

## EUROSPINE 2021 scientific programme oral presentations

Friday, 8 October 2021, 08:30–10:00

### Spinal Cord Tumours and Degenerative Spine

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#### **CORRELATION BETWEEN THE MECHANICAL PROPERTIES OF THE METASTATIC VERTEBRAE AND THE FEATURES OF THE LESIONS**

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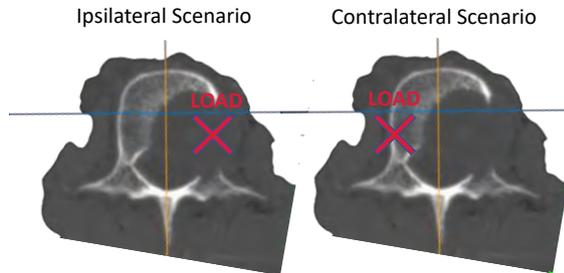
The clinical evaluation of the spine mechanical instability in case of metastatic vertebrae is based on the assessment of radiographical parameters and pain (Spine Instability Neoplastic Score, SINS)[1]. However, the score does not provide a clear recommendation for 73% of the cases. We hypothesize that this is due to the fact that the properties of the lesion, such as size and position that may be related to the mechanical properties of the vertebra, are not included in the SINS. The aim of this study was to evaluate i) if the radiographical objective parameters of the SINS reflect the biomechanical evidence and ii) if a correlation exists between the features of the metastasis and the mechanical properties of the vertebra.

Twenty spines with metastases were obtained through an ethically-approved donation program. Each spine was CT scanned. For each metastatic vertebra the type of metastasis, the SINS (excluded the pain score), the size and the position of the metastasis were evaluated. 35 segments, consisting of a metastatic and a control vertebra, were isolated and biomechanically tested in four loading conditions: flexion, left and right lateral bending, and pure compression. The full-field strain distribution was measured on the vertebral surfaces, by using Digital Image Correlation[2]. A surrogate of the biomechanical properties of the metastatic vertebra with respect to the control one (Biomechanical Ratio, BR, ratio between the mean compressive principal strain on the metastatic vertebra and the adjacent healthy vertebra) was computed for each segment, in each loading scenario. Finally, the correlations between the SINS and the BR, and between the metastatic features and the BR were analyzed.

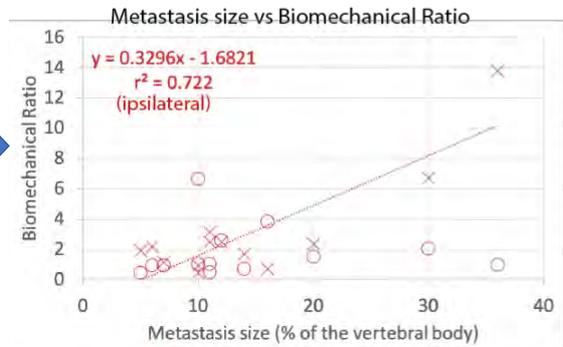
A weak but significant correlation was found between SINS and BR ( $r^2=0.12$ ). For the lytic metastases, a significant correlation was found between their size and BR ( $r^2=0.42$ ). This correlation was further improved ( $r^2=0.72$ ) when the position of the lesion with respect to the load direction was taken into account (Fig. 1). Poor or non-significant correlations were found for blastic or mixed metastasis and BR.

The radiographical parameters of the SINS only partially reflected the biomechanical evidence. The combination of metastasis type, size and position, instead, explained the reduction of the mechanical competence of the vertebra. In particular, this strong agreement was obtained for the lytic lesions[3]. Vertebrae with blastic and mixed metastases showed strains similar to the controls. This evidence suggested that the evaluation of the mechanical stability would benefit if such metastatic features were taken into account, and should be tested in a future clinical study.

