ASSOCIATION BETWEEN CERVICAL DEGENERATION AND SELF-PERCEIVED NON-RECOVERY AFTER WHIPLASH INJURY

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Background: Pre-existing radiological degenerative changes have often been considered not being a risk factor for non-recovery after motor vehicle accidents (MVA) resulting in neck pain. However, results from previous studies are often based on assessment of plain radiography or MRI and little consideration has been taken to facet joints. Further, previous studies have often been lacking a validated scoring system.

Purpose: To investigate association between cervical degeneration on Computed Tomography (CT) and non-recovery after whiplash trauma

Outcome measures: The primary outcome measure was self-perceived non-recovery (yes/no) after 6 months. Secondary outcome measure was self-reported pain (Numeric Rating Scale).

Material and Methods: In this longitudinal cohort study we included 121 patients seeking care at an Emergency Department because of neck pain after MVA, 2015-2017. All patients conducted a valid CT-scan of the cervical spine and completed the follow up after 6 months. Data regarding demographics and health factors were gathered through a web-based questionnaire. The CT-scans were assessed regarding degeneration of the facet joints and intervertebral discs according to a validated scoring system. Binary logistic regression was used to study the association between cervical degeneration and non-recovery.

Results: Moderate facet joint degeneration was associated with non-recovery (aOR 6.7, 95% Confidence interval: 1.9-24.3) There was no association between disc degeneration and non-recovery. Together, facet joint degeneration and disc degeneration were associated with non-recovery (aOR 6.2 (2.0-19.0)). Additionally, moderate facet joint degeneration was associated with high pain level at follow up.

Conclusions: These results suggest a revaluation of the view of cervical degeneration, especially facet joint degeneration, not being a risk factor for non-recovery after whiplash trauma. We hypothesize that whiplash trauma can occasionally be a trigger for manifestation of facet joint mediated pain.

Association between non-recovery and degeneration and other factors. Logistic regression analysis.
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<tr>
<th>Facet joint degeneration</th>
<th>Count</th>
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<th>Adjusted Coef</th>
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<td>3 (53.6%)</td>
<td>&lt;0.05</td>
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<td>Ref</td>
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<tr>
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<tr>
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<tr>
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<td>52</td>
<td>19 (36.5%)</td>
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<td>1.7-4.4</td>
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<tr>
<td>7-10</td>
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<td>18 (58.0%)</td>
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<tr>
<td>Yes</td>
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<td>20 (38.0%)</td>
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<td>0.7-5.3</td>
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C.I. = Confidence Interval, NRS= Numeric Rating Scale, RCT= Randomized Clinical Trial
* missing values n= 3, ** adjusted for all eleven variables in the table

Disclosures:
author 1: none; author 2: none; author 3: none; author 4: none
IMPORTANCE OF THE PREOPERATIVE CROSS-SECTIONAL AREA OF THE SEMISPINALIS CERVICIS AS A RISK FACTOR FOR LOSS OF LORDOSIS AFTER LAMINOPLASTY IN PATIENTS WITH CERVICAL SPONDYLOTIC MYELOPATHY

Byung-Jou Lee, Jin Hoon Park, Sang-Ryong Jeon, Sung Woo Roh, Seung-Chul Rhim
Department of neurosurgery, Inje University Ilsan Paik Hospital, Neuroscience & Radiosurgery Hybrid Research Center, Gyeonggi, Republic of Korea; Department of Neurosurgery, Inje University Ilsan Paik Hospital, Neuroscience & Radiosurgery Hybrid Research Center, Gyeonggi, Republic of Korea; Asan Medical center, Seoul, Republic of Korea

Purpose: To investigate the effect of the preoperative cross-sectional area (CSA) of the semispinalis cervicis on postoperative loss of cervical lordosis (LCL) after laminoplasty.

Methods: A total of 144 patients who met the inclusion criteria between January 1999 and December 2015 were enrolled. Radiographic assessments were performed to evaluate the T1 slope, C2-7 sagittal vertical axis (SVA), cephalad vertebral level undergoing laminoplasty (CVLL), preoperative C2-7 Cobb angle, and preoperative CSA of the semispinalis cervicis.

