
EXPERT OPINION ON PUBLISHED ARTICLES

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Reassessment of the usefulness of frozen section analysis for hip and knee joint revisions

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The use of intra-operative frozen section (FS) in revision arthroplasty for aseptic loosening has become standard practice in order to exclude occult infection. Kanner *et al* revisit this practice in their retrospective review of 244 cases, to evaluate the effectiveness where FS was employed during revision hip and knee surgery.

The study criteria for a 'positive' FS for infection was defined as more than five polymorphonuclear leukocytes per high powered field (hpf) in at least five separate hpf's, excluding surface inflammatory exudate or fibrosis as proposed by Mirra *et al*. The pre-op results of ESR, CRP and microbiological culture of intra-operative tissue samples and paraffin section results were entered into their data base for cross-correlation.

Of 244 cases, 24 (9.8%) were identified where FS, or paraffin section or both were initially called positive. Review of the negative cases revealed seven additional cases that had been missed on FS or paraffin section.

At final review for paraffin section, 27 cases were positive and for FS 15 cases were positive.

Analysis of the FS of the 27 paraffin section studies deemed positive showed that 10 were deemed negative at FS as a result of the pathologist not examining all the submitted tissue by FS. This sampling error is well recognised as a limitation of FS and the recommendation is that as much tissue as possible be examined by FS to improve the sensitivity of this test. Of the initial 15 positive FS results, six had been incorrectly interpreted as positive because they failed to satisfy the criteria for the required number of polymorphs. Using 'positive' histology (paraffin section) as the point of reference, the authors found that the sensitivity and specificity for the diagnosis of infection by FS alone was 29% and 95%, by MCCS was 64% and 90%, by CRP was 88% and 65%, and by ESR was 78% and 54%.

Their findings that FS alone had a high specificity (95%) but low sensitivity (29%), and a positive predictive value of 40%, is similar to the findings in other published studies. This low level of positive yield suggests that FS is of little use as a test sent unselectively for the assessment for acute inflammation in joint revision surgery.

Both this study and a literature review revealed that not all pathologists were aware of, or applied the correct criteria for a 'positive' FS, namely those suggested by Mirra.

Criticisms of this study relate principally to the problems encountered in retrospective studies. The numbers of cases that had all the required data is relatively small and hence may skew the results.

The use of the histological assessment of the paraffin sections as the 'gold standard' or defining parameter for infection is in itself limiting. Firstly, this study therefore focuses on the identification of infection that evokes an 'acute inflammatory' response only, and is not identifying those. They report which are known to evoke a lymphocytic and not polymorph response, such as propionibacterium acnes. Secondly by their own admission, paraffin section issued some infected cases identified by FS.

The authors do not state if any of their patients had received pre-operative antibiotics which may influence both the FS and histological findings, thereby masking some occult infections.

This paper revealed a significant error rate with FS diagnosis and underlined the importance of adhering to the criteria for FS diagnosis in order to minimise errors.

They also stress the importance of using the full clinical picture and all the related investigations when deciding on infection in aseptic loosening because of the low sensitivity rate (29%) when FS is used in isolation.

A randomised trial of arthroscopic surgery for osteoarthritis of the knee

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Despite the lack of scientific evidence that arthroscopic surgery for moderate to severe OA is beneficial, or that clinical trials have shown to the contrary, practitioners persist with this practice.

The controversy regarding the use of arthroscopic debridement in moderate to severe osteoarthritis of the knee prompted these authors to conduct a prospective randomised controlled trial to assess the efficacy of arthroscopy.

Included were patients with idiopathic or secondary osteoarthritis. The degree of arthritic involvement was graded on a modified Kellgrin-Lawrence classification, and those with grade 2 to 4 radiographic severity were included. Among the exclusion criteria were patients with large meniscal tears (bucket handle tears), detected clinically or on MRI, major trauma, inflammatory and post-infective arthritis, alignment deviation more than 5°, involvement of two or more compartments, and age above 60 years.

A total of 188 subjects were recruited over an 8-year period and were randomised into 'surgery' (arthroscopic) and 'control' (medical treatment) groups, each with 94 subjects. All were assessed with the WOMAC, SF 36 (physical component), MACTAR and ASES arthritis outcome instruments.

Five separate assessments were made by independent observers, at intervals over a 2-year period.

Results

Primary outcome measure:

Although the WOMAC scores at 3 months had improved to a greater extent in the arthroscopy group than those in the control group, there was no significant difference between the two groups at any of the visits thereafter. The authors state that this improvement may be as a result of the placebo effect as demonstrated by other authors.