A) Definition of ipsilateral (load direction and lesion on the same side) and contralateral (load direction and lesion on the opposite side) scenario



B) Correlation between the Biomechanical Ratio and the lytic lesion size in case of ipsilateral scenario (X) and contralateral scenario (O)



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[1]Fisher et al,2010,Spine

[2]Palanca et al,2018,MEP

[3]Costa et al,2019,JMBBM

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## PROGNOSTIC FACTORS FOR SHORT-TERM VERSUS LONG-TERM READMISSION-FREE SURVIVAL AFTER METASTATIC SPINE TUMOR SURGERY

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### Objectives

Unplanned hospital readmissions(UHR) after metastatic spine tumor surgery(MSTS) are important indicators of poor general condition of the patient, aggressive disease, and inappropriateness of treatment approach. Increase in UHR reduces quality of life(QoL) of the patient and increases resource utilization. Hence, readmission-free survival(ReAFS) defined as 'time duration between discharge after index-operation and first UHR/death', may serve as a new outcome indicator in MSTS-patients. The aim of our study was to identify the prognostic factors for short-term(up to 3-months) and long-term(up to 1-year) ReAFS after index-MSTS.

### Methods

We retrospectively reviewed the medical records of 266 consecutive adult patients who underwent MSTS between 2005-2016 with follow-up until 2 years or demise, whichever was earlier. Institutional Review Board approval was obtained prior to study initiation. Demographic, oncological, procedural, and postoperative details were collected. Factors predictive of short and long-term ReAFS were evaluated using multivariate analysis.

### Results

Final analysis included 209-patients. Mean age was  $60 \pm 12$  years. Majority had lung primaries(25.8%). 110 and 57-patients were alive without UHR up to 3-months and 1-year of index-MSTS, respectively. Both univariate and multivariate analysis revealed that patients with Eastern Cooperative Oncology Group performance status (ECOG-PS) 0-2 [multivariate adjusted odds ratio (95% confidence interval)=0.286 (0.110-0.747),  $p=0.011$ ], preoperative-hemoglobin  $>12$ g/dL [0.444 (0.244-0.807),  $p=0.008$ ], number of comorbidities  $<4$  [0.474 (0.223-1.008),  $p=0.052$ ], index length-of-stay  $\leq 10$  days [0.359 (0.170-0.760),  $p=0.007$ ], and no neurological/hematologic complications during index-stay [0.145 (0.031-0.688),  $p=0.015$ ] had higher probability of ReAFS up to 3-months after MSTS. On univariate analysis, patients with a higher probability of ReAFS up to 1-year included those with ECOG 0-2 ( $p=0.017$ ), preop-Hb $>12$  ( $p=0.003$ ) and prostate primaries ( $p=0.014$ ). Multivariate analysis revealed preoperative-hemoglobin and primary tumor type to be significant factors influencing long-term ReAFS. Lung primaries had highest UHR/death, while breast had the least at 1-year after MSTS.

### Conclusions

Our study revealed that general condition of the patient at the time of index surgery (ECOG and preoperative hemoglobin status) may significantly influence both short and long-term ReAFS after MSTS. Short-term ReAFS may also be influenced by the number of comorbidities and quality of postoperative recovery (length of index stay and postoperative complications during index stay), while long-term ReAFS may be influenced by the primary tumor type. Knowledge of factors influencing short-term ReAFS can allow oncologists and surgeons to optimize treatment approach, quality of cancer care, and patient counselling/surveillance to prolong the ReAFS, set expectations and improve the long-term QoL of MSTS-patients.

### Disclosures:

author 1: none; author 2: none; author 3: none; author 4: none; author 5: none

## **CAN BODY COMPOSITION MEASURES ON COMPUTED TOMOGRAPHY PREDICT MORTALITY IN PATIENTS WITH SPINAL METASTASES UNDERGOING SURGERY?**

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### Background

Although survival of patients with spinal metastases has improved over the last decades due to advances in multi-modal therapy, there are currently no reliable predictors of mortality. Computed tomography (CT) body composition measurements have been recently proposed as biomarkers for survival in patients with and without cancer. Patients with cancer routinely undergo CT for staging or surveillance of therapy and body composition assessed using opportunistic CTs might be used to determine survival in patients with spinal metastases.

### Questions/Purposes

(1) The purpose of our study was to determine the value of body composition measures obtained on opportunistic abdomen CTs to predict 90-day and 1-year mortality in patients with spinal metastases undergoing surgery. We hypothesized that low muscle and abdominal fat mass were predictors of mortality.