Results: The T1 slope and the summation of the CSAs (SCSA) at each level of the semispinalis cervicis correlated with LCL, whereas the C2-7 SVA, CVLL, and preoperative C2-7 Cobb angle did not. Multiple regression analysis demonstrated that a high T1 slope and a low SCSA of the semispinalis cervicis were associated with LCL after laminoplasty in patients with cervical spondylotic myelopathy (CSM). The CSA of the semispinalis cervicis at the C6 level had the greatest association with LCL, which suddenly decreased with a LCL of 10°. The best cutoff point of the CSA of the semispinalis cervicis at the C6 level, which predicts LCL >10°, was 154.5 mm² (sensitivity, 74.3%; specificity, 71.6%; area under the curve, 0.828; 95% confidence interval, 0.761-0.895).

Conclusions: Preoperative SCSA of the semispinalis cervicis was a risk factor for LCL after laminoplasty. Spine surgeons should evaluate semispinalis cervicis muscularity at the C6 level when planning laminoplasty for patients with CSM.
TYPE II ODONTOID FRACTURE IN ELDERLY PATIENTS TREATED CONSERVATIVELY: IS FRACTURE HEALING THE GOAL?
Giorgio Lofrese, Antonio Musio, Federico De Iure, Francesco Cultrera, Roberto Donati, Corrado Iaccarino, Pasquale De Bonis
Neurosurgery Division, Cesena, Italy

Purpose: Analysis of functional outcome of elderly patients with type II odontoid fractures treated conservatively in relation to their radiological outcome.

Methods: 50 geriatric patients with type II odontoid fractures were treated with Aspen/Vista collars. On admission, each patient was assessed assigning ASA score, modified Rankin scale (mRS-pre) and Charlson Comorbidity Index (CCI). 12-15 months after treatment, functional evaluations were performed employing a second modified Rankin scale (mRS-post) together with Neck Disability Index (NDI) and Smiley Webster Pain Scale (SWPS). Radiological outcome was evaluated through dynamic cervical spine x-rays at 3 months and cervical spine CT scans 6 months after treatment. Three different conditions were identified: stable union, stable nonunion, unstable nonunion.

Surgery was preferred whenever a fracture gap >2 mm, an antero-posterior displacement >5 mm, an odontoid angulation >11° or neurological deficits occurred.

Results: Among the 50 patients, 24 reached a stable union while 26 a stable nonunion. Comparing the two groups, no differences of ASA (p=0.60), CCI (p=0.85) and mRS-pre (p=0.14) were noted. Similarly, no differences of mRS-post (p=0.96), SWPS (p=0.85) and NDI (p=0.51) were observed between patients who reached an osseous fusion and those with a stable fibrous nonunion. No effects of age, sex, ASA, mRS-pre, fracture dislocation and radiological outcome were discovered on functional outcome. At logistic regression analysis, female sex and high values of CCI emerged associated with worse NDI.

Conclusions: In geriatric type II odontoid fractures pre-injury clinical status and comorbidities overcome imaging in determining post-treatment level of function. Hard collar immobilization led to a favourable functional outcome with mRS-post, NDI and SWPS values diffusely encouraging whatever a bony union or a fibrous nonunion was obtained.

Figure. Dynamic cervical spine x-rays (flexion, A; extension, B) at 3 months and dynamic cervical spine CT-scan (flexion, C; extension, D) settling any doubts on evolutionary instability 6 months after injury.

NECK PAIN RESPONSE TO OPERATIVE INTERVENTION IN PATIENTS WITH DEGENERATIVE CERVICAL MYELOPATHY: RESULTS FROM THE MULTICENTER INTERNATIONAL PROSPECTIVE AOSPINE STUDIES

Michel Schneider, Jetan Badhiwala, Lindsay Tetault, Mary Zhu, Keegan Idler, Michael G. Fehlings
Toronto Western Hospital, Department of Neurosurgery, Canada; University College Cork, Cork, Ireland; St. Michael’s Hospital, Department of Neurosurgery, Canada; University of Toronto, Canada

Background context
Decompressive surgery is increasingly recommended for the treatment of degenerative cervical myelopathy (DCM) as it effectively halts neurological progression and improves functional impairment, disability, and quality of life. Despite the high incidence of neck pain in patients with DCM, there is a paucity of high-quality, prospective studies evaluating the impact of surgery on neck pain outcomes.

Purpose
The objectives of this study are to assess neck pain outcomes at 6, 12 and 24 months following surgery for DCM.