Secondary outcome measure:

No significant difference was observed between the two treatment groups in terms of pain function and disability. Specifically, subgroup analysis of patients with mechanical symptoms of catching, locking or early disease did not show any benefit from arthroscopic surgery.

From the 6-month assessment onwards to the end of 2 years the arthroscopic group who in addition had physiotherapy and medical treatment had no greater improvement than those treated with physiotherapy and medical treatment alone.

A previous trial by Mosely *et al* in 2002 (*N Engl J Med* 2002;347:81-88) with identical findings was criticised for methodological shortcomings which these authors believe have been addressed in their study.

The message

This study of Kirkley *et al*, together with that of Mosely *et al* (level 1 studies) provide ample evidence that the widespread use of arthroscopic surgery, irrespective of mechanical symptoms, cannot be supported as ethical practice.

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Humeral insertion of the supraspinatus and infraspinatus. New anatomical findings regarding the footprint of the rotator cuff

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This article revises the anatomical insertion of the supraspinatus and infraspinatus tendons of the humerus.

The infraspinatus inserts into the middle and highest impression of the greater tuberosity, and has a much wider insertion than previously known. This insertion is also much larger than the supraspinatus insertion and is trapezoidal in shape.

The supraspinatus tendon inserts on the higher impression of the greater tuberosity. It is also shown to be triangular in shape. In 21% of patients the tendon inserts into the lesser tuberosity over the biceps tendon.

The wider insertion of the infraspinatus is postulated to be the reason why the infraspinatus is known to atrophy with the supraspinatus if the latter is torn. This was thought to be injury to the nerve, but this anatomical observation may help to point to the real cause.

The article is well written and shows good grasp of the anatomical structure of the shoulder. The article will help in the evaluation of rotator cuff tears and may change the treatment of such tears, because the infra on supraspinatus should be regarded as a complex structure that forms the superior portion of the cuff rather than two separate muscles.

The above-mentioned information can help the orthopaedic surgeon with his assessment of injuries of the rotator cuff.

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Percutaneous fixation of the pelvic ring: an update

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Over the last two decades open reduction and internal fixation has become the standard method of treating acetabular fractures with displacement of more than 2 mm or for those involving the weight bearing dome.

Most injuries to the pelvic ring are due to high energy trauma and the mortality rate is 10% to 20%, due mainly to haemorrhage. Classical techniques of internal fixation have traditionally required extensive surgical exposure of the deep structures of the pelvis, which can be associated with problems of wound healing and an incidence of infection of up to 25%.

Percutaneous fixation of the pelvis has been receiving increasing attention.

Iliosacral screws are commonly used for treating complex injuries of the pelvic ring. Closed reduction with percutaneous fixation of non-displaced or minimally displaced fractures of the acetabulum using CT or fluoroscopy with computer navigation has attracted interest. Percutaneous techniques may offer a shorter surgical exposure, decrease soft tissue disruption and does not decompress the pelvic haematoma; surgical stabilisation is therefore possible without the risk of additional haemorrhage. Elderly patients may have comorbid conditions and can benefit from a percutaneous procedure.

Fixation under image guidance with cannulated screws is an option in cases of minimally displaced transtectal acetabular fractures, high anterior-column fractures, posterior hemitransverse fractures of the anterior column or vertical fractures of the ilium. Fractures of the posterior wall of the acetabulum are rarely amenable to percutaneous reduction and fixation.

Fractures of the acetabulum which are potentially amenable to fixation by percutaneous techniques include unstable fractures of the weight-bearing dome displaced by 3 mm to 5 mm.

In all patients with suspected disruption of the pelvic ring essential radiographs include anteroposterior (AP) inlet and outlet radiographs. Obturator and iliac oblique acetabular radiographs should be included to define the pattern of injury. Two- and three-dimensional CT scans are useful in evaluating the severity and geometry of the fractures.

Fluoroscopic control and the application of various techniques such as leg traction, hip rotation and the use of Schanz pins or a temporary external fixator can be used to realign the fracture.

For fractures of the superior ramus an antegrade or retrograde medullary screw is recommended. Sacral fractures

are located more medially than sacroiliac disruptions and are oriented more vertically. The screw is introduced from the lateral ilium in a more horizontal direction and aimed perpendicular to the fracture into the upper part of the body of the sacrum. Injuries in zone II merit particular care due to the risk of neural complications. Traumatic disruptions of the sacroiliac joint are often accompanied by other injuries to the anterior pelvic ring. It is essential to obtain an anatomical reduction of the hemipelvis before introducing iliosacral screws. Under imaging control a guide wire is passed from the lateral edge of the ilium, perpendicular to the sacroiliac joint towards the body of the first sacral vertebra. A 7.0 mm cannulated screw is then inserted and directed perpendicularly to the sacroiliac articulation while the chondral surfaces are avoided.