### Methods

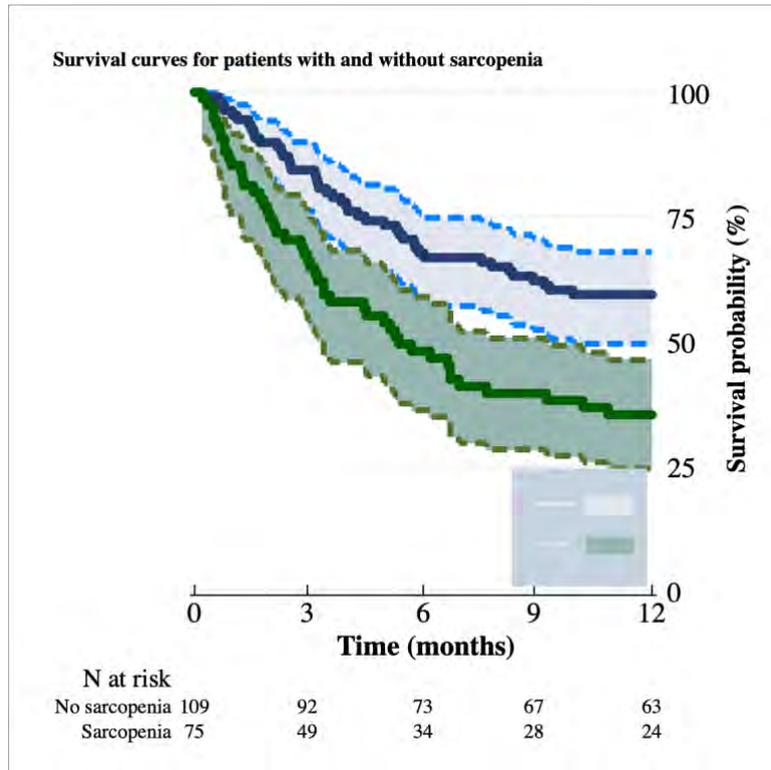
Between 2001 and 2016, 196 patients who underwent surgery for spinal metastases at a single tertiary center underwent CT of the abdomen within three months prior to surgery. Quantification of cross-sectional areas (CSA) and CT attenuation in Hounsfield Units (HU) of abdominal subcutaneous adipose tissue (SAT), visceral adipose tissue (VAT), and paraspinal skeletal muscle were performed on CT images at the level of L4 using an in-house automated algorithm under the supervision of a fellowship-trained musculoskeletal radiologist. Sarcopenia was determined by total muscle area (cm<sup>2</sup>) divided by height squared (m<sup>2</sup>) with cutoff values of <52.4 cm<sup>2</sup>/m<sup>2</sup> for men and <38.5 cm<sup>2</sup>/m<sup>2</sup> for women. Bivariate and multivariate Cox proportional-hazard analyses were used to determine the associations between body compositions and 90-day and 1-year mortality.

### Results

The median age was 62 years (interquartile range = 53-70). Mortality rates for 90-day and 1-year were 24% and 54%, respectively. Sarcopenia and decreased muscle attenuation were associated with increased mortality for both timepoints ( $p=0.04$  and  $p=0.04$ , respectively) after controlling for sex, age, body mass index, Charlson Comorbidity score, primary tumor type, visceral metastases, and duration between diagnosis of spinal metastases and surgery. Decreased SAT area was associated with increased 90-day mortality after controlling for the same covariates ( $p<0.01$ ).

### Conclusions

Decreased muscle attenuation and sarcopenia are independently associated with an increased risk of 90-day and 1-year mortality for patients surgically treated for spinal metastases, and low SAT CSA is independently associated with increased risk of 90-day mortality. Therefore, body composition measurements could serve as novel biomarkers for prediction of mortality in patients with spinal metastases.



Disclosures:

author 1: none; author 2: none; author 3: none; author 4: none; author 5: none; author 6: no indication; author 7: none; author 8: none

## THE DEVELOPMENT OF A SPINAL OLIGOMETASTASES PATHWAY AT A SUPRA-REGIONAL CENTER. A SURGICAL PERSPECTIVE

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### Introduction

Radical treatment for spinal oligometastatic disease (SOD) represents the fundamental difference when compared to palliative treatment for spinal metastatic disease. Stereotactic ablative radiotherapy (SABR) and Radiofrequency ablation (RFA) of spine allow less invasive radical oncological treatment to be offered for spinal oligometastatic disease obviating Tomita En Bloc Spondylectomy (TES). Bilsky Score >1C are generally not suitable for radiosurgery alone and a multimodal technique of Separation Surgery with post adjuvant SBRT can offer Maximal Local Control (MLC) without the morbidity of TES. There are few spinal centres with formal pathways the surgical management of SOD. This paper looks at the evolution of the multidisciplinary pathway for SOD being developed in our supra-regional spinal oncology centre.