Study design/setting
Ambispective cohort study

Patient sample
From 2005 to 2011, 757 patients with DCM were enrolled in either the AOSpine CSM-North America or CSM-International study at 16 global sites. All patients underwent surgical decompression of the cervical spine and were assessed at 6, 12 and 24 months post-operatively. A total of 664 patients had complete pre-operative pain scores and 497 had pain outcomes at 24-month follow-up.

Methods
As part of the NDI questionnaire, patients were asked to rate their neck pain as none, very mild, moderate, fairly severe, very severe or the worst imaginable. Frequencies and percentages were used to describe pain outcomes at 6, 12 and 24 months following surgery. Paired t-tests were conducted to determine differences in mean NDI pain intensity scores between baseline and 24 months post-operatively. As a further analysis, the percentage of patients who exhibited an improvement, no change, or regression in pain scores was computed for each pre-operative pain intensity group. The association of pre-operative pain severity on improvement in pain was evaluated by univariable logistic regression to derive an odds ratio and 95% confidence interval.

Results
 Compared to the pre-operative incidence of neck pain (79.2%, n=526), neck pain was less frequent at 6 months (67.1%, n=380), 12 months (60.3%, n=324), and lowest at 24 months (52.1%, n=259). Pain intensity was significantly lower 24-months after surgery (mean NDI 1.83 ±1.32; 0.96 ±1.13; p<0.0001). Whereas pre-operatively 130 patients (19.6%) rated their pain as fairly severe, 64 (9.6%) as very severe, and 13 (2.0%) as worst imaginable, at 24 months, only 32 (6.4%) indicated fairly severe, 14 (2.8%) very severe, and 3 patients (0.6%) worst imaginable. At 24-month follow-up, 263 (67.6%) patients exhibited improvement in their neck pain intensity score by at least one point, with 156 (40.1%) reporting no pain at all. Patients who reported more severe neck pain pre-operatively were more likely to have experienced improvement at 24 months (OR 1.8, 95% CI:1.4 to 2.3, p<0.0001).

Conclusion
To our knowledge, this is the first multi-center, international study to demonstrating significant improvements in neck pain up to 24 months after surgical decompression for DCM. Further studies are needed that evaluate important predictors of improvement in neck pain.
Disclosures:
author 1: grants/research support; Swiss National Foundation, Balgrist Foundation Zurich; author 2: none; author 3: none; author 4: none; author 5: none; author 6: not indicated; author 7: none; author 8: ; author 9: ; author 10: ;
TEN-YEAR OUTCOMES OF ONE- AND TWO-LEVEL CERVICAL DISC ARTHROPLASTY: RESULTS FROM A U.S. MULTI-CENTER STUDY

Kee D. Kim, Greg Hoffman, Hyun W. Bae, Andy Redmond, Pierce Nunley, David Tahernia, Robert Jackson, Ali Araghi
UC Davis, Department of Neurological Surgery, Sacramento, CA USA

Background
Short- and mid-term studies have shown the effectiveness of cervical disc arthroplasty (CDA) to treat cervical disc degeneration. Upon completion of the 7-year U.S. Food and Drug Administration (FDA) study, follow-up continued on a subset of CDA patients out to 10 years.

Purpose
The purpose of this study is to report the 10-year outcomes of a multicenter experience with cervical arthroplasty for 1- and 2-level pathology.

Methods
This was a prospective study of patients treated with CDA at one- or two contiguous levels. Upon completion of the 7-year post approval study, follow-up continued to 10 years for consenting patients at 9 high-enrolling centers. The primary inclusion criteria were cervical degenerative disc at one or two contiguous levels and no prior cervical operations. Outcome measures included NDI, VAS neck and arm pain, patient satisfaction, secondary surgery (removals, revisions, reoperations, or additional fixation) and adverse events. Radiographic endpoints included segmental and global range of motion, sagittal alignment, adjacent level degeneration (ALD) and heterotopic ossification (HO).

Results
Ten-year follow-up was obtained from 187 of 231 eligible patients (81%). The longest follow-up was 11.2 years. There were no significant differences in preoperative characteristics between these patients and the original FDA cohort. Ten years after CDA, patients continued to show significant improvement from baseline NDI, VAS neck and arm pain, and neurologic function. Outcomes at 10 years were improved from 7 years for NDI at one (14.2 vs 18.7; p=0.12) and two levels (15.6 vs 19.7; p=0.02). Comparable results were observed for neck and arm pain. There were no significant differences in outcomes between 1- and 2-level CDA at 10 years.

