new adjacent vertebral fractures outcome. Statistical analysis is performed using Review Manager version 5.3 software.

Results A total of 9 out of 236 studies, among 1013 included patients are assessed comparing PVP and CT in OVCFs. All included studies have evidence of good quality, as assessed by the Oxford Center for Evidence-based Medicine. Percutaneous vertebroplasty provides equally balanced outcomes: pain relief at 3 months (mean difference -0.76; 95% CI: -2.02 to 0.49; $p < 0.00001$; I^2 87%), quality of life EuroQOL (mean difference -0.76; 95% CI: -2.02 to 0.49; $p < 0.00001$; I^2 87%), quality of life Roland Morris Questionnaire (mean difference 1.75; 95% CI: -0.87 to 4.38; $p = 0.02$; I^2 74%), and new adjacent fracture (mean difference -0.07; 95% CI: -0.17 to 0.03; $p < 0.53$; I^2 0%).

Discussion Osteoporotic vertebral compression fractures could be devastating to patients. Percutaneous vertebroplasty is meant to treat OVCF in accordance to the advantages and disadvantages. In this study, PVP is equally balanced to CT in managing OVCF.

Conclusion Percutaneous vertebroplasty could be an alternative treatment to conservative treatment in osteoporotic vertebral compression fracture.

How I Do it: Transforaminal Endoscopic Lumbar Decompression by Extraction of Extravasated Cement in Upper Lumbar Spinal Canal

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Objective To evaluate the feasibility of transforaminal endoscopy in symptomatic cement extravasation into the spinal canal after vertebroplasty.

Methods A 71-year-old female after T12, L1 vertebroplasty for osteoporotic vertebral compression fracture at local hospital had relief of her back pain but started having new onset bilateral anterior thigh pain(Left>Right). On further evaluation at the local hospital her symptoms were diagnosed to have been due to T10-T11, T11-12 spinal stenosis for which she underwent T10-T12 posterior instrumented decompression. Her bilateral anterior thigh pain(Left>Right) did not resolve after second operation the local hospital and she was referred to us for second opinion. Evaluation of the postoperative CT and MRI scan showed that extravasated cement into spinal canal of index vertebroplasty procedure was the cause for her symptoms. This was confirmed by temporary relief obtained after bilateral L1 selective nerve root block. We excised the cement through left transforaminal lumbar endoscopic decompression under local anesthesia and she was completely relieved of her pain post procedure.

Discussion Most common complication of vertebroplasty is cement extravasation. Although most of the cases of cement extravasation are clinically asymptomatic, some symptomatic cases require clinical intervention. New onset radiating pain or weakness should raise a suspicion of symptomatic cement extravasation.

Conclusion Transforaminal endoscopic lumbar decompression is a safe and viable option to remove extravasated cement from vertebroplasty.

5-year Radiological Outcomes Post an Interlaminar Device Insertion for Symptomatic Lumbar Spinal Stenosis

Naresh Kumar; Meettra Seyher Rajoo; Andrew Cherian Thomas; Kasia Chen Xi Chua; Sean Junn Kit Lee; Shen Liang; Laranya Kumar

Introduction Lumbar spinal stenosis (LSS) is a common spine condition that is frequently encountered especially with an ageing population. A common treatment strategy employed for symptomatic patients is open decompression and fusion. However, that option poses its own unique set of drawbacks which led to the adjunct use of the interlaminar device (ILD) as an increasingly popular alternative instead. There are varying designs available for interlaminar and interspinous devices, all aiming to serve a common goal of limiting extension at the affected index lumbar segment and allowing for increased foraminal height and reduced disc pressure. This in return may translate into a longer symptom free interval with reduced recurrence or need for further procedures. There is a paucity in the current literature about the radiological parameters that are affected or maintained with the use of an ILD and the implications of those observations. The objective of our paper was to compare and monitor several radiological indices as a surrogate marker to determine the effectiveness of the ILD insertion up to 5-years postoperatively.

