X-ref ***For other Roundups in this issue that cross-reference with Spine see: Children's orthopaedics Roundups 1, 2, 3 & 4; Research Roundup 6***

Lumbar spine paraspinal muscle and intervertebral disc height changes in astronauts after long-duration spaceflight on the International Space Station

On a recent editorial board trip to Namibia, we found ourselves staring at the stars and wondering if the field of spinal pathology will benefit from our ongoing space exploration. Tangential, yes, but if the future of mankind in space is to be realized, then the spine needs its due consideration. Fortunately, recent forays to the International Space Station (ISS) have led to a group in **San Diego, California (USA)** and the **International Space Station** reporting some interesting research into the effect of long-duration space travel on the cross-sectional area of the paraspinal musculature and heights of intervertebral discs at the L2/3 level.[1] The spine has long been neglected and, although the effects of weightlessness are well known within the rest of the body, particularly the hypercalcaemia seen with weightlessness, there are also some cohort data that suggest that astronauts have a 4.3-fold increased risk of disc prolapse. This group used a cohort of six astronauts, each of whom spent at least six months at the ISS. T2-weighted MRI imaging of the lumbar spine was performed pre-flight, within two days of landing post-flight, and again up to two months post-flight. Previous studies reveal that spine pain is endemic in astronauts, with a prevalence of up to 100% even in short duration flights. This study showed that paraspinal musculature decreased in size by 14% when compared with pre-flight size, and that this recovered by 9% in the two months after returning to Earth. This effect is even more dramatic when lean muscle mass is considered, where a reduction of 19% is found between the pre- and post-flight cross-sectional area, with a 68% recovery within two months of returning to Earth. Somewhat surprisingly, disc heights did not change in the lumbar spine, and no discernible pattern between pre- and post-flight disc heights were found. The implications of this study for terrestrial medicine are at present elusive. However, if humankind is to function after long journeys in microgravity, subsequent long-distance space travel will need to address the lumbar weakness, evidenced by this study, through modified exercise regimes.

A Bug's Life: *Propionibacterium acnes* in the cervical spine

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Since 2013, it has been established that infection with *Propionibacterium acnes* (*P. acnes*) has had a role in disc herniation and subsequent low back pain. The shoulder surgical literature is rife with reports of *P. acnes*, with everything from early loosening in joint arthroplasty to chronic pain following shoulder interventions and poor functional outcomes laid at the door of this indolent infection. Similarly, infection with the same pathogen has been found to be relevant in the aetiology of discitis, discogenic back pain, and sciatica. However, it remains to be seen whether infection is ubiquitous throughout the spine when disc herniations are present, or whether different regions of the spine show a different distribution of infection. A group from **Tabriz (Iran)** have studied this phenomenon to determine whether infection at the site of symptomatic disc herniations at different levels of the spine vary.[2] The group recruited a consecutive series of 145 patients with single cervical or lumbar disc herniation who underwent discectomy and cultured disc biopsies specifically for *P. acnes* in Columbia blood agar for seven days at 37°C. Patients with diabetes, previous spinal instrumentation, or epidural steroid injection were excluded. The phenotypic identification of the pathogen was through polymerase chain reaction (PCR); it is worth bearing in mind that, although incredibly accurate, PCR is also incredibly sensitive and, as such, picks up subclinical infection and contaminants. *P. acnes* was identified in 36% of patients with cervical disc herniations and 38.3% of patients with lumbar disc herniation. Overall, 37.9% of patients showed evidence of *P. acnes* infection in disc fragment samples. No significant differences were found in the distribution of *P. acnes* infection by spinal region; however, between lumbar levels there was a higher incidence of infection in the more cranial lumbar levels. This study ably demonstrates that although *P. acnes* is present in a proportion of herniated discs, it is by no means the sole cause of disc herniation, and that its uniform distribution between spinal segments suggests that biomechanical considerations still have a principal role. The study was not set up to identify other pathogens that previous studies have indicated could have a role in the aetiology of disc herniation, and so this work forms part of a wider compendium in the explanation of a microbiological cause for this common disease process. It is potentially an important piece in the puzzle.

