Expert Opinion on Published Articles

Reviewer: Prof J Shipley
Department of Orthopaedics
University of the Free State

A prospective multicentre study of Legg-Calvê-Perthes disease: Functional and radiographic outcomes of nonoperative treatment at a mean follow-up of twenty years

AN Larson *et al. J Bone Joint Surg Am.* 2012; **94A**; 7; 584–92

The authors reviewed 58 hips in 56 patients a mean of 20.4 years (range 16.3–24.5) after enrolment in a study of conservative management of Perthes disease by either hip range of motion exercises, or a weight-bearing abduction brace (Atlanta Scottish Rite). Forty-one patients (59%) of 69 from one centre were followed up in addition to 15 patients from another centre. The group reviewed had similar demographics, bilateral disease, and Stulberg and lateral pillar classifications to those who did not return for follow-up. Patients were assessed for pain and examined clinically for range of motion, femoro-acetabular impingement and Trendelenburg sign. The Tönnis grade, femoral head-neck offset, articular-trochanteric distance, head size ratio and sourcil type (normal or dysplastic) were assessed on X-rays. Measurement of joint space narrowing and alpha angle was unreliable in these incongruent and deformed hips.

Four patients (7%) had undergone reconstructive surgery; three had an arthroplasty and one an acetabular osteotomy and they were excluded from the outcomes analysis. Forty-one patients (76%) had pain, 21 (39%) at least several times each week, and four (7%) had severe pain. Impingement tests were positive in most cases: anterior in 31 cases (57%), 18 (33%) lateral and 14 (26%) posterior. Sixteen patients (30%) had a positive Trendelenburg sign and four patients had more than 2 cm limb shortening.

Twenty-four (44%) of the hips had moderate or severe (Tönnis grade 2 or 3), and 16 (30%) mild (Tönnis grade 1) osteoarthritis on X-ray. A dysplastic sourcil was seen in 35% of cases.

Clinical femoro-acetabular impingement was associated with pain and poor outcomes on the Iowa (IHS) and Non Arthritic Hip Scores (NAHS) ($p = 0.0008$ and 0.004 respectively).

The lateral pillar classification was closely associated with the Stulberg classification at skeletal maturity ($p = 0.0063$) and clinical impingement ($p = 0.041$). A worse Stulberg classification was similarly associated with impingement signs ($p = 0.0495$), and worse NAHS ($p = 0.003$) and Tönnis grades ($p = 0.012$). Stulberg grade III hips had fair or poor outcomes in 61% (IHS) and 72% (NAHS) of cases, and grade IV in 77% (IHS) and 60% (NAHS) respectively.

This paper reports similar or higher rates of reconstructive surgery, hip pain and osteo-arthritis than earlier reports of conservative treatment, but at only 20 years follow-up compared to the 30 to 40 year follow-up in earlier studies. It suggests that outcomes of conservatively managed Perthes disease are worse, and that symptoms appear earlier, than we thought previously, and discusses some of the possible reasons. It also confirms the predictive value of the lateral pillar and Stulberg classifications for poor outcomes. The study is flawed by the loss of patients to follow-up; the possibility of symptomatic cases returning more reliably for follow-up; and the automatic inclusion of less severe cases in the non-operative group. It is possible that better results could have been achieved with a non-weight-bearing programme or a different brace. Nonetheless, it provides a valuable baseline for comparison with other treatment protocols.

The most significant finding is the frequency and association of early pain after Perthes disease and clinical femoro-acetabular impingement; with our new understanding of this condition it is possible that early recognition and treatment may improve the prognosis for these hips. Although instability and dysplasia were not assessed in these patients beyond the common finding of a dysplastic sourcil, this also requires recognition and perhaps early surgery to extend the life of the hip. Many cases had advanced degeneration and longstanding symptoms at this 20-year review, suggesting that earlier, more aggressive treatment should be considered in more cases.

Current concepts review: Pathophysiology and new strategies for the treatment of Legg-Calvê-Perthes disease

HW Kim. *J Bone Joint Surg Am.* 2012; **94A**; 7; 659–69

This is an excellent review of recent thinking on this common and controversial condition.