Segmental flexion-extension range of motion remained significantly higher (p<0.01) than preop ROM. Segmental and global ROM, and sagittal alignment were maintained from 7 to 10 years. Clinically relevant ALD at 10 years was not significantly different from the 7-year incidence (p>0.05). The incidence of clinically relevant HO at 10 years was not significantly different from the 7-year incidence for 1-level (30.7% vs 29.6%; p=0.88) or 2-level (41.7% vs 39.2%; p=0.70) CDA patients.

Only 2 subsequent surgeries were reported after 7 years. One patient underwent supplemental fixation at the index level 9.5 years after CDA. The other case was ACDF at a non-adjacent level unrelated to the CDA. Total incidence of subsequent surgery after 10 years was 4.7% at the index level and 3.5% at an adjacent level.

Conclusions
At 10-years, both 1- and 2-level CDA demonstrate sustained improvement of NDI, pain scores, range of motion and sagittal alignment compared to baseline. Progression of ALD and HO from 7 to 10 years was minimal. Our results through 10 years demonstrate that CDA continues to be a safe and effective surgical treatment for patients with 1- or 2-level cervical degenerative disc disease.

Disclosures:
author 1: grants/research support; Vertex, InVivo, Medtronic, Mesoblast, Seikagaku, ZimmerBiomet, consultant; Vertex,
ZimmerBiomet, stock/shareholder; Company = Moelcular Matrix, royalties; Company = Precision Spine ZimmerBiomet, author 2: stock/shareholder; Company = Nanovis, royalties; Company = Nanovis; author 3: grants/research support; Pfizer, Simplify Medical, Inc., Medtronic, Mesoblast, Morley Research, OrthoRebirth, consultant; Stryker, Medtronic, DePuy (J&J, Zimmer, LDR Spine, royalties; Company = Nuvasive, Stryker, Biomet; DePuy (J&J) related to patent; LDR Spine related to patent; Prosidyan, related to patent; author 4: not indicated; author 5: stock/shareholder; Company = Statera Spine, other financial report; Partner, start up company-West End Bay Partners; author 6: consultant; K2M, ZimmerBiomet, Spineology, Vertiflex, Camber Spine, Integrity Spine, Centinel Spine, stock/shareholder; Company = Amedica, Paradigm, Spineology, Camber Spine, royalties; Company = K2M, ZimmerBiomet, Camber Spine; author 7: grants/research support; premia spine, consultant; arthrex, stock/shareholder; Company = fuse medical, desert orthopedic center, royalties; Company = globus, seaspine; author 8: stock/shareholder; Company = Medtronic, royalties; Company = Globus; author 9: grants/research support; LDR, royalties; Company = globus
CERVICAL SPINE ANOMALIES WITHIN THE 22Q11.2 DELETION SYNDROME: RISK AND SCREENING

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Introduction: The 22q11.2 deletion syndrome (22q11.2DS), previously known as the DiGeorge syndrome or velocardiofacial syndrome, is the most common microdeletion syndrome occurring in ~1:3000-6000 children and ~1:1000 pregnancies. This deletion results in a variation of clinical features; including congenital cervical spine anomalies. Based on small case series, the prevalence of cervical spine anomalies is 90.5-100% and radiological screening including flexion extension X rays for all patients with 22q11.2DS is recommended. Yet, the clinical significance of these anomalies and the effect of screenings remains unclear. The objective of this study is to identify the prevalence of cervical spine anomalies in 22q11.2DS in a large cohort including clinical implications.

Methods: All consecutive patients (at least 5.5 years old) with a confirmed 22q11.2 deletion evaluated between January 2014-November 2018 were included. The cervical spine radiograph reports were reviewed for cervical anomalies. Moreover, the need for cervical MRI was determined. Demographics and associated features were analysed (gender, age, congenital heart defect). The means, standard deviation and Odds Ratios(OR) were calculated.