Materials and Methods A retrospective review of prospectively collected data under a single surgeon cohort study, consisting of 116 patients who underwent spinal decompression with and without an ILD insertion between 2007 - 2015 was performed. Patients who met the study criteria were offered the choice of an ILD device insertion. Those who accepted an ILD insertion were placed in the D+ILD group (n=61); while those opting for decompression alone, were placed in the DA group (n=55). Radiological indices consisting of anterior and posterior disc height, foraminal height at the level of decompression, segmental lordosis and sagittal angle were assessed both preoperatively and up to 5-years postoperatively.

Results The D+ILD group achieved and maintained significant radiological correction at all time points for posterior disc height, foraminal height, sagittal height and L4 to S1 lordosis measured while the DA group did not attain this; implying good lateral recess restoration and neuroforaminal decompression. This in return is translated into better clinical outcome scores in the postoperative period and improvement in radiological parameters.

Conclusion The use of an interlaminar device in conjunction with spinal decompression in patients with symptomatic LSS has been shown to offer a sustained correction in radiological parameters.

Role of Icotec Carbon Fiber Implants for Spine Tumour Disease – A Multicentre Singapore Experience

Sean Junn Kit Lee; Karthiges Palanichami; Joel Tan Yong Hao; Laranya Kumar; Dinesh Shree Kumar; Naresh Kumar

Introduction Spinal metastasis is seen in approximately 10% of cancer patients and contributes to 50% of skeletal metastasis. MSTs is indicated in severe or rapidly progressive neurological deficits, instability or intractable pain. Titanium implants are considered as 'gold standard' in operative fixation in metastatic spine tumour surgery (MSTS), but resulted in artefact generation which compromised post-operative imaging modalities such as CT and MRI, resulting in poor radiotherapy planning, suboptimal tumour surveillance and hence poorer quality of care for patients. Carbon fiber reinforced PEEK (CFR-PEEK) implants (e.g. Icotec) were developed for the specific use in MSTS and primary spine tumour surgery because it generates less artefact in imaging and less backscatter of radiation during radiotherapy. Biomechanically, it has been shown to be comparable to titanium implants. There is also the added benefit of having a modulus of elasticity closer to bone and hence, reduced risk of implant related problems. Several smaller case series have shown acceptable outcomes in patients undergoing surgery with these implants with a few studies showing the potential radiotherapy benefits. In this study, we aim to highlight two-year outcomes of 23 consecutive patients who underwent metastatic spine tumour surgery using Icotec.

Patients and Methods We report the results of 23 patients from four hospitals who underwent MSTS using Icotec implants from 2020 to 2022. Basic demographics, operative details, clinical outcomes scores and radiological data were collected. Radiotherapy parameters including total artefact volumes, dose calculations and discrepancy between calculated and delivered doses, Clinical Target Volume (CTV) and Gross Tumour Volume, as well as the spinal Cord Visualization were collected and assessed.

Results All patients in this study reported either a maintenance or improvement in ASIA scores. The median time to radiotherapy was 30 days, and there were no reported delays in oncological treatment. One case alone underwent removal of implants due to L4 screws pull out. There were no major complications in our series.

Conclusion CFR-PEEK implants display promising outcomes in improved radiotherapy planning, better tumour surveillance and safety.

Unipedicular-screw Index Vertebra Manipulation Technique for Minimally Invasive Short-Segment Thoracolumbar Fracture Fixation

Naresh Kumar; [Brian Zhaojie Chin](#); Kasia Chen Xi Chua; Karthiges Palanichami; Pradnya Nishant Mohite; Shen Liang; Arnaldo Songcayaon Favila, Jr.; Jonathan Jiong Hao Tan

Introduction MIS spine surgery has revolutionized fixation of thoracolumbar fractures with burst elements. Recent studies have proven that percutaneous pedicle screw instrumentation is as effective as open instrumentation, with reduction in intraoperative blood loss and operative duration. Techniques such as short-segment pedicle screw fixation including the fractured vertebra has shown satisfactory radiological correction and functional outcomes, avoiding the need for extensile posterior constructs. We describe our technique utilizing unipedicular index vertebra fixation and manipulation in minimally invasive surgery (MIS) for thoracolumbar fractures with burst elements. We aim to highlight the two-year radiological & functional outcomes of 20 consecutive patients who underwent this technique.