### Methods

Retrospective review of SOD at our Complex Spine MDT between 2017-2021. Demographics, NOMS framework, Tokuhashi (Revised), Tomita score, Bilsky classification, operative course and outcomes were recorded.

Utilisation of supra-regional MDT specialists included: Complex spinal surgeons, radiologist, oncology pain specialist, physiotherapy, clinical psychology, Radio-oncologist and Medical Oncologists with MDT co-ordinator and Clinical Nurse Specialists.

### Results

Referrals to MDT 2017: 398, 2018: 382, 2019: 456, 2020: 444, March 2021: 93; Total 1391

SOD for maximum local control multimodal radical treatment 2017: 2, 2018: 2, 2019: 9, 2020: 9, March 2021: 2; Total 24

Mean age: 53.8y, range 12-77, 51% male

Tokuhashi score range 6-15, Tomita score range 2-8

Histology: Breast/renal/sarcoma: 16.7% ea, prostate/thyroid/chordoma: 8.3% ea

Surgical procedure: Separation Surgery: 70%, En-bloc resection: 30%, 29% RFA

Oncological treatment: Post-op SBRT planned 70%

Mortality: 30 Day: 8.3%, 1y: 16.7%, 3y: - 25%, Synchronous mortality 75% at 3 years.

Local Recurrence (LR): Of 15 patients for whom postoperative imaging were readily available: LR: 6 (range 1 -22 months), No LR: 9; 4 demonstrated systemic disease progression before/without LR. 2y revision for LR 5% (Revision at 23 months).

### Conclusion

In our series, approximately 5% of referrals to the Spinal Oncology MDT qualify as SOD suitable for surgical intervention. The mean Tomita score was 4 which justified the need for radical oncological treatment. About 70% of the patients subsequently had post adjuvant SBRT. 29% of patients received RFA. These techniques used as part of multimodal strategies with SS or TES allow Maximal Local Control. The incidence of surgically treated SOD has increased year on year in our institution. The evolution of the Spinal Oligometastatic pathway relies on recognition of the disease state and formulating a multidisciplinary treatment plan that is best for the patient depending on aspects such as tumor type, prognosis, performance score and radiosensitivity. The shift from palliative surgery to multimodal radical oncological treatment should improve patient outcomes.

### Disclosures:

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## **MINIMALLY INVASIVE DOUBLE TUBULAR RESECTION OF INTRADURAL EXTRAMEDULLARY MENINGIOMA: SINGLE CENTER INITIAL EXPERIENCE**

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### Introduction:

Non-expandable tubular retractors are commonly used in minimally invasive spine surgery (MIS) for a variety of pathologies. Spinal meningioma are the most common primary tumors of the adult spine and their resection requires precision and adequate visualization of adjacent structures at risk. In particular, the use of non-expandable tubular retractors is limited by the need for tension sutures at the durotomy. We previously introduced a novel double tubular MIS technique in which telescopic insertion of a second thinner tubular retractor spreads the tension sutures and expands the intraoperative field of view. In this study, we investigate this technique and evaluate its potential for expanding the intraoperative field of view during resection of 22 consecutive cases of intradural extramedullary meningiomas in our center.

### Methods:

From December 2019 to February 2021, 22 consecutive cases of intradural extramedullary meningiomas (thoracic: 12, cervical 8, lumbar 2) were operated in our hospital using the double tubular MIS approach. Posterior tubular interlaminar fenestration was chosen for all resections. Initially, a tube with a base diameter of 18 mm was inserted to form the main surgical corridor. The durotomy exceeded the diameter of the tube base in all cases. After placing two tenting sutures on each side of the durotomy and applying tension, the resulting surface area of the achieved dura fenestration was measured by optical analysis of the intraoperative video (S1). In the next step, a second thinner tube with a 16-mm base diameter was inserted telescopically through the first, resulting in spreading of the tenting sutures. The resulting surface area was again measured (S2) and compared to S1. The extent of resection was assessed with postoperative contrast-enhanced MRI images.