Results: A total of 127 patients with 22q11.2DS were included. The mean age was 10.3 years and 48% were male. Sixty-six percent had at least one cervical spine abnormality. A correlation was found between male patients and congenital cervical spine anomalies (OR: 2.26). Based on the cervical radiographs, four patients (3%) required a cervical MRI; one due to a block-fusion, in order to determine the articulation between C1 and C2 and three because of possible instability. These patients underwent a flexion-extension MRI revealing a stable spine. Nevertheless, one patient that was not thought to have instability developed neurological symptoms without significant trauma, years after initial screening, and required cervical spondylodesis.

Conclusion: In this study we found that the majority (66%) of 127 patients with 22q11.2DS had some cervical anomaly. A higher prevalence was found in male patients. The majority of the anomalies can be regarded as insignificant, since they have no clinical implications. In three patients a flexion-extension MRI was considered necessary based on the radiograph which however indicated a stable spine. Unfortunately the radiological screening could not prevent the occurrence of neurological symptoms in one of our patients.

Disclosures:
author 1: grants/research support; Scoliosis Research Society, small exploratory grant; author 2: none; author 3: none; author 4: none; author 5: grants/research support; National Institutes of Health, Bethesda, MD, USA, employee; Company=Children's Hospital of Philadelphia and Perelman School of Medicine of the University of Pennsylvania, Philadelphia, PA, USA; author 6: none; author 7: not indicated
COMPARISON OF DURAL GRAFTS IN CHIARI MALFORMATION TYPE I DECOMPRESSION SURGERY

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Abstract. Background: Suboccipital bony decompression with duroplasty, to recreate a proper CSF flow between the cranial vault and the spinal canal, is one of the surgical techniques used for Chiari malformation type I treatment. For duroplasty, autologous or non-autologous grafts can be used. The aim of this study was to compare the neurological outcomes and complication rates in surgically treated patients depending upon the type of graft used for duroplasty.

Material and methods: We present a retrospective analysis of 85 patients (65 female and 20 male; mean age 41.7 years) who were surgically treated for Chiari type I malformation from 2003 to 2018. All patients underwent suboccipital bony decompression with duroplasty. Autologous grafts (fascia or epicranial aponeurosis) were used in 40 cases and non-autologous grafts (Dural-repair®, Duragen® or Duragen Plus®) in 45 cases. The long-term outcomes were evaluated with the use of the Chicago Chiari Outcome Scale (CCOS). Complications taken into consideration were CSF leakage, cerebellar subsidence, hematoma, aseptic meningitis, and purulent cutaneous fistula. The average follow-up period was almost 6 years (range 3 to 187 months).

Results: In the group with autologous grafts (AG), 28 (70.0%) patients had significant improvement and stabilization of symptoms, while 12 (30.0%) others deteriorated in the long term. In comparison with the non-autologous group (NG), the results were 35 (77.8%) and 10 (22.2%), respectively (p = 0.46). Mean CCOS for the AG group was 12.27 (functional outcome) and was comparable with the NG group (12.33). Excellent or functional outcome occurred in 27 (67.5%) cases in the AG group and in 33 (73.3%) in the NG group. Impaired or incapacitated outcome occurred in 13 (32.5%) and 12 (26.7%, p = 0.64) cases, respectively. Complication rates in both groups were similar: 7.5% in the AG group and 6.7% in the NG group (p = 1). Six patients had complications, 4 of them (66.7%) required reoperation, 2 in each group (5.0% in the AG group vs 4.4% in the NG group, p = 1). CSF-related complications (pseudomeningocele) occurred in 3 patients, including 1 (2.0%) in the NG group and 2 (5.0%, p = 0.60) in the AG group together with cerebellar subsidence. In the remaining 3 patients, hematoma (2.2%) and purulent cutaneous fistula (2.2%) in the NA group and aseptic meningitis (2.5%) in the AG group were treated.

Conclusions: There are no significant differences in clinical outcomes and complication rates depending on the type of graft used for duroplasty in patients with Chiari type I malformation, and both autologous and non-autologous grafts can be safely used.

PLASTICITY OF THE BRAIN AND PROGNOSTIC PREDICTION IN EVALUATING SPONTANEOUS BRAIN ACTIVITY FOR CERVICAL MYELOPATHY: A RESTING-STATE FMRI STUDY

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<Introduction>
Our previous results indicated functional connectivities using resting-state functional MRI (rs-fMRI) between the visual association area and the right superior frontal gyrus as potential biomarkers for postoperative gain in the 10-second test in patients with cervical myelopathy (CM). In the present study, we aimed to investigate the plasticity in the brain and the capability of prognostic predication by calculating the amplitude of low-frequency fluctuation (ALFF) using rs-fMRI to measure the spontaneous brain activity.