Material and Methods A retrospective review of prospectively collected data was conducted on 20 patients with thoracolumbar fractures with burst elements who underwent fixation using our technique. Baseline characteristics and injury profiles of included patients were collected. Radiological parameters - vertebral wedge angle, regional kyphosis angle, coronal Cobb angle, anterior and posterior vertebral body heights were recorded at preoperative, intraoperative, postoperative, and up to 2-year follow-up. Clinical outcome scores of VAS and ODI were also recorded at similar time-points.

Results Radiological outcomes reflect significant lordotic corrections of the vertebral wedge angles up to 2-year follow-up when compared to preoperative values (intraoperative: $p=0.06$; postoperative: $p=0.001$; 3-month: $p=0.002$; 6-month: $p=0.004$; 1-year: $p=0.011$; 2-year: $p=0.016$). Additionally, significant lordotic corrections of regional kyphosis angles (intraoperative: $p=0.00$; postoperative: $p=0.00$; 3-month: $p=0.031$; 6-month: $p=0.039$) and increases in anterior vertebral body heights (postoperative: $p=0.001$; 3-month: $p=0.010$; 6-month: $p=0.020$) up to 6-month follow-up was found. Significant improvements in functional outcomes VAS and ODI scores compared to preoperative data were found, with mean scores of 11.5 and 9.9 respectively at 2-year follow-up.

Conclusion Our approach in treating thoracolumbar fractures with burst elements using MIS short-segment fixation and unipedicular screw manipulation technique shows satisfactory radiological correction & high rates of fracture union, whilst reducing approach-related morbidity & improving functional outcomes.

A Prospective Randomized Controlled Multicentre Study of ProDisc-C vs Anterior Cervical Discectomy and Fusion for Treatment of Symptomatic Cervical Disc Disease in Asian Population: A 4-year Outcome

Naresh Kumar; [Karthiges Palanichami](#); Laranya Kumar; Shen Liang; Wong Hee Kit

Background Current standard surgical treatment option for symptomatic cervical disc disease (SCDD) is anterior cervical discectomy and fusion (ACDF). Although ACDF results in high clinical success and low complications, it could lead to hypermobility and increased intradiscal pressure at adjacent levels secondary to rigid immobilization at fused vertebral levels, resulting in adjacent disc degeneration. ProDisc-C is a cervical total disc replacement (TDR) designed to potentially preserve the motion at involved cervical vertebral segment, to reduce pain and neurological symptoms. Current literature comparing ProDisc-C and ACDF in Asian population is limited, but race is an important component that influences complication rate, length of hospital stay and mortality after cervical spine procedures.

Objective/Aim To evaluate safety, efficacy, and success of ProDisc-C versus ACDF at 48-months post-surgery in Asian patients in treating single-level SCDD.

Methods This multicentre, prospective, randomized controlled trial was conducted with patients with single-level SCDD involving C3-C7 segments. Patients were randomized into group-A(ProDisc-C) and group-B(ACDF)(treated with standalone cage with bone autograft) at 2:1 ratio. 120 patients consisting of 80 patients in group-A and 40 in group-B were enrolled. Assessments conducted at baseline, 6-weeks, and 3-, 6-, 12-, 18-, 24-, 36- and 48-months post-surgery and annually till 84 months. The overall success at 48-months was composed of: (1) $\geq 20\%$ improvement in neck disability index (NDI); (2) neurological success (maintained/improved); (3) absence of secondary surgery at index level; and (4) absence of device-related adverse events.

Results Of 120 patients, 76-patients in group-A and 37-patients in group-B were treated as per protocol (PP). Overall success in PP last observation carried forward analysis was 79% in group-A and 75.7% in group-B at 48-months($p=0.0122$), demonstrating non-inferiority of ProDisc-C to ACDF. ProDisc-C demonstrated non-inferiority to ACDF at 18-months(81.6% vs 83.8%, $p=0.0398$) and 36-months(80.3 vs 78.4, $p=0.0156$). Both groups had similar results in (i) NDI success(97.2% in group-A vs 100% in group-B), (ii) neurological success(83.3% in group-A vs 87.5% in group-B), (iii) absence of secondary surgery at index level(97.2% in group-A vs 100% in group-B) and (iv) absence of device-related adverse events(97.2% in group-A vs 193.75% in group-B) at 48-months(pp). Both groups had similar secondary outcomes(VAS-pain scores&SF-36). Range of motion was preserved in group-A and significantly reduced in group-B at 48-months.