Swallowing hard: cervical spine surgery and dysphagia

Dysphagia is a common complication following anterior cervical spine surgery, with a reported incidence of up to 88% immediately after surgery. While temporary dysphagia is not in itself worrying, there are patients who go on to have persistent problems, which really can be a quality-of-life issue. The authors of this study from **Beijing (China)** performed a systematic literature review to determine the risk factors and potential preventative measures for post-surgical dysphagia.[3] They undertook a thorough literature review and identified 59 studies that met the relevant criteria, ranging from level I to level IV evidence, although only three studies were level I. The authors carried out the review with the intention of identifying patient and other risk factors associated with temporary and persistent dysphagia following anterior spinal surgery. Several risk factors were found to be clearly associated with dysphagia, including prolonged surgical time, use of recombinant human bone morphogenetic protein (rhBMP), the presence of elevated endotracheal tube (ETT) cuff pressure, cervical plate type (smoother and lower profile plates are better), tobacco-smoking, injury to the superior or recurrent laryngeal nerves, and a change in postoperative prevertebral soft-tissue swelling greater than 5 mm. One of the more interesting findings of this review comes from two studies that found that prevertebral soft-tissue swelling, as well as dysphagia, reduced with perioperative steroid administration. Large increases in cervical lordosis were also seen as a risk factor for dysphagia, and this was thought by the authors to be due to associated compression on the posterior pharyngeal wall, reducing the pharyngeal space. Patients with a psychiatric history were also at risk and the authors suggested that this was due to a tendency to 'over-report' their symptoms, and that this group should be given extra support prior to surgery. Other identified factors included multilevel and revision surgery, gender, and elevated body mass index (BMI). Cranial levels were also identified by eight studies, although a single study suggested mid-cervical levels were a risk factor.

Three studies compared anterior cervical fusions with disc replacements and found the latter to be a lower risk for dysphagia. This review is a useful resource during the consenting process, so that patients can be appropriately counselled and the surgeon can be prepared with risks mitigated where possible. Dysphagia remains a significant risk following cervical surgery even when there is a clear focus on it.

Practice makes perfect in lumbar spine surgery

■ Practice makes perfect, but what are the minimum numbers required for a spine surgeon to maintain their skills and remain competent? There has been much focus on arthroplasty in recent months, with papers suggesting that between 30 and 40 cases a year are needed for surgeons to remain competent and avoid a higher complication rate. A group from **Boston, Massachusetts (USA)** looked at surgical volumes and how they may affect outcomes for four lumbar procedures: discectomy, decompression, lumbar interbody fusion, and posterolateral fusion.[4] The authors investigated the relationship between surgeon volume and complications, including readmission within 90 days. This is a registry study in which the authors used the Florida Statewide Inpatient Dataset to answer the question, and this registry contained 187 185 procedures meeting the inclusion criteria. The authors selected 90 days as their follow-up, and the development of a complication or hospital readmission was the measure of surgical outcome. Each surgeon within the series was subject to a spline analysis, with individual surgeon volume plotted against complications and readmissions. The authors also accounted for case-mix by adjusting for known covariates. The relationship between volume and complications was then established through use of spline cut-points and log-binomial regression analysis. The volume 'cut-off' per year was found to vary somewhat by procedure. The authors suggest that, annually, at least 25 decompressions, 40 discectomies, 43 interbody fusions, and 35 posterolateral fusions were needed to reduce complications. For surgeons who did not meet these volumes, there was a 63% increase in complications for decompressions, a 56% increase for discectomies, a 15% increase for interbody fusions, and a 47% increase for posterolateral fusions. This study has several implications. First, it reinforces the growing trend in orthopaedics, as in other surgical fields, towards subspecialization, and makes it harder to justify the 'general' orthopaedic surgeon doing the occasional spine procedure. Second, it gives the individual surgeon a target to work towards in order to maintain their skills and ensure safe practice: a mean per month of four discectomies and interbody fusions, three posterolateral fusions, and two decompressions.