<Methods>
Twenty-eight patients (14 men and 14 women; mean age of 66.5 years) with CM and 28 age- and sex-matched healthy controls (HCs) underwent rs-fMRI (twice for CM patients, before and six months after cervical decompression surgery). The following three statistical analyses were conducted: (i) ALFF comparisons between preoperative CM and HC; (ii) postoperative ALFF changes in CM; and (iii) correlation analysis between preoperative ALFF and clinical scores. Clinical outcomes in the CM group was assessed using the 10-second test, the Japanese Orthopaedic Association extremity motor (JOA-UEM) score, and Japanese Orthopaedic Association Cervical Myelopathy Evaluation Questionnaire upper-extremity function (JOACMEQ-UEF) score before and 6 months after surgery.

<Results>
Neurological examination 6 months after surgery revealed a significant improvement in the 10 second test, the JOA-UEM, and the JOACMEQ-UEF (p < 0.001). The CM group had a significantly higher ALFF in the bilateral primary sensorimotor cortices (the precentral gyrus and postcentral gyrus) and left visual association area compared with the HC group. In contrast, the CM group had a significantly lower ALFF in the bilateral posterior supramarginal gyrus (Figure). After masking based on the difference in preoperative ALFF (CM > HC), the decrease of ALFF was observed in the bilateral primary sensorimotor cortices and left visual association area postoperatively. In correlations between preoperative ALFF and clinical score changes in the CM group, the bilateral frontal pole and the left inferior frontal gyrus region (pars opercularis) showed significantly positive correlations with the JOACMEQ-UEF.

<Conclusion>
Preoperative higher ALFF and postoperative decrease of ALFF in the primary sensorimotor cortices may explain plasticity of the brain for CM patients. Moreover, similar changes in the visual association area may demonstrate plasticity in the preoperative decreased functional connectivities between the visual association area and the right superior frontal gyrus which was observed in our previous study. Our analyses indicated that the bilateral frontal pole and the left inferior frontal gyrus showing significantly positive correlation with JOACMEQ-UEF may be potential biomarkers to predict postoperative recovery.

<Figure Legends>
R, right; L, left; PreG, precentral gyrus; PostG, postcentral gyrus; pSMG, supramarginal gyrus (posterior division).
Disclosures:

A. CM > HC

B. CM < HC
A CLINICAL PREDICTION MODEL FOR THE RECOVERY OF WHIPLASH-ASSOCIATED DISORDERS

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Background: Whiplash-associated disorders (WAD) is the most common traffic injury. However, predicting the prognosis of WAD is challenging for health care providers, insurers and policy makers. Our inability to predict who will recover from WAD limits our ability to identify patients who are at risk of developing persistent pain and disability. Clinical prediction models are tools developed to assist clinicians with the prediction of clinical outcomes. However, few clinically relevant validated models are available to assist clinicians predict the recovery of patients with acute WAD.

Objective: We aimed to develop an evidence-based clinical prediction model to predict self-reported recovery and insurance claim closure from WAD.

Study Design and Setting: Our study included two cohorts of patients with acute WAD (≤ 21 days). The development cohort included 4923 participants from Saskatchewan and the validation cohort included 340 participants from Ontario. The outcomes were self-reported recovery and time to claim closure within the first year after the injury. The candidate predictors was selected from a systematic review of the literature. We used Cox regression to build models in a cohort of Saskatchewan adults. The models were internally validated using bootstrapping and externally validated in Ontario cohort (n=340). We used C-statistics (95% CI) to describe predictive ability.

Results: Participants from both cohorts were similar at baseline. Two thirds of participants were female, half were married, most were employed (84.1%) and most presented shortly post-collision (9 days in Saskatchewan [range 0-21]; 6 days in Ontario [range 0-25]). Participants had a mean age of 38.3 (s.d. 15.1) years in Saskatchewan and 40.5 (s.d. 13.2) years in Ontario. The mean baseline neck pain was 6.5/10 (s.d. 2.1) in Saskatchewan and 5.7/10 (s.d. 13.2) in Ontario and the 12-month follow-up rate was 84.4% in Saskatchewan and 78.8% in Ontario. Finally, median time to self-reported recovery was similar (95 days in Saskatchewan and 98 days in Ontario).