Conclusion ProDisc-C is feasible, safe, and effective for treatment of SCDD in Asian population. It demonstrated non-inferiority to ACDF in overall success at 18, 36 and 48-months.

Does Patient Blood Management Affect Outcomes in Metastatic Spine Tumour Surgery? A Review of Current Concepts

Si Jian Hui, Karthiges Palanichami, Eunice Xin Yi Lee, Ashokka Balakrishnan, Jiong Hao Tan, Naresh Kumar

Objective The spine is the most common site of metastases, associated with decreased quality of life. Increase in metastatic spine tumour surgery (MSTS) has caused us to focus on the management of blood, as blood loss is a significant morbidity in these patients. However, blood transfusion in MSTS patients with extensive blood loss is also not without its own risks, and hence this led to blood conservation strategies and implementation of a concept of patient blood management (PBM) in clinical practise focusing on these patients.

Methods A narrative review was conducted and all studies that were related to blood management in metastatic spine disease as well as PBM surrounding this condition were included.

Discussion A total of 64 studies were included in this review. We discussed a new concept of patient blood management in patients undergoing MSTS, with stratification to pre-operative and intra-operative factors, as well as anaesthesia and surgical considerations. Our team has described the spinal metastasis invasiveness index (SMII), comprised of surgical factors, tumour vascularity and embolisation status, which significantly predicts operative time and intraoperative blood loss. This novel predictive system is of use to both surgeon and anaesthetist to predict expective blood loss and need for PBM measures pre-operatively. Subsequently, we also established three important pillars of PBM measures in MSTS, namely the detection and management of anaemia, minimising blood loss, as well as optimisation of physiological tolerance to anaemia. The studies in current literature also show that PBM and reduction in blood transfusion allows for reduced readmission rates, lower risks associated with blood transfusion, and lower morbidity for patients undergoing MSTS.

Conclusion Through this paper, we highlight various pre-operative and intra-operative methods in the surgical and anaesthesia domains that can help with PBM. It is an important concept with the significant amount of blood loss expected from MSTS, and it is important for both anaesthetists and surgeons to work hand in hand to tackle blood loss in MSTS patients with adequate pre-operative, intra-operative and post-operative measures.

Neurological Outcomes of Decompression Stabilization and Fusion Surgery for Spinal Metastases at Prof. Dr. IGNG Ngoerah General Hospital: A Retrospective Case Series

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Background Patients with metastatic spinal cord compression (MSCC) frequently experience not only pain but also neurological deficits and decreased functional autonomy. Paralysis due to spinal cord compression is the most feared of the complications associated with metastatic spine disease. Surgical decompression has been shown to improve neurological outcomes. This case series present patients with metastatic bone disease underwent surgical decompression.

Case Presentation From total of 55 patients with MSCC. Among 55 patients, most were caused by lung cancer followed by mammary, ovary and another type of cancer at the least. We present 5 patients with neurological deficits on both lower extremities due to spinal compression. Most patients came with continuous progressive backpain overtime. Decompression, stabilization and fusion surgery was done on all the patients. The outcomes were satisfying on 5 presented cases with improvement on neurological deficits and patient's quality of life at 3 months follow up. Patients continue cancer's regiment therapy following their clinical outpatient control.

Conclusion Patients with metastatic spinal cord compression (MSCC) frequently experience not only pain but also neurological deficits and decreased functional autonomy. Paralysis due to spinal cord compression is the most feared of the complications associated with metastatic spine disease. Surgical decompression can improve the patient's condition by improving their neurological outcomes.

Tubular Microdiscectomy Complicated by Late-presenting Dural Tear, Cerebrospinal Fluid Cutaneous Leak, Subarachnoid Haemorrhage, Communicating Hydrocephalus and Spondylodiscitis. A Case Report

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Introduction Late-presenting dural tears are associated with cerebrospinal fluid fistulas and superficial surgical site infections. Intraoperative dural injuries are known to result in intracranial haemorrhage due to CSF leak, although typically of subdural or cerebellar nature. The authors report an unusual case of subarachnoid haemorrhage following a late-presenting dural tear post-L5/S1 tubular microdiscectomy. This was complicated by hydrocephalus with altered mental status, requiring ventriculoperitoneal shunt insertion, and concomitant L5/S1 spondylodiscitis, requiring repeated debridement before definitive anterior and posterior fixation.

