ROUNDUP360

Spine

Just how common is lumbar spinal stenosis?

Symptomatic lumbar spinal stenosis is the hip osteoarthritis of the spinal community. Seen in just about every clinic the world over, patients present with significant recalcitrant pain and can often be all but cured with relatively straightforward surgery. Despite the ubiquitous nature of the condition, there is a relative paucity of high quality data surrounding the frequency and prevalence of lumbar spinal stenosis (LSS) in the general population. Researchers in **Fukushima (Japan)** set out to estimate the prevalence of LSS at a population level. The researchers undertook a stratified cross-sectional population study using a questionnaire survey administered to 4400 subjects selected from residents aged 40 to 79 years in Japan by stratified two-stage random sampling method. The research team carefully constructed their questionnaires to consist of questions aimed directly at lower limb symptoms suggestive of LSS, and the self-administered diagnostic support tool for LSS (LSS-DST). The researchers also collated demographic, lifestyle and comorbidity information from the study sample. Psychological health was assessed using the Japanese Perceived Stress Scale (JPSS), and the Mental Health Index 5 (MHI-5). The return rate was just over 60%, meaning 2666 subjects returned completed questionnaires. The mean age was 60 years and 47% were male. Using the LSS-DST criteria, 153 (5.7%) of the population had symptoms specific for LSS. As would be expected, the prevalence in this sample increased with age and peaked at age 70 to 79 years, irrespective of gender. Factors associated with symptoms of LSS included diabetes mellitus, urological disorders, and osteoarthritis or previous fracture, as were depressive symptoms (although causal association is unclear).[1] While unlikely to change the world, establishing the prevalence of disease is extremely important in healthcare planning. There is the potential for overestimation of prevalence with this study methodology as patients with symptomatology are far more likely to return their questionnaires.

How much will they bleed?

Multilevel spinal fusion surgery is fraught with difficulty. Not only can the surgery be challenging, but the large exposures and multilevel instrumentation required for some surgical procedures can result in significant blood loss. There are currently no well-researched studies to predict the requirement for transfusion that could be used to guide the need for autologous blood donation pre-operatively. This is particularly troublesome in fusion for adolescent idiopathic scoliosis. Researchers in **New York (USA)** designed a retrospective prognostic study to identify risk factors for significant blood loss during spinal fusion for adolescent idiopathic scoliosis (AIS). Using a series of 340 consecutive AIS patients (81 males, mean age 15.2 years) treated by a single surgeon, a retrospective analysis of all available demographic, patient and surgical factors was undertaken to develop a risk model. Details included in the model were demographic (gender, age, height, weight, and associated comorbidities), laboratory (haematocrit, platelet, PT/PTT/INR), standard radiographic, and peri-operative data including complications. Mean estimated blood loss was 907 ml for posterior fusion and lower at 323 ml for anterior fusion. A stepwise linear logistic model identified gender, operative time, and pre-operative kyphosis to be the most important predictors of increased blood loss in posterior spinal fusion for AIS. Mean arterial pressure and operative time were predictive of estimated blood loss in anterior spinal fusion.[2] These factors have been used by the authors to produce a comprehensive risk model which can be used to estimate blood loss pre-operatively.

C5 palsy associated with stenosis

C5 level palsy is not an uncommon complication after cervical laminoplasty. Despite the relative frequency of occurrence, it is not yet completely clear which patients are at risk of such events. Surgeons in **Niigata (Japan)** undertook a retrospective study in an attempt to establish which pre-operative variables were most closely associated with a post-operative C5 palsy. They analysed the complications, pre-operative scans and medical records of 141 consecutive patients, all of whom underwent an open-door laminoplasty for cervical myelopathy over a three-year period. The authors paid particular attention to a number of pre-operative MRI variables, including the level of cord compression; level of cord high signal; new post-operative high cord signal, and the diameters of the C4/5 and C5/6 foramens. There was a 6.4% (n = 9) incidence of C5 palsy post-operatively, a remarkably low incidence rate, making the results potentially subject to normal variation. The authors established no differences in gender, age, diagnosis, operation time, blood loss, level of spinal cord compression, level of T2 high-signal lesion, or new T_2 high-signal lesions between the two groups. However, they did note a higher rate of large C4/5 foramen in the uncomplicated group (mean 2.76 mm *versus* 1.99 mm). The authors conclude that a tight foramen is likely the main aetiology for post-operative C5 palsy.[3] While the results certainly support this hypothesis, it is important to remember this conclusion is based on just nine events.

Atlanto-axial dislocations revisited

The volume of pathology presenting to the major hospitals in China is simply staggering. This large number of patients has allowed our Chinese colleagues to shed new light on relatively rare pathologies. Surgeons in **Beijing (China)** have done precisely this and reviewed their experience of over 900 atlanto-axial dislocations. This staggering

number of cases has been collected over a 12-year period, and the authors describe a novel classification and treatment algorithm based on a combination of dynamic radiographs, CT scans and attempted reduction with skeletal traction. Their algorithm suggests posterior reduction and fusion for type I and II dislocations, conversion of a type III (irreducible) to a type II with a transoral atlanto-axial release and treatment of type IV (bony dislocation) with a transoral decompression and subsequent posterior fusion. The authors were able to present a wide spread of patients (472 Type I, 160 Type II, 268 Type III, 4 Type IV) with a minimum two-year follow-up (mean 60 months). The surgical team achieved a sound fusion in 99.4% (n = 899) and reduction in 98.7% (n = 892). Improvement of neurological symptoms was seen in 84.1% (n = 512/609) and a low complication rate of just 9.1% was reported.[4] These authors have been able to achieve an excellent outcome for their patients with a simple stepwise algorithm and supported their clinical practice with the largest series of these injuries we are aware of in the literature.