The author notes that management of Perthes disease is based on two rather conflicting principles, i.e. maintaining a good range of motion, and containment of the soft femoral head to retain sphericity. Containment is difficult to assess on radiographs and, even when it is achieved, results are inconsistent. He suggests that the variable and mediocre results of the present management strategies for Perthes are due to the poor understanding of the underlying pathophysiology, and that new approaches are needed to prevent deformity of the femoral epiphysis.

He summarises the pathogenesis as follows:

- It is probably a multifactorial disease with genetic and environmental factors playing a role.
- Alternatively it may be caused by several different independent factors which share a common pathogenesis, avascular necrosis of the proximal femoral epiphysis, and clinical presentation.
- There is evidence that collapse follows multiple attacks of ischaemia and osteonecrosis; if so it may be possible to identify the cause at an early stage, abort the process and limit or prevent collapse.
- It is also possible that the process is started by a single ischaemic event, but mechanical overloading and collapse may subsequently distort or collapse blood vessels and cause episodes of secondary ischaemia. In this case, control of loading of the head is critical.
- There is necrosis and later calcification of the deep layer of articular cartilage and subchondral bone; in effect there is a spherical growth plate surrounding the femoral head, and this necrosis may cause a growth disturbance distorting the femoral head irrespective of loading.
- The calcified articular cartilage and subchondral bone are probably brittle, and prone to micro-fractures unable to heal in the avascular environment, with eventual collapse.
- There appears to be uncoupling of bone resorption and bone formation during healing, rather than a process of creeping substitution. This weakens the bone excessively before healing occurs, leading to collapse.
- The role of magnitude and frequency of loading in deforming the epiphysis is not clear, nor is the effect of unloading the hip by restricting activity.

In contrast to the essentially mechanical traditional approach to treating the condition, the author speculates on possible biological methods of treatment. The first is the use of anti-resorptive agents to suppress abnormal removal of necrotic bone while healing occurs. There is evidence that reduction in osteoclast numbers and function by osteoprotegerin (a RANKL inhibitor) significantly reduces bone resorption and femoral head deformity in an animal model.

Bisphosphonates are more familiar, and achieve a similar effect by inhibiting osteoclast function and accelerating apoptosis, but without reducing osteoclast induction. Reduction in bone resorption and femoral head deformity has been demonstrated in a number of animal studies with bisphosphonates, but repeated systemic dosage is necessary to penetrate the avascular bone and achieve therapeutic drug levels in the epiphysis. Prolonged systemic administration of bisphosphonates raises concerns about toxic effects on the immature skeleton; to bypass this problem, studies using a single local intraosseous dose of bisphosphonate have been performed and found to be effective with only 5% of the systemic dose.

Unfortunately a number of investigations show that anti-resorptive drugs also inhibit new bone formation and may well delay healing.

Bisphosphonate use in adult avascular necrosis is still under investigation, but appears to help relieve pain, improve function and preserve the femoral head. No useful information is available for their clinical use in Perthes disease.

The second possibility is the use of osteoinductive drugs to accelerate healing. There is good evidence in animal studies, and some in human trials, that BMP-2 is beneficial in adult avascular necrosis when combined with core decompression or strut grafting. There appear to be no reports in a paediatric population.

Local injection of BMP-2 combined with a bisphosphonate into avascular animal epiphyses showed better bone healing and remodelling, and in some cases restoration of epiphyseal growth, when compared to bisphosphonate alone or saline injected controls. Unfortunately use of BMP-2 was complicated by heterotopic ossification of the joint capsule apparently following leakage after transarticular injection.

Publication of Ethics Articles

As from this issue of *SA Orthopaedic Journal*, we will be publishing an article covering one or more topics related to ethics in the practice of medicine (see page 88). Not only does this enhance the status of the journal but it also helps doctors to earn those rather elusive ethics CPD points. A questionnaire accompanies the article and doctors are encouraged to send in their answer form in order to qualify for ethics CPD points. Please refer to page 111 and follow the instructions at the bottom of the page.

Giant cell tumour of the extremity: Retrospective analysis of 621 Chinese patients from the same institution

X Niu, *et al. J Bone Joint Surg Am.* 2012; **94A**; 5; 461–67

This is a retrospective review of 621 cases of giant cell tumour (GCT) of the extremities, treated at the authors' institution between 1989 and 2009. The incidence of 13.7% of all primary bone tumours is consistent with other reports that this tumour is more common in Asian races, and the authors also noted a male predominance of 1.4:1 in contrast to the usual female predominance in Caucasians. The only other difference from standard statistics was that following the distal femur (34%) and proximal tibia (29%), the third most common site was the proximal femur (11%) rather than the more usual distal radius (8%).