### Results:

Optical surface analysis using ImageJ software (NIH.org) of the dura fenestration (S1 versus S2) showed a mean visual field difference of 18.84 mm<sup>2</sup> (95% CI: 16.8 - 20.8, p-value <0.001). The double tubular approach allowed a widened surgical visual field in all cases, facilitating comfort and precision. Clinical examination 6 weeks and 3 months postoperatively showed complete regression of the pre-existing neurologic deficits. Intraoperative blood loss did not exceed 120 ml, and the maximum duration of surgery was 150 min. Postoperative MRI verified complete resection of the pathologies. No perioperative complications occurred.

### Conclusions:

The double-tubular minimally invasive approach, which extends the intraoperative field of view, is a safe and effective technique for resection of intradural extramedullary meningiomas.

### Disclosures:

author 1: none; author 2: none; author 3: none; author 4: none; author 5: none; author 6: none

## **COST-UTILITY ANALYSIS OF MICRODISCECTOMY VERSUS NON-OPERATIVE MANAGEMENT FOR THE TREATMENT OF CHRONIC RADICULOPATHY SECONDARY TO LUMBAR DISC HERNIATION**

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**Background:** A recent randomized control trial comparing early surgery to 6 months of conservative care for chronic sciatica showed early surgery resulted in improved outcomes. The cost utility/effectiveness of surgical management for disc herniation has been questioned in the past given the natural history. Health care providers and payers should be aware of the relative value in funding early access to surgical management.

**Objective:** The primary objective is to quantify the cost-effectiveness when comparing early surgery to non-operative management for chronic sciatica.

**Methods:** A decision-analytic model served as the vehicle for the cost-utility analysis. The decision tree was parameterized using data from a randomized control trial design, augmented with institutional micro-cost data. Quality-adjusted life-years (QALYs) derived from EQ-5D-3L was the health outcome. The cost-utility analysis was from the payer perspective. Cost-effectiveness was assessed using the incremental cost-utility ratio (ICUR) and a threshold of willingness to pay (WTP) of CAD 50,000/QALY in the base case. Sensitivity analysis was performed both with probabilistic sensitivity analysis (PSA) and two one-way sensitivity analyses.

**Results:** Patients in the early surgical treatment group had relatively higher expected costs but had better expected health outcomes. The ICUR was CAD 5,816/QALY gained (95% CI: 730-29,893). Probabilistic sensitivity analysis demonstrated that the likelihood that early surgical treatment is cost-effective was 0.99 at the WTP threshold.

**Conclusions:** Early surgery is cost-effective compared to conservative care in patients with chronic sciatica of 4-12 months. Decision-makers should ensure adequate funding to allow timely access to surgical care.

**Disclosures:**

author 1: none; author 2: none; author 3: none; author 4: no indication; author 5: none; author 6: none; author 7: no indication; author 8: none; author 9: none

## **MINIMALLY-INVASIVE TRANSFORAMINAL LUMBAR INTERBODY FUSION INCREASES LATE-TERM RATES OF PSEUDARTHROSIS VERSUS OPEN APPROACH**

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**Introduction:** Lumbar fusion has developed into an effective surgical treatment option for patients with various lumbar pathologies including discogenic pain, stenosis and spinal instability. Popular minimally-invasive (MI) fusion techniques, such as transforaminal lumbar interbody fusion (TLIF) have been increasingly utilized by spinal surgeons, offering similar clinical outcomes to traditional open approaches and often reporting decreased blood loss and complications in the long-term. Despite a number of reports comparing open versus MI-TLIF, a paucity of literature exists stratifying return to OR (RTO) complications between the two approaches by time after surgery. Therefore, the purpose of this study was to determine the differences in early, late and long-term revision rates between open and MI-TLIF.

**Methods:** A retrospective review was performed to identify all patients between 2012-2018 who underwent one or two level open or MI-TLIF with a minimum follow-up of 2 years. Demographic data was compared between groups. RTO complications were noted and grouped according to categories related to infection, neurologic, fusion status, hardware and global alignment. These complications were then stratified by early (< 6 months), late (6 months-2 years), and long-term (>2 years) time periods. Standard binominal and categorical comparative analyses were performed.