Methods A 56-year-old Chinese female, with no significant past medical history, underwent elective right L5/S1 laminotomy and microdiscectomy for a symptomatic right L5/S1 prolapsed intervertebral disc. Postoperatively, the patient had minimal back pain with complete resolution of radicular symptoms before discharge on postoperative day (POD) 1. She returned to the Emergency Department on POD 4 for bilateral occipital headache, vomiting and neckache. The patient was afebrile with a Total White Count (TWC) of $6.3 \times 10^9/L$ and C-Reactive Protein (CRP) $0.7mg/L$. The surgical wound was clean with no erythema or discharge. A Computer Tomography (CT) and Magnetic Resonance Imaging (MRI) of the brain demonstrated a subarachnoid haemorrhage (SAH). An MRI of the lumbar spine revealed a thecal sac injury at L5/S1 with no deep collections. After a trial of conservative bed rest, the patient developed a cutaneous CSF fistula on POD 13 with surrounding erythema. This was associated with an increase in CRP and TWC to $208mg/L$ and $14.9 \times 10^9/L$ respectively. She underwent wound debridement on POD 13 with repair of dura. Intraoperative cultures grew methicillin-susceptible *Staphylococcus aureus* (MSSA) and *Klebsiella aerogenes*. Progressive L5/S1 spondylodiscitis with rim-enhancing collections were found on POD 18. The patient underwent multiple debridements without instrumentation before a definitive L5/S1 anterior discectomy, debridement and interbody fusion with a tibial cortical allograft was performed in-conjunction with posterior instrumentation of L4 to S1 and posterolateral bone grafting on POD 53. Subsequently, the patient developed altered mental status on POD55, secondary to a newfound severe communicating hydrocephalus. This was attributed to the index SAH. An external ventricular drain was inserted with minimal improvement. A right ventriculoperitoneal shunt was inserted, with recovery of the patient's mentation. The patient had resolution of CRP and TWC after culture-directed antibiotic therapy.

Results At her follow-up visit 3 months post-discharge, the patient had no further back pain. Her wound was well healed. She had full lower limb power and sensation, and could ambulate independently.

Conclusions Late-presenting dural tears may be complicated by CSF fistulas and subarachnoid haemorrhage. No standard treatment guidelines exist, although most cases reported are managed conservatively. Conservative treatments should be promptly escalated to surgical management if CSF fistulas progress to deep spondylodiscitis or if hydrocephalus occurs. A high index of suspicion for these rare complications is recommended, with early treatment to prevent further progression and improve outcomes. Further studies is required to establish its pathophysiology and establish treatment methods.

Low Density Instrumentation in Adolescent Idiopathic Scoliosis

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Background Optimal implant density for correction of Adolescent Idiopathic Scoliosis is still controversial. Low or limited density of the pedicle screw construct in which the number of pedicle screws are reduced, can also lead to correction of scoliosis comparable to high density pedicle screw construct in Adolescent Idiopathic Scoliosis.

Objectives To determine whether a carefully planned fixation using reduced number of pedicle screws placed in key fixation points along the construct used to correct Adolescent Idiopathic Scoliosis can lead to correction that is comparable to High Density Constructs.

Methods Patients treated operatively for Adolescent Idiopathic Scoliosis between 2017 and 2022 were assessed. A low density pedicle screw construct was used. Radiographic assessment included the percentage correction of the major curve, the number of screws used in the construct along with their placement were assessed.

Results Twenty-two patients were included in the analysis with ages ranging from 14 -19 years. Average screw density was 1.35 per level. Average screw density in the concave side was 0.69 and on the convex side was 0.66. Mean percentage of curve correction of the major curve was 64.5%.

Conclusion Low density constructs can achieve curve correction comparable to High density constructs at lower cost which is an important factor for consideration for low income countries like Nepal.