

# ROUNDUP<sup>360</sup>

## Spine

### Smuggling spinal implants

■ Despite the plethora of papers concerning the ability of specific implants to activate airport security gates, there is little literature surrounding spinal implants. While in everyday life it may be of little concern for the patient (other than the inconvenience of a pat down) it is certainly our experience at 360 that many of our patients worry they may activate the airport metal detectors. Researchers from **Nottingham (UK)** have devised a study to help answer this question in the setting of spinal implants. The non-ferrous nature of most modern spinal implants makes them much more difficult to detect by automated metal detectors. In the first phase of the study the team identified the volume of titanium implants required to activate both the arch and handheld metal detectors. In the second part of the study patients with a variety of spinal implants were used to establish the sensitivity of the standard metal detectors to modern spinal implants. The study team established that the arch metal detector was unable to detect titanium metal mass up to 215 g, even when carried by hand. However, the handheld metal detector was sensitive to as little as 2 g titanium at a minimum distance of 5 cm. The 40 volunteers had a range of previously implanted spinal instrumentation and implants. There were nine patients with disc replacement (eight lumbar, one cervical), 21 spinal instrumentations (17 posterior, four anterior) and ten

with other implants of various types. The authors established that the arch metal detectors were incapable of detecting any implants *in vivo* and the handheld metal detector was only able to detect cervical and posterior lumbar implants. The researchers were unable to establish any link between patient BMI, age, metal mass or metal density/segment and detection rate.<sup>1</sup> While we would be the first to accept, here at 360, that this study is hardly likely to set the world alight, it did get us thinking not only about our own safety on aeroplanes – titanium handguns are available – but also about the volume of incorrect advice we have given patients in the past. In contrast to studies performed with hip, knee and trauma implants, it would be reasonable to advise any patient with a well buried titanium spinal implant that they are very unlikely to set the alarms off as they walk through the airport metal detectors.

### Local is the way forward with PLIF

■ Bony nonunion in lumbar spinal surgery can be symptomatic, and the use of autologous bone graft and bone graft substitutes is commonplace to increase union rates. Bone graft is particularly important in posterior lumbar spinal surgery where implants placed on the tension side of the bone have high failure rates if a sound fusion is not achieved. Donor site morbidity can be a problem with autologous bone graft itself (and particularly from the iliac crest), to the extent that here at 360 we often

have patients who complain more of post-operative pain from the graft site than they do from the surgery itself. Our colleagues in **Aichi (Japan)** reasoned that many surgeons use local bone graft or substitute for their posterior interbody fusion (PLIF) cages, and set out to investigate the fusion rates associated with both local and iliac crest bone grafting. The investigators enrolled 106 patients with a minimum post-operative follow-up of two years. The authors selected a wide inclusion criteria (46 canal stenosis, 12 disc prolapses, 51 patients with spondylolisthesis). A single level PLIF procedure with a cage was performed in all cases, in addition to an iliac crest bone graft in 53 and local bone graft in 56 patients. The primary outcome measure was radiological evidence of sound fusion on two views. There were no differences in the rates or grades of fusion between the two study groups at any timepoint; by final follow-up there were no significant differences in fusion rates (96.3% *versus* 98.3%). There were no significant differences in operative time or recorded inter-operative blood loss between the two techniques, however, in the iliac crest group nearly 1:10 patients were still complaining of donor site pain and nearly 1:5 had suffered a complication of some sort at the graft site three months later.<sup>2</sup> This is a compelling study; while not the most groundbreaking, it answers a simple and clinically important question, and based on the results presented here one wonders why iliac crest

bone graft is needed at all in a single level PLIF procedure. Of course many units use synthetic substitute and have reported similar fusion rates, underlining the ability to perform these single level procedures without the morbidity associated with distant allograft. A more extensive procedure may of course require access to larger volumes of allograft afforded by iliac crest grafting.