**Results:** A total of 423 consecutive patients were included, 127 in the open TLIF cohort and 296 in the MI-TLIF cohort. There were 67 males and 60 females in the open TLIF group compared to 177 males and 119 females in the MI-TLIF group ( $p=0.180$ ). Mean age was 54.1 years (21.9-79.2). Mean follow-up for the open TLIF and MI-TLIF groups were 67.9 and 69.6 months, respectively ( $p=0.633$ ). The overall RTO rate was 10.8% in the MI-TLIF cohort and 11.8% in the open TLIF cohort ( $p=0.764$ ). The open TLIF cohort had a significantly lower incidence of pseudarthrosis requiring RTO at the late-term time point ( $p=0.042$ ). There were no significant differences with respect to rates of adjacent segment disease (ASD) or any other particular complication requiring RTO. RTO rates at respective time points were 2.4%, 5.7%, and 2.7% for the MI-TLIF group and 5.5%, 0.8%, and 5.5% for the open TLIF group. Subgroup analysis of single level operations only (75 open TLIF vs 255 MI-TLIF) demonstrated a significantly lower incidence of pseudarthrosis and ASD at both the late and long-term time points ( $p<0.001$ ) in the open TLIF cohort, with no significant differences between overall RTO rates or any other complication ( $p=0.333$ ).

**Conclusions:** Open and MI-TLIF have both been shown to provide equivalent long-term clinical outcomes. In this study, patients undergoing open TLIF had significantly lower rates of pseudarthrosis compared to MI-TLIF. Open TLIF should be considered in patients with risk factors for nonunion; however, larger cohort studies are required to corroborate these findings.

**Disclosures:**

author 1: no indication; author 2: none; author 3: none; author 4: none; author 5: no indication; author 6: consultant=Stryker Spine; author 7: consultant=Stryker Spine; author 8: grants/research support=NuVasive

## EFFECT OF INDIRECT DECOMPRESSION TO ADJACENT LEVEL AFTER SINGLE-LEVEL OBLIQUE LATERAL INTERBODY FUSION (OLIF) PROCEDURE

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**Background:** Oblique lateral interbody fusion (OLIF) for treating spinal degeneration has been reported to improve both clinical and radiographic outcome by an indirect decompression of neural structure with preserving posterior spinal structure. However, increasing of disc height, foraminal height and area, restoring of sagittal parameters of surgical level can alter biomechanics that may results in radiographic changes of an adjacent level. Our study analyzed radiographic parameters of adjacent level (above and below) after performing OLIF in L4/5 in patient with degenerative spine disease.

**Purpose:** To investigate the radiographic changes of level above and below after a single level oblique lateral interbody fusion (OLIF) procedure.

**Materials and methods:** Patients with symptomatic L4/5 degenerative spine disease treated with OLIF procedure with percutaneous pedicle screws fixation without direct posterior decompression were included. After an IRB approved, post-operative plain radiograph and MRI at 6 months were done. Comparison of cross-sectional area (CSA), spinal canal diameter (SCD), foraminal area (FA), left and right foraminal height (FH), ligamentum flavum areas (LFA) and diameter (LFD) on MRI and disc height (DH), segmental lordotic angle on plain radiograph of surgical level (L4/5), level above (L3/4) and level below (L5/S1) pre- and postoperatively were done. Correlation of each parameter was analyzed. Degree of facet joint degeneration and disc degeneration were also recorded.

**Results:** Twenty patients were included. Mean age is  $61.2 \pm 7.0$  year-old. Measured spinal parameters were shown in table. Significant decrease of average FH of L5/S1 (mean change  $0.75 \pm 1.5$  mm,  $p < 0.05$ ) was found. Other parameters were not significant. However, FA and CSA trend to decrease both L3/4 and L5/S1. LFA increased in L5/S1 and decreased in L3/4.

Anterior disc height restoration was found to strongly correlated with an increase in SCD ( $r=0.728$ ,  $p < 0.01$ ) and decrease in LFD ( $r=0.517$ ,  $p=0.02$ ) of upper (L3-4) level, with a weak correlation with an increase in posterior disc height of L5/S1 ( $r=0.453$ ,  $p=0.045$ ).

Anterior and posterior DH and CSA at L4/5 increase significantly after surgery (from  $11.19 \pm 4.36$  mm to  $14.3 \pm 2.54$  mm,  $6.89 \pm 2.33$  mm to  $10.12 \pm 2.01$  mm and  $82.76 \pm 24.33$  mm<sup>2</sup> to  $127.82 \pm 29.49$  mm<sup>2</sup> retrospectively).

**Conclusions:** Our study showed a significant decrease in foraminal height of lower level (L5/S1) in early postoperative period (6 months) after OLIF L4/5. Anterior disc height restoration of L4/5 was correlated with an increase of spinal canal diameter and decrease of ligamentum flavum diameter of upper level (L3/4). An increase of spinal neural canal by indirect decompression may affect adjacent level especially the lower level. While treating L4/5 pathology with OLIF procedure, surgeon should be aware of asymptomatic L5/S1 neural compression.