Our prediction model for self-reported recovery included prior traffic-related neck injury claim, expectation of recovery, age, percentage of body in pain, disability, neck pain intensity and headache intensity (C=0.64; 95% CI 0.63-0.65). The prediction model for claim closure included prior traffic-related neck injury claim, expectation of recovery, age, percentage of body in pain, disability, neck pain intensity, headache intensity and depressive symptoms (C=0.64; 95% CI 0.63-0.65).

Conclusion: Our prediction models are useful to health care practitioners and insurers because they can predict time to recovery and time-to-claim closure. Although their predictive ability is could be improved, their performance is better than chance. Considering that the predictive ability of clinical judgment alone is unknown, using our predictive model could improve clinical care.

Disclosures:
author 1: grants/research support; Ontario Ministry of Finance and the Financial Services Commission of Ontario, other financial report; Canadian Institutes of Health Research - Canada Research Chair Program; author 2: none; author 3: none; author 4: none; author 5: none; author 6: none
RESULTS OF THE SURGICAL TREATMENT OF ATLANTOAXIAL METASTATIC TUMOURS; A SINGLE CENTRE CASE SERIES OF 35 CONSECUTIVE PATIENTS.

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Introduction:
Tumours of the cervical spine are rare in comparison to the thoracic and lumbar regions. Tumours at the atlantoaxial region are difficult to be surgically accessed because of their location and complex anatomic relations.

Material and methods
A retrospective review of the surgical records in a single spine surgery centre between 1994 and 2016 was performed. A series of 35 consecutive patients who were surgically treated for metastatic atlantoaxial tumours was identified. The imaging studies and medical records were evaluated. The location and extent of the tumour were defined, and the surgical management was analysed.

Results
There were 23 males, and 12 females, the mean age at surgery was 50.7 ± 12.5 years. C2 affection was in 20 cases, C1 in 8 cases, while in 7 cases both C1 and C2 were affected. In 6 patients a preoperative incomplete neurological deficit was recorded (ASIA (C) in 4 patients and cervical myelopathy in 2 patients), while in 29 patients the indication of surgery was cervical pain and instability with pathological fractures. Preoperative mean VAS was 7.6 ± 2.1 and NDI was 18.4 ± 4.3.

The surgical approach was combined anterior trans-oral tumour resection with decompression of the spinal cord and posterior cranio-cervical fixation in 21 cases, and in 14 cases posterior tumour resection and fixation was performed. The mean operative time was 247 ± 60.6 minutes and the mean blood loss was 700 ± 435 ml. There were no intraoperative complications.

The primary tumour was bronchial carcinoma in 10, breast cancer in 6, renal cell carcinoma in 4, plasmacytoma in 4, tongue angioleomyoma in 3, Prostate Cancer in 3, colon carcinoma in 3 patients, and in 2 patients the primary tumour was not identified. The mean follow-up was 18 ± 12 months. 8 patients (22.8%) died due to advanced malignancy within the first 6 months after surgery, they had other metastatic lesions on presentation. 2 weeks postoperatively the VAS was significantly improved to 3.7 ± 2.8 and NDI to 10.8 ± 4.3 (p=0.03 and 0.05 respectively). Neurological improvement was observed in 3 of the 6 patients. Reoperation was necessary in 4 patients, three of them underwent a second anterior transoral resection after primary posterior only approach, and in one patient posterior revision was performed due to wound dehiscence.

The mean documented survival rate was 18 ± 12 months, that could be significantly more because many patients did not attend the recommended follow up visits.

Conclusions
Surgical treatment of the atlantoaxial metastasis is safe and significantly improves the quality of life of the affected patients. Transoral approach provides excellent access and visualisation of the anterior elements of the atlas and axis vertebrae which are most commonly affected regions in metastatic cranio-cervical disease. Life expectancy of the patients are not negatively affected through the surgical intervention in case of cranio-cervical metastasis.

Disclosures:
author 1: none; author 2: none; author 3: none; author 4: none; author 5: royalties; Company=Medicon eG, Tuttlingen, Germany