Treatment records could be analysed in 395 cases, with a median 49 months, minimum 18 months, follow-up. Tumours were staged according to Campanacci. Functional results were assessed using the Musculoskeletal Tumour Society (MTS) Score.

Treatment of the 283 primary tumours was separated into:

1. Curettage in 41 patients. This was intralesional curettage only, followed by bone graft (75%) or cement packing.
2. Extensive curettage in 116 patients. This comprised curettage through a large cortical window, followed by burring at least 10 mm into cancellous or 1 mm into cortical bone, pulse lavage and packing with bone graft or cement. Subchondral bone graft was used in addition to cement to support and protect the joint if necessary.
   In both types of curettage at least one adjuvant (phenol, alcohol or bone cement) was used.
3. En bloc resection and reconstruction by various methods in 126 patients. This was indicated for extensive soft tissue extension, massive bone defects, pathological fracture involving the joint or some recurrences.

Local recurrence occurred in 12.4% of cases; recurrence followed 56.1% of curettage operations, 8.6% of extensive curettages and 1.6% of resections. There was no significant difference if extensive curettage was followed by bone grafting, bone cement or a combination. Multivariate analysis showed that the only variable associated with absence of recurrence was the type of surgical procedure, with simple curettage having an Odds Ratio of 43.7, compared to extensive curettage (6.3) or resection (1).

Recurrent tumours were treated in 147 patients. Although 59% of them were treated by resection with a re-recurrence rate of 9%, curettage was also effective (7% re-recurrence), though presumably used for smaller tumours.

Pulmonary metastases were diagnosed in 3.4% of cases, but only two out of 21 patients had histological confirmation, so valid conclusions are not possible.

Functional outcomes were assessed in 197 patients. The mean MTS Score was 92.6% after extensive curettage and 85.6% after resection and reconstruction; this was significantly different.

The authors make a good case for the use of extensive curettage, as defined above, in the treatment of primary or recurrent GCT. This is based on the low recurrence rate and better function after this procedure compared to resection and reconstruction. Simple curettage has an unacceptable recurrence rate and cannot be condoned. The indications for resection listed above can be simplified to: tumours so extensive that the affected bone and joint has already lost, or after extensive curettage will predictably lose, its mechanical integrity, and result in a pathological fracture. In addition the authors make the point that the distal radius is notorious for a high recurrence rate, and that resection is advisable at this site.

Reviewer: Dr ICM Robertson
Senior Consultant
Dept of Orthopaedics
Tygerberg Hospital
Stellenbosch University

Human hip impingement morphology: An evolutionary explanation

T Hogervorst, H Bouma, SF de Boer, J de Vos. *JBJS* Vol. **93-B**, June 2011, pages 769–76

From an orthopaedic point of view, and as an orthopaedic surgeon, I would like to comment on the following:

Man's upright stance is an obvious reason why the lumbar spine is a common source of orthopaedic problems. In this article the authors use evolution to explain why the hip commonly develops an impingement syndrome which can lead to arthritic changes.

'Cam' impingement (where the main feature is lack of sphericity of the femur head) and 'pincer' impingement (where the main feature is over cover, of the femoral head, due to a deep acetabulum) begin in adulthood. There are no corresponding paediatric precursor lesions. Cam-type impingement is seen more commonly in men and the pincer-type, with its deep acetabulum (coxa profunda), is predominantly observed in females. The authors explain these differences from an evolutionary standpoint.

From the literature, and 22 museum mammal specimens, they determined foetal head size to work out its effect on pelvic shape and ultimately gait.