### Predicting disability with ‘slipped discs’

■ The impact of disc prolapse on quality of life and disease specific scores, along with the profound effects back and limb pain can have on depressive indexes, is well documented. There is, however, surprisingly little literature examining the prediction of disability in disc prolapse and we are not aware of any predictive models at 360. A research team in **Tao-Yuan (Taiwan)** set out to develop a predictive model of disability in patients with lumbar disc herniation. They conducted a cross-sectional study recruiting patients presenting to an orthopaedic clinic with lumbar disc prolapse and aiming to assess how those patients went on to develop symptoms or otherwise. The team used a path analysis method (which allows for quantification of causal relationships) between disability and the factors they examined. The researchers collated data on the patients’ demographics, together with perception of pain, fatigue, depression and their disability. The path analysis yielded regression

co-efficients (which determine the strength of an association) in order of strength as pain (0.746), fatigue (0.138) and depression (0.100). However, the relationship was more complex than this, with depression interdependent with fatigue (0.416) and pain (0.538) while perceived pain levels were affected by age (0.140) and a history of previous surgery (0.260).<sup>3</sup> This study confirms and quantifies the complex relationship between pain, depression, fatigue and disability. While the obvious question to ask is 'so what?', here at 360 we don't find these models most useful as predictive tools, but more to understand causation and the best treatment. Predictive models like this are useful not only to underline the importance of a multimodal approach to treatment but also to help to define the importance of the individual parts of a complex intervention.

#### Fat first or back first?

■ Unpicking the complex relationship between obesity, back pain and the psychology of illness is more than a little challenging. One thing is clear; it is a vicious circle. Overweight, unhappy people with back pain are at risk of comfort eating, thus worsening the weight and back pain, representing a difficult problem to tackle in the clinic. Spinal surgeons are often wary of tackling back pain on its own, without the added complication of obesity. Often the initial advice that patients are given is to lose weight, but does this really work? Surgeons from **Tel Aviv (Israel)** decided to find out. They conducted a prospective longitudinal cohort study of morbidly obese patients following bariatric surgery. Patients were investigated following their surgery to establish the effect of weight reduction on intervertebral disc space height, axial back pain (VAS), radicular leg pain (VAS) and quality of life scores (SF-36 and Moorehead-Ardelt). Outcomes were assessed prior to, and one year after, bariatric surgery. In total, 30 patients were enrolled and the mean change

in body weight was nearly 40 kg per patient in the year following bariatric surgery (119.6 kg pre- versus 82.9 kg post-surgery), which amounts to a significant reduction in BMI (42.8 versus 29.7). During this year the L4/L5 inter-vertebral disc height increased significantly by 30% (2 mm) with a corresponding improvement in both axial and radicular back pain. Quality of life scores showed a more mixed pattern with a non-significant improvement in the SF-36 but a significant improvement in the Moorehead-Ardelt score. On first glance one would be tempted to conclude that the authors had proved a causal relationship between radicular and back pain, disc height and obesity. However, the authors observed no correlation between pain improvements and intervertebral height. It appears therefore that obesity causes back pain, radicular symptoms and squashed discs. Treating the obesity improves both, but there is no direct relationship between improvement of disc space narrowing and the magnitude of pain improvement.<sup>4</sup> In the pothole-filled world of spinal surgery decision-making, this paper offers some solace for those obese patients with back pain; a simple diet, exercise programme or bariatric intervention should improve symptoms and it would seem that in the very obese, treating the fat may be more effective than treating the back. It should be noted, however, that these patients started with a mean BMI of 43, so these results may not be applicable to less obese patients.

#### Mortality and spinal surgery

■ The risk of death is inherent in all surgical procedures but is thankfully very rare in the majority of elective procedures. Understanding the risk



factors for, and causes of, mortality associated with spinal surgery is key to making it safer and in attaining informed consent. Researchers in **Charlottesville (USA)** aimed to assess the incidence, causes and risk factors for mortality associated with spinal surgery. They designed a database study (using the Scoliosis Research Society Morbidity and Mortality database) and included patients operated on for all spinal diagnoses between 2004 and 2007. The outcome measure chosen was 60 day mortality associated with surgery or complications of surgery. This impressive study assessed the outcomes of 108 419 patients with 197 mortality events (giving an event rate of 0.18%). The authors used simple methodology to produce event rates/1000 patients to assess the risk factors they had identified. They established that adults had a worse prognosis than children (2.0 versus 1.0 death per 1000 cases). Their series also established differing death rates by diagnosis of degenerative disease (0.9, n = 7393) and spondylolisthesis (0.9, n = 11 421), with double the death rate for scoliosis surgery (1.8, n = 26 421) and much higher rates for kyphosis (4.4, n = 3600) and fracture surgery (5.7, n = 6706). The range of other presentations had a death rate of 3.3/1000 (n = 12 455). Differences in death rates by diagnosis may be partly explained by the magnitude of the surgery (e.g. scoliosis correction) but also by the underlying pathology. Kyphosis is often associated with pulmonary compromise or tumour which makes the surgery itself more risky. The causes of death were most commonly respiratory 42% (n = 83), 21% cardiac (n = 41), 18% sepsis (n = 35) and cerebrovascular