3D predictors of progression in scoliosis

Scoliosis is a three-dimensional problem imaged (usually) in two-dimensional plains. Taking the decision to operate on an adolescent with idiopathic scoliosis revolves around a number of factors, but often what the patient and their parent/guardian wish to know is whether it will get any worse. There are a number of potential prognosticators for scoliosis with the Cobb angle and Risser stage being the most widely used. However, these only take into account a single plain and are not especially accurate. Researchers in **Québec (Canada)** set out to establish if there were any suitable 3D morphological parameters that were predictive of eventual progression in immature adolescent idiopathic scoliosis (AIS). Two separate cohorts formed the basis of this study; a surgically corrected group (n = 19) and a second group who reached skeletal maturity without the requirement for corrective surgery. Using 3D reconstruction, the research team measured a number of potential predictors for progression: Cobb angles (scoliosis, kyphosis, lordosis), 3D wedging (apical vertebra, mean two apical discs), rotation (upper and lower junctional vertebra, apical vertebra, and disc), torsion, and slenderness (height/width ratio of T6, L4, and T1-L5). The researchers were unable to establish any differences between the groups with regards to age, 3D Cobb angle, lordosis, and kyphosis.

However, mean 3D wedging (apical disks), lower junctional vertebral axial rotation, torsion and T6, and whole spine height/width ratio were all significantly different between the two groups.[5] Although this is a small series (and with the arbitrary end point of surgery, not a defined radiological progression), it is interesting to see that the most widely used measures were not those that predicted most accurately the requirement for surgery. Given that the majority of patients these days will have at least a baseline spine CT when presenting with AIS, it seems sensible to use all the information available. A larger study with a more robust statistical analysis would be helpful here to establish the threshold values for those variables potentially predictive of change.

No difference in outcomes by surgical approach for fusion

Posterior lumbar spinal fusion can be approached through either a midline or paraspinal approach. There is little to choose between the two in the literature, but there are fervent proponents of both. Researchers in **Minneapolis (USA)** undertook a prospective randomised, single-blinded comparative study of the two approaches. They included patients with advanced two-level lumbar degenerative disc disease (DDD). Patients were randomised to either paraspinal approach (25 patients) or midline approach (25 patients). The skin incision was identical and patients were blinded to the fascial incision and subsequent exposure to the posterior spine. Operatively, all patients underwent intertransverse and facet joint fusions with pedicle screw instrumentation. Outcomes were assessed using a VAS score, pain drawing and the Oswestry Disability Index. In addition, patients were approached for self-assessment of the procedure success. Post-operative magnetic resonance image (MRI) scanning was obtained, including the paraspinal muscles. Like so many randomised controlled trials, there was apparently no difference in operative time, blood loss or any intra-operative parameter. Both groups exhibited significant clinical improvement for all outcome scales and there was no difference between the two groups. Post-operative MRI T_2 relaxation values were significantly increased at the operative levels and distally, but the changes were similar for both groups. There were no noted differences between the two groups in this study with over five years of follow-up. However, the groups are small and without a formal power analysis it is impossible to say if the trial is subject to a type II error.[6]

Cervical balance changes after thoracolumbar surgery

Much has been made in recent years of the compensatory changes in both balance and hypermobility that occur in adjacent segments of the mobile spine following fusion surgery. Particular attention has been paid to the potential for adjacent segment degeneration and unbalancing of minor curves in scoliosis. However, there is very little known about the effects of surgical correction of thoracolumbar deformity on the mobile cervical spine. Researchers in **Seoul (South Korea)** aimed to identify changes in cervical alignment as a direct result of thoracolumbar correction. They designed a simple 49-patient retrospective case series and conducted a study based on the changes between their pre- and post-operative planning and check films. The research teams used the sagittal vertical axis (SVA) as a surrogate marker for cervical spine alignment and divided the cohort into two groups based on their pre-operative assessment into those with slow SVA (≤ 6 cm) and high C7 SVA (≥ 9 cm). The team then used a multilinear regression analysis to establish any statistical relationships between post-operative cervical lordosis and pre-operative spinopelvic anatomy and surgical plan. In patients with a low pre-operative C7 SVA, the cervical lordosis significantly increased after deformity correction. In contrast, the high SVA group demonstrated a significantly decreased lordosis post-operatively. A number of co-variates were found to influence post-operative lordosis, including pre-operative C2-7 angle, T1 slope, the surgical plan and, of course, the C7 SVA.[7] This article highlights a potential long-term spinal balance problem that is currently under-recognised. The consideration of the cervical balance, and paying particular attention to those factors known to influence the eventual outcome will, we are sure, play an increasingly important role in the future.

Spinal surgeons first in space

As man pushes further and further into the cosmos, one of the challenges that will continue to arise is the need to provide comprehen-

sive healthcare or at least telemedicine advice to crews manning deep space missions, and even living currently on the international space station. While perhaps not the imaging modality of choice, astronauts and researchers have recently evaluated the use of ultrasound in orbit. With low data size images and small physical footprint, ultrasound may well become the diagnostic tool of choice as man continues to explore near space. The first 'point of care' imaging has been undertaken using non-expert operator astronauts, to provide accurate anatomic information about the spine in long-duration crew members in space. Following brief ultrasound instruction on the ground, astronauts were able to perform in-flight cervical and lumbosacral ultrasound examinations using a just-in-time training methodology linked to remote expert tele-ultrasound guidance. Crew members obtained diagnostic-quality examinations of the cervical and lumbar spine.[8] Although it is not relevant to the majority of our general practices, the authors make a valid point that this technique may be easily extensible to point-of-care situations in emergency departments or remote areas where direct access to diagnostic suites is limited or non-existent.

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