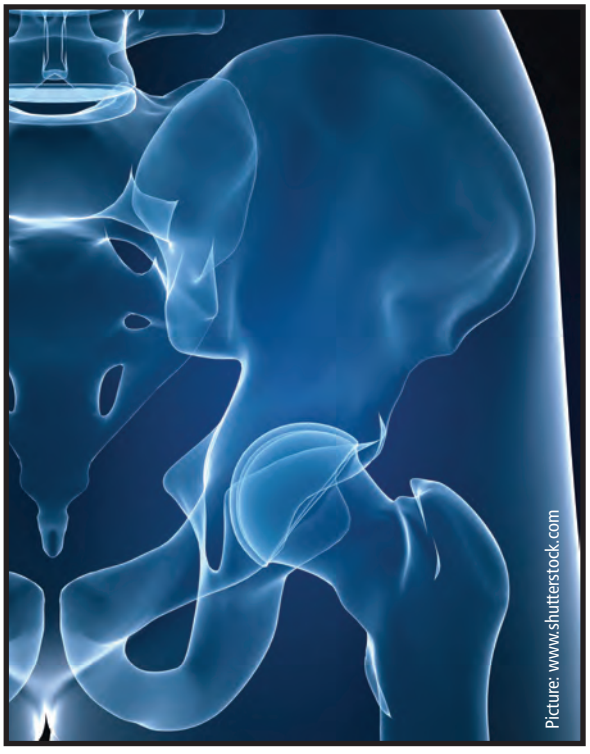
Two types of hip joint, coxa recta and coxa rotunda, conceptually describe all hip joints. A coxa recta has a non-spherical femur head which is seen in most mammals e.g. horse, rhinoceros. It offers strength (broad, short femoral neck), but there is, as a result, little adduction/abduction. Coxa rotunda has a round femoral head, with a long narrow femoral neck. Few mammals have this type, e.g. sea otter, and climbers, such as apes.

Hominids began walking upright before developing a large brain. The large brain necessitated a wide pelvis to facilitate the birth process. In the path from a chimpanzee-like ancestor to modern man, body size doubled, but brain size tripled. The large head made labour hazardous for mothers.

Because of this obstetric imperative the pelvis enlarged in all dimensions. The sacrum moved forward and became ventrally tilted, while the lumbar spine lengthened with an increased lordosis. *Au. Africanus* (2–3 million years ago) had a wide flat pelvis due to these adaptations. After this, from about 0.5 million years ago (the stage when the human head increased markedly in size) obstetric factors made the pelvis deepen in an anterior–posterior direction. The pelvis then became narrower too. This was to keep the work of the hip abductors cost effective. The lever arm is measured from the centre of gravity (far side of the sacrum) to the centre of the femoral head. Another adaptation was to make the femoral head deep in the pelvis (coxa profunda) to further decrease this lever arm.

Because the knee needs to be near the midline, a wider pelvis (especially in the female) also necessitates a more valgus knee. Such knees are more prone to injury.

A coxa rotunda is arguably more prone to femoral neck fracture. Conversely the coxa recta femoral neck is better adapted to withstand the shock loads of endurance running



The authors postulate that as hominids began to run on the savannah there was evolutional selection away from the coxa rotunda towards the sturdier, but less spherical coxa recta seen in other running mammals. Competing with this is the broad female pelvis that needs a deep acetabulum, as explained above. Coxa profunda is approximately four times commoner in modern females than males. In coxa profunda impingement occurs when the lips of the deep acetabulum impinge on the femoral head causing labral damage, and later, cartilage wear.

Discussion

A coxa rotunda is arguably more prone to femoral neck fracture. Conversely the coxa recta femoral neck is better adapted to withstand the shock loads of endurance running.

Human females have a wide birth canal and their acetabulae are further apart than in the male. This deeper acetabulum shortens the lever arm of body weight reducing the work of the hip abductors.

The authors point out that this study is of evolution, and empirical evidence cannot be found by experiment. Could other disease processes, such as slipped upper femoral epiphysis, have simulated coxa recta in the femora studied? Other disease processes can lead to a recta proximal femur (e.g. multiple epiphyseal dysplasia, and spondyloepiphyseal dysplasia), but the incidence of 20% of abnormal femoral heads studied is too high to have to invoke uncommon asymptomatic childhood diseases.

In most mammals, there is one proximal femoral epiphysis, and this develops into a recta hip. Humans divide this proximal epiphysis in two, resulting in an apophysis for the greater trochanter and the capital epiphysis of the femoral head. This is the coxa rotunda pattern.

Cam impingement results from this rotunda hip adaptation which suits the female requirement for a broad pelvis for childbirth. Pincer-type hip impingement may develop in these hips. The recta hip is more suited to males who have evolved to take the peak loads of running. The downside to this is possible development of cam impingement.