MRI parameters									
parameters	L3/4			L4/5			L5/S1		
	Pre-operative	Post-operative	Mean change	Pre-operative	Post-operative	Mean change	Pre-operative	Post-operative	Mean change
FA (mm <sup>2</sup> )	87.86 ± 23.88	84.9 ± 23.29	-2.96 ± 20.58	Surgical level			93.64 ± 23.59	88.42 ± 26.34	-5.22 ± 14.22
FH (mm)	16.66 ± 2.27	15.96 ± 2.26	-0.7 ± 1.56				14.91 ± 1.86	14.16 ± 1.85	-0.75 ± 1.5
CSA (mm <sup>2</sup> )	131.19 ± 37.04	128.95 ± 35.56	-2.24 ± 15.86				115.41 ± 42.51	108.43 ± 43.85	-6.98 ± 17.79
SCD (mm)	14.46 ± 2.91	14.58 ± 3.09	0.12 ± 1.28				11.71 ± 2	11.88 ± 1.84	0.17 ± 0.83
LFA (mm <sup>2</sup> )	98.73 ± 28.51	94.13 ± 28.05	-4.6 ± 21.56				92.83 ± 21.56	105.75 ± 29.65	12.92 ± 28.82
Plain radiograph parameters									
DH ant (mm)	13.13 ± 3.42	13.63 ± 3.04	0.5 ± 1.8	11.19 ± 4.36	14.3 ± 2.54	3.11 ± 3.49	15.22 ± 3.99	14.55 ± 2.57	-0.67 ± 2.89
DH post (mm)	6.84 ± 1.66	7.07 ± 1.7	0.23 ± 1.38	6.89 ± 2.33	10.12 ± 2.01	3.23 ± 2.4	6.59 ± 1.87	6.81 ± 1.26	0.22 ± 1.46
Disc angulations (degrees)	10.68 ± 3.53	10.83 ± 4.46	0.15 ± 3.18	6.83 ± 5.63	7.8 ± 3.8	0.98 ± 4.58	15.45 ± 6.36	15.55 ± 4.93	0.1 ± 3.58

Table: Measured parameters on MRI; foraminal area (FA), foraminal height (FH), cross-sectional area (CSA), spinal canal diameter AP (SCD) and ligamentum flavum area (LFA) and plain radiographs; anterior disc height (DH ant), posterior disc height (DH post) and disc angulation were shown. Significant differences were ( $p < 0.05$ ) were highlighted in gray.

Disclosures:

author 1: none; author 2: none; author 3: none; author 4: none; author 5: consultant=Medtronic

**HOW BACK PAIN INTENSITY RELATES TO CLINICAL AND PSYCHOSOCIAL FACTORS IN PATIENTS WITH IDIOPATHIC SCOLIOSIS**

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**INTRODUCTION:** Pain intensity score > 3 on the NRS scale has been determined to represent a reliable cutoff point to differentiate patients with IS who have acceptable pain from those who do not.

**OBJECTIVE:** To analyze psychosocial, family and quality of life differences in patients with IS as a function of pain intensity.

**MATERIAL AND METHODS:** Patients with IS, without previous surgery, Cobb magnitude  $\geq 30^\circ$  and age 12-40 years were included in the study. They reported their pain intensity on the NRS, and completed the following questionnaires: Tampa Scale for Kinesiophobia (TSK)-11, SRS-22r, Hospital Anxiety and Depression Scale (HADS), COMI item 7 (work/school absenteeism) and family APGAR. Analysis of covariance was performed to compare means between group PAIN (NRS>3) vs No-PAIN (NRS<3) controlling for the effect of age and the magnitude of the curve.

**RESULTS:** 272 patients were included, 101 patients belonged to the PAIN group (83.4% women, mean NRS 5.3), and 171 patients to NO PAIN group ( 83.4% women, mean NRS 1.1). The PAIN group had higher Cobb angle (48.6° vs 44.6°,  $p=0.025$ ) and were older (20.9 vs 16.5,  $p=0.0001$ ) compared with NO PAIN group.