Pain expectation in scoliosis

■ Managing expectations and addressing both patients' and parents' concerns are part and parcel of any paediatric surgical practice, and there is evidence that addressing concerns in the preoperative period will result in better postoperative outcomes. Surgeons in **Los Angeles, California (USA)** have surveyed patients undergoing treatment for adolescent idiopathic scoliosis, as well as their parents, in order to determine their 'fears and concerns' about surgery at the time of their preoperative appointment.[5] Interestingly, their treating surgeons were also surveyed to find out their concerns regarding treatment. A total of 48 patients and parents took part, with a mean patient age of 14.2 years. Patients and parents were asked to rate concerns on a scale of 0 to 10, and, in addition, procedural complexity was also rated 0 to 10, which was predicted by the surgeons. Understandably, mean parental concern was greater than that of the patients (6.9 *versus* 4.6), but there was no correlation of preoperative concern with how the surgeon rated the complexity of the procedure. The appeal of this study is how it reveals the differences in perception of concern between the three groups. The top three concerns for patients were pain (25%), ability to return to activities (21%), and neurologic injury (17%), whereas for parents it was pain (35%), neurologic injury (21%), and amount of correction (17%). For surgeons, the top three concerns were postoperative shoulder balance (44%), neurologic injury (27%), and the lowest instrumented vertebrae selection (27%). This paper really does give an insight into the hopes and concerns of patients, parents, and surgeons prior to embarking on corrective surgery for adolescent scoliosis. The take-home message for surgeons is how little overlap there is between their concerns and those of their patients and the patients' parents. Pain is a key concern but was very rarely mentioned by surgeons, and studies like this should influence the preoperative care and information provided in what is a stressful time for families.

Timing balloon kyphoplasty: hitting the sweet spot X-ref

■ Lumbar compression fractures are a common and disabling condition. Although the majority do eventually heal, it takes about three months to achieve solid bony union, and, in reality, this is often not without residual pain and deformity. Balloon kyphoplasty has the potential both to correct deformity and to relieve pain, although, in practice, results have been mixed and not always reproducible between series. In this study, surgeons from **Osaka (Japan)** set out to establish if there were any perceivable differences in the short- and long-term clinical and radiological outcomes dependent on the timings of balloon kyphoplasty.[6] The authors report the outcomes of 72 consecutive patients, all treated with balloon kyphoplasty over a four-year period. The patients were arbitrarily divided into two cohorts: the early (less than two months) and later groups. Of the 72 patients, there were 27 (38%) who underwent early kyphoplasty, and there were some differences between the two group, with the late group having greater angular motion and loss of vertebral height prior to the kyphoplasty, which is what would be expected. The final outcomes demonstrated significantly better visual analogue scale (VAS) scores in the early than in the late group (19.9 *versus* 30.4), and better preservation of the correction in the early group at final follow-up. It certainly looks as though it's better to perform kyphoplasty early before the fractures are healed, and that this both improves correction and pain relief. It is perhaps therefore necessary in those units who are performing kyphoplasty to consider whether the procedure should be performed with urgency in order to ensure the best possible outcomes for patients.

BMP-2: safe or not? X-ref

■ Following the debate surrounding bone morphogenetic protein (BMP) in orthopaedic surgery has been a rollercoaster, to say the least. The discovery of BMPs, along with other matrix proteins, in the last century was felt to be the breakthrough needed to improve union rates, treat nonunions, and potentially even hasten fracture healing. Despite early promise and strong basic science, there has been a somewhat mixed picture for the use of BMPs in clinical