In a further article,[1] Dr Hogervorst also discusses the foetal position with its hyper-flexed hips as a cause of Developmental Dysplasia of the Hip (DDH). Because of our large head, the 'foetal' position is adopted in utero. Hyperflexion levers the long femur against the iliac spine. The iliac wing is less prominent than in the ape, causing the hip to be levered out of the acetabulum. Could DDH also be caused by incomplete evolutionary adaptations to our changing morphology?

As with *The Theory of Evolution*, these arguments will probably never be definitively settled. This article sheds light on the evolutionary perspective. If you accept the above concepts, most of the orthopaedic surgeon's spinal workload, including the majority of hip surgery (impingement, OA) as well as paediatric orthopaedics (DDH) comes from man's incomplete adaptation to his distinguishing features, i.e. his big brain and upright posture.

Reference

1. Hogervorst, T. Osteoarthritis. *Bone & Joint.* **2012;** 360(1):2-6.

Reviewer: Dr A Ikram
Senior Consultant/Hand Surgeon
Tygerberg Academic Hospital
Stellenbosch University

Injuries complicating musical practice and performance: The hand surgeon's approach to the musician–patient

Andrew J. Rosenbaum, MD; Jacqueline Vanderzanden, MD; Andrew S. Morse, MD; Richard L. Uhl, MD
Division of Orthopaedic Surgery, Albany Medical Center, Albany, NY.
JHS Vol **37A**, June 2012

The CME brief that was published in this month's *JHS* deals with musculoskeletal injuries in instrumental musicians. The problems stem from repetitive motion, awkward posture and long practice hours.

The clinical approach to musician–patients should include details of the instrument played, technique, change in practice and full medical history. The symptoms at presentation are mainly pain, loss of dexterity, cramping/stiffness, weakness, tremors, swelling and clicking.

The examination should consider intrinsic and extrinsic factors. The evaluation should be done with and without the patient's instrument. Sensation, motor function and perfusion should be checked. Joint hyperlaxity should also be checked as it can lead to pain, fatigue and spasm. Joint hypermobility can lead to digital nerve compression, traction neuropathies and traumatic synovitis in the affected joints.

The common causes of the symptoms are the following:

- Overuse syndrome – injury/inflammation to muscle, ligament, tendon or capsule
- Thoracic outlet syndrome – due to posture while playing instruments
- Nerve entrapment syndrome
- Focal dystonia, which is analogous to writer's cramp. It is described as painless motor control disorder involving sustained muscular contractions, leading to twisting and abnormal posture.

The initial management of the musician–patient should be conservative – rest, posture correction and in some cases instrument modification. Surgery should not be considered a last resort, especially if earlier surgical intervention will result in better restoration of function or a shorter recovery period.

In my opinion the broad principles highlighted are the same as in any patient with chronic wrist and hand pain. Chronic wrist pain is like backache and a systematic approach is required for its correct management.

Reviewer: Dr H. Sean Pretorius
Senior Consultant Shoulder Surgeon
Tygerberg Academic Hospital
Stellenbosch University

Evolution of non-operatively treated symptomatic isolated full-thickness supraspinatus tears

Sandro F. Fucentese, MD; Andreas L. von Roll, MD; Christian W.A. Pfirrmann, MD; Christian Gerber, MD; Bernhard Jost, MD
Investigation performed at the Department of Orthopaedics and Division of Radiology, University Hospital Balgrist, Zurich, Switzerland
J Bone Joint Surg. Am. 2012; **94**:801-808

This article helps to answer a question that has been relevant for a long time and I have found it to be very useful in my clinical practice. In essence the article states that patients under 65 years of age with a small rotator cuff tear show no significant increase in the size of the tear over a 3.5-year period. The study involved only 24 patients but this is not an issue because all of the patients had the same or similar results. The study was a level IV prospective study.

It is my anecdotal opinion that the article statement is true as my state patients often wait six months to a year for surgery. The ultrasound examination does not clinically differ from the intra-operative findings in the symptomatic patients; a few patients have improved to the level that an operation is no longer required. I have not had the experience that the patients return with massive tears or irreparable tears. I find that we may put undue pressure on our patients to have surgery for a small cuff tear that has not been through a proper rehabilitation programme, with specific attention to scapula stabilisers and the prevention of scapula–thoracic movement.