The PAIN group had lower SRS-22 pain, mental health and subtotal values. Groups did not differ in function or self-image. The PAIN group showed higher levels of kinesiophobia, anxiety, depression, work/school absenteeism and impact on the social/family environment. In contrast, family dynamics was similar between the two groups.

Table 1. Outcomes comparison between patient groups (pain vs no pain)

	PAIN	NO PAIN	P
SRS-22 subtotal	3,28	3,56	0,02
SRS-22 function	3,64	3,83	0,1
SRS-22 pain	3,13	3,58	0,002
SRS-22 image	3,11	3,23	0,3
SRS-22 Mental health	3,24	3,62	0,0001
TSK	23,6	21,7	0,023
HAD anxiety	7,2	4,9	0,0001
HAD depression	3,3	1,9	0,0001
COMI#7	1,34	1,08	0,001
family APGAR	8,58	8,80	0,38

**CONCLUSIONS:** Pain intensity in IS patients is partially related to age and curve magnitude. Independently of these two variables, patients in the PAIN group showed a greater degree of anxiety, depression, fear of movement and poor adaptation to family/social environment, despite seemingly adequate family support. This group of patients had a significantly worse quality of life than the NO PAIN group.

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## TRABECULAR VOLUMETRIC BONE MINERAL DENSITY OF THE OCCIPITAL BONE AT PREFERRED SCREW PLACEMENT SITES MEASURED BY QUANTITATIVE COMPUTED TOMOGRAPHY

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### OBJECTIVE

Occipitocervical fixation commonly includes the use of occipital plates, and bone screws of at least 8 mm length are recommended for adequate screw purchase. The occipital bone often reaches its maximum thickness at the external occipital protuberance (EOP), with the trabecular table accounting for more than one third of total bone thickness. Biomechanical studies showed that unicortical screw fixation at the EOP is as strong as bicortical fixation in other locations, possibly highlighting the influence of the trabecular table on pull-out strength. However, studies that reliably quantify trabecular bone mineral density (BMD) in this area and the upper cervical spine are lacking.

### METHODS

This retrospective study included patients who were referred to the spine service of a single academic institution and underwent non-contrast-enhanced computed tomography (CT) of the cervical spine that included the occipital bone up to the EOP between July 2007 and December 2020. Patients with previous or present fractures or instrumentation at the occipitocervical junction were excluded. Measurements of trabecular volumetric BMD (vBMD) were performed in the midline area, with the region of interest extending 4.5 mm above and below the maximum extent of the EOP, as well as the C1 lateral masses and the C2 vertebral body using asynchronous quantitative computed tomography (QCT). Interclass correlation coefficients (ICC) were calculated to assess the interobserver reliability of occipital and spinal measurements.

### RESULTS

86 patients (female, 37.2%) were included in the final analysis, with a mean age of  $62.3 \pm 13.1$  years (range 30-93 years). Total bone thickness at the EOP was  $16.7 \pm 3.4$  mm (range 9.7-25.9 mm), with a ratio of trabecular to total bone thickness of 0.44. Overall, trabecular vBMD (mean  $\pm$  SD) was significantly higher at the EOP than at C1 and C2 (EOP =  $612.3 \pm 145.8$  mg/cm<sup>3</sup>, C1 average =  $290.3 \pm 66.5$  mg/cm<sup>3</sup>, C2 =  $305.8 \pm 78.8$  mg/cm<sup>3</sup>;  $p < 0.001$ ). A significant strong correlation between trabecular vBMD of C1 and C2 was observed ( $r = 0.744$ ;  $p < 0.001$ ), but only a low correlation between the EOP and C1 ( $r = 0.295$ ;  $p = 0.008$ ) and C2 ( $r = 0.413$ ;  $p < 0.001$ ), respectively. Cervical vBMD was significantly higher in men. In individuals  $>65$  years of age, cervical vBMD was significantly lower, but remained equally high at the EOP. ICC was acceptable for the occipital ( $k = 0.763$ ) and good for the spinal measurements ( $k = 0.860$ ).

### CONCLUSIONS

Although the EOP is characterized by considerable anatomic variability among individuals, the trabecular table in this location has a significantly higher BMD than the upper cervical vertebrae. Furthermore, and in contrast to the cervical spine, trabecular BMD at the EOP remains high in aged populations. These results add to biomechanical evidence and suggest that unicortical screw fixation in this area might be performed independently of patient age, potentially reducing the risk of injury to the venous sinuses.

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