practice since their introduction. Although there is still much enthusiasm within the surgical fraternity, concerns surrounding excessive bone formation and the possibility of tumorigenesis have somewhat tempered this, and, in the absence of any definitive clinical trials proving efficacy, there is certainly less and less appetite for the use of BMPs as time passes. We were delighted to see this systematic review from **London (UK)**, which tackles the rather difficult dual questions of safety and efficacy based around the published reports in the indexed literature.[7] The review team's search included all published reports about spinal fusion where the fusion rates were assessed using either plain film or cross-sectional imaging. A total of six studies were deemed suitable for inclusion in the review, reporting the outcomes of 203 patients. Of these, there were four comparisons of bone graft *versus* BMP-2, and two reporting the outcomes of BMP-assisted fusion alone. The bottom line from this study is that BMP-2 appears safe to use (with no increase in the reported rates of complications over bone graft); however, it also appears ineffective, with no differences in the reported rates of radiological union at 24 months of follow-up. The authors conclude that "BMP-2 is safe and effective" but offer the caveat that this is really only suitable for clinical use when bone graft is contraindicated. We are, of course, somewhat struggling to think of a clinical situation in which bone graft is contraindicated but BMP could be of use. The state of play appears to be that, at present, the only difference between BMP and other forms of bone graft is really the cost.

Magnetic growing rods and the law of diminishing returns **X-ref**

■ Magnetic growing rods are a rather attractive option in the arsenal of the paediatric scoliosis surgeon. Offering the advantage of familiar instrumentation and the ability to harness the powerful correction provided by pedicle screw instrumentation, the growing rods afford the added benefit of allowing for spinal growth, and thereby not limiting stature or running the risk of complications seen in patients with long segments of fusion. Magnetic growing rods potentially offer a range of benefits over the traditional growing rods, which require multiple operations to achieve their growth and often seem to be governed by the law of diminishing returns. Surgeons in **Oxford (UK)** sought to determine how this conventional wisdom fits with magnetic growing rods over a series of distractions.[8] The authors report the outcomes of a total of 35 patients with variable follow-up to a maximum of nearly five years. The study focuses on the comparison of true distraction (TD) (defined at the expansion gap measured on fluoroscopy) and intended distraction (ID). Over a mean follow-up of 30 months, there was a decrease in the TD/ID ratio. This was seen with both convex and concave rods and the mean ratio decreased from 0.81 to 0.17 with convex rods, and 0.93 to 0.18 with concave rods. This clearly indicates that the law of diminishing returns is seen after serial distraction using magnetic growing rods. However, there were also some further conclusions that the authors were able to make from their series. The diminishing returns were linear with a gradual decline in lengthening, and are associated with a reduced distraction ratio in older, heavier children.

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Trauma

X-ref ***For other Roundups in this issue that cross-reference with Trauma see: Foot & Ankle Roundup 4; Wrist & Hand Roundup 8; Shoulder & Elbow Roundups 1 & 2; Spine Roundup 6; Oncology Roundup 2; Research Roundup 7***

Postoperative CT in acetabular fracture reliably predicts hip survivorship

■ Pelvic and acetabular surgeons have a reputation for being fastidious about their surgery and for spending long periods of time in the operating theatre seemingly chasing the 'perfect' reduction. Despite this focus on surgical excellence, there is often a single common pathway for severe acetabular fractures in the end: that of total hip arthroplasty (THA). Although acetabular surgeons maintain that a perfect anatomical reduction improves outcomes, there has been precious little to support this perspective, and with postoperative radiographs often obscured by plates and screws, it has been somewhat tricky in the past to prove or disprove this widely held belief. Surgeons from the Hospital for Special Surgery in **New York, New York (USA)** have set out to prove the widely held belief that reduction really does matter.[1] The surgical team included 211 patients, all of whom had undergone acetabular fracture reduction and fixation and had at least two years of clinical follow-up data available. All patients had both plain film radiographs and postoperative CT scans available. The authors undertook a stratified analysis using Matta's original criteria (articular reduction step-off of 0 mm to 1 mm, anatomic; 2 mm to 3 mm, imperfect reduction; and > 3 mm, poor reduction). The outcomes assessed were conversion to total hip arthroplasty, and Kaplan–Meier survival analysis was used to establish the survival of the native hip following acetabular fracture surgery. The mean follow-up of nine years yielded an impressive 76% native hip survival rate. The CT scans were better at demonstrating deficiencies in reduction, and in 59% of hips there was a poorer reduction shown on postoperative CT than on the radiograph. When the quality of reduction on CT was used to stratify patients, the quality of reduction was seen to be markedly linked to eventual