In conclusion I think that this 'supervised neglect' is acceptable for patients who do not want surgery. I believe that a repeat ultrasound on patients who have continued symptoms is mandatory. I must stress that any patient who remains symptomatic should be advised to undergo surgery as such a patient has an increased chance of suffering from tear progression.

Reviewer: Dr JH Davis
Senior Consultant
Department of Orthopaedic Surgery
Tygerberg Academic Hospital
Stellenbosch University

Obesity and early reoperation rate after elective lumbar spine surgery: a population-based study

Evidence-Based Spine Care Journal Volume 3; Issue 2: 2012
Cinzia Gaudelli, McCaig Institute for Bone and Joint Health, University of Calgary, Alberta, Canada
Ken Thomas, Departments of Surgery and Clinical Neurosciences, University of Calgary, Alberta, Canada

This thought-provoking article presents level III evidence in the form of a population-based retrospective cohort analysis of the outcomes – in specific complications requiring acute surgical correction – of elective lumbar surgery in obese patients. The vexing question of obesity and how it influences our results as orthopaedic surgeons is a fiercely debated one; with interest respectively from funders, as well as our own, in limiting costs and ensuring optimal outcomes for our surgically managed patients. The reports in the available body of literature are varied and conflicting.

Degenerative lumbar disease and the associated clinical symptomatology are associated with morbid obesity, leaving this patient population exposed to higher surgery rates. A clear quantification of the associated complication risks is therefore warranted.

In this article the authors reviewed the Alberta (Canada) health-and-wellness administrative database, to identify patients who underwent lumbar spinal surgery over a two-year period (July 2007–June 2009), and also to sub-classify these patients as obese (Body Mass Index > 35) or non-obese (Body Mass Index < 35).

There were 3 388 patients included in the analysis. They subsequently looked at the reoperation rates within the first three months following the index procedure for these patients, equating this to arising complications. Other factors increasing risk for certain subjects were reviewed. These subgroups included: gender, age, location of care provider (rural vs urban), procedure type (decompression alone, decompression and fusion, deformity correction or arthroplasty). Of the patients 52.2% were males, with 61.5% of patients aged between 40 and 74 years. An isolated decompression procedure was performed in 61.8% of patients, with 33.4% of patients undergoing an instrumented fusion procedure.

Three per cent (N=101) of patients required reoperation within 3 months. The obese group showed a statistically significant higher reoperation rate of 4.8% compared to 2.8% in the non-obese group.

Interestingly the odds ratio of the adjusted point estimates for reoperation within three months was more dramatically influenced by type of procedure, with deformity correction showing an odds ratio of 4.49 (95% confidence interval 2.34–8.53) compared to an odds ratio of 1.57 (95% confidence interval 0.89–2.77) for obesity. Instrumented fusion also displayed a relatively high odds ratio for early reoperation of 1.64 (95% confidence interval 1.05–2.56).

The most prevalent reason for reoperation is stated as repeated nerve root compression (2.1% of complications in obese patients compared to 1.9% in non-obese patients) followed by infection (2.4% of complications in obese patients compared to 0.9% in non-obese patients).

The state-funded Canadian health care system provides for a captured patient population. This affords the opportunity to collect data for an entire population with lengthy follow-up. The database review is however limited in that obesity as a risk factor could not be isolated from other co-existing detrimental outcome factors including social habits like smoking. This limitation is acknowledged by the author. Co-morbidities associated with obesity such as diabetes are also not factored in as isolated risk factor and could therefore influence the results.

The vexing question of obesity and how it influences our results as orthopaedic surgeons is a fiercely debated one; with interest respectively from funders, as well as our own, in limiting costs and ensuring optimal outcomes for our surgically managed patients

This article confirms the more complex nature of surgical intervention in the obese patient, and affirms the intuitive increased risk and technical difficulty that we encounter in our dealings with spinal pathology in the obese. The reader should however be cautioned against generalising obesity as an isolated risk factor. Similar to age – shown to have less of a predictive value as a risk factor in spinal surgery compared to multiple co-morbidities (Deyo, *JAMA* 2010) – obesity contributes in itself a risk factor for systemic illness more likely to be the cause of morbidity, or a poor outcome.

As clearly demonstrated in this article, the weight and magnitude of our surgical intervention far exceeds the involved patient factors as contributing to a negative outcome.

Patient selection in spinal elective surgery therefore remains paramount. The scientific art remains in matching the appropriate procedure to the patient.