event 8% (n = 15). Worryingly, eight patients (4%) bled to death intra-operatively. The majority of patients died in hospital and after the fourth post-operative day. A number of factors were found to be associated with higher mortality rates including higher ASA rates, spinal fusion and the use of implants. Mortality rates were also found to rise with age to as high as 34.3/1000 in those aged over 90 years.<sup>5</sup> Here at 360 we would congratulate the investigators on a thorough investigation of the incidence and risk factors for mortality. Although not exciting, epidemiological research such as this is extremely important, not only as a benchmarking tool but to quantify risk factors for early mortality.

#### Spondyloarthropathy: more aggressive in women

■ Inflammatory back pain (spondyloarthropathy) is characteristically associated with HLA-B27 and is a disease of men with reported male:female ratios of 3:1. There has been surprisingly little research conducted concerning the characteristics of disease with respect to gender differences. Researchers in **Clermont-Ferrand (France)** used the DESIR cohort to quantify gender differences in patients with a diagnosis of early axial spondyloarthritis. The DESIR cohort is a prospective multicentre study containing patients with early inflammatory arthropathy and back pain. Patients were only included in the study if they fulfilled the Assessment of SpondyloArthritis International Society (ASAS) criteria. The 475 patients (239 men and 236 women) in the DESIR cohort were included in the study, and clinical and imaging findings were compared between genders according to the DESIR criteria. The cohort revealed higher disease activity rates, fatigue and functional scores in women compared with men. Despite this there were lower rates of radiological sacroiliitis and MRI inflammatory findings although disease activity scores were higher in the male subgroup. There were different clinical patterns

between men and women with females more likely to have sacroiliitis, peripheral involvement and family history whereas males were more likely to be positive for HLA-B27 and demonstrate elevated CRP and inflammatory spondylolisthesis.<sup>6</sup>

### Brachytherapy second time around?

■ Brachytherapy has to some extent transformed the treatment of some awkwardly situated tumours with the ability to offer very targeted radiosurgery and has been used to great effect to control some radiation-sensitive tumours and metastases in the spinal column. Doctors in **New York (USA)** have developed a new treatment to tackle resistant recurrent lesions, which are usually not suitable for repeat irradiation due to the limitation of local tissue tolerances. The researchers report the results of five patients treated with a novel high dose rate (HDR) regime in an attempt to treat patients in whom progressive recurrent disease was seen despite initial brachytherapy. The technique involves placement of a catheter (two intra-operative and three via image guidance) and subsequent delivery of a single HDR treatment using iridium-192. The investigators

were able to achieve a 14 Gy dose while staying within the safe dosage level at the spinal canal. By nine months of follow-up there were no cases of subsequent recurrence, and in four patients significant pain reduction was observed.<sup>7</sup> The authors conclude that these are encouraging results and that the flexibility provided by an operatively placed brachytherapy cannula may improve treatments for a large cohort of patients. Who are we to argue?

### Fibrin mesh and BMP

■ One of the difficulties with biologic therapies is that growth factors and other signals have a therapeutic dosage window like any drug, but also have an often complex diurnal rhythm. In contrast, synthetic growth factors are usually delivered once at the time of surgery, and mimicking pulsatile release or maintaining a long-term therapeutic window is an unresolved challenge, which must be overcome to improve the efficacy of these treatments. A biomedical research team in **Goyang (South Korea)** have proposed the use of a heparin-conjugated fibrin (HCF) mesh to deliver bone morphogenetic proteins (BMP) over a long period of time, thus overcoming

the peak and trough effect of bolus application. They present the results of an animal model for spinal fusion augmented with HCF impregnated with BMP-2. In total, 15 rabbits were divided into three groups; collagen sponge, collagen sponge + BMP-2 and HCF+BMP-2. A posterolateral spinal fusion was attempted in each rabbit and the efficacy assessed at eight weeks after surgery using a combination of radiographs, manual palpation, computed tomography scan, and mechanical testing. There were no cases of solid fusion in the HCF+BMP-2 or control groups while all five cases in the BMP-2-only group appeared to have achieved solid fusion.<sup>8</sup> The prospect of a carrier able to release growth factors in a controlled and therapeutic way has turned out, this time, to be too good to be true. We, at 360, are convinced that this type of modified sustained release carrier is the future for biologic therapies.

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