Screws can be placed in the anterior column in either an antegrade or retrograde fixation. The insertion point for antegrade fixation is determined by a line drawn between the tip of the greater trochanter and the thick part of the iliac crest, about 4 cm posterior to the anterosuperior iliac spine. Image control using the outlet-obturator oblique and inlet-iliac oblique views allows safe passage of a 2.8 mm guide wire down the superior pubic ramus towards the symphysis and a 7.3 mm cannulated screw is passed over the guide wire for retrograde placement. Care must be taken to avoid damage to the femoral vessel or nerve, or to the spermatic cord, obturator nerve and artery. Lateral compression type-II fractures are a consequence of a force to the lateral aspect of the pelvis with the fracture line in the ilium usually arising from or just anterior to the sacroiliac joint. Reduction requires external rotation with longitudinal traction on the leg. Percutaneous procedures may well save operating time and reduce exposure but they can endanger intrapelvic organs because of the narrow safe zones. Detailed pre-operative planning is based on a thorough understanding of the pattern of injury. Closed reduction of displaced anterior acetabular fracture is possible using virtual fluoroscopic surgical navigation. However, the equipment and instruments required are costly and financial considerations will probably hinder their widespread acceptance in the short term.

The risk of neurological injury after positioning of sacroiliac screws has been reported to be between 0.5% and 7.7%. Damage to the superior gluteal artery has also been reported. Strict adherence to the principles concerning the time of intervention, the quality of reduction, and the adequacy of imaging and meticulous utilisation of instrumentation will minimise the risk of iatrogenic injuries. The early results of percutaneous fixation have shown a decrease in hospital stay and morbidity in longitudinal studies.

This is an interesting paper. These techniques are associated with a steep learning curve. Prior practice on cadavers, models and adequate pre-op planning will ensure a satisfactory outcome.

Guided growth for fixed knee flexion deformity

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Fixed knee flexion deformity is a common problem in children affected by neuromuscular disease. We know that a knee flexion contracture of 15 degrees or more causes compromised gait kinematics and compensatory deformities in the spine, hips and ankles.

When conservative modalities like stretching, physical therapy, serial casting, bracing and medial/surgical spasticity fail or are not indicated, the orthopaedic surgeon is faced with several surgical options. The problem with correcting these often bilateral contractures by surgical means is that surgery is often aggressive with potentially severe complications. Major soft tissue releases, extension supracondylar osteotomies and reduction on frames is often indicated.

Guided growth in the growing child remains an eloquent,

minimally invasive technique to correct deformity. Indications are fixed flexion deformities of the knee of more than 15 degrees in a growing child or adolescent where non-operative treatment failed. Anterior distal femoral stapling has been successfully utilised for knee flexion deformities. Advantages of this technique are that it is minimally invasive with correction very close to the centre of rotational of angulation (CORA). Disadvantages are the limited rate and degree of angular improvement. Insertion of relatively large staples in young children can be difficult. Dislodgement and breakage can occur.

This paper postulates that guided growth of the distal femur using a pair of anterior eight plates as opposed to the traditional staples is an effective and safe method of gradual correction of fixed knee flexion deformities in growing children and adolescents. The eight-plate is a custom-made titanium plate that looks like a figure-of-eight with two cannulated non-locking screws at the ends. Due to the point of rotation at the plate screw interface this plate potentially ensures quicker and a greater magnitude of correction compared to the more rigid staples.

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Total ankle replacement: medium-term results in 200 Scandinavian total ankle replacements

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To fuse or to replace

In the 1970s and early 1980s the uncertainty of long-term results, patient dissatisfaction and a high wound-complication rate dampened total ankle replacements (TAR). Since the early 1990s TAR has, however, made a comeback due to improved designs (or possibly a new generation of surgeons).

Ankle arthritis is usually the result of post-traumatic cartilaginous damage, joint mal-alignment or, in the case of secondary osteoarthritis, a variety of inflammatory causes. Primary osteoarthritis is rare. Early arthritis of the ankle can be surgically treated with realignment osteotomies or by distraction, using a fine-wire technique. Although TAR has been shown to be an effective alternative treatment in selected patients, **ankle fusion still remains the golden standard in the treatment** of symptomatic end-stage arthritis.

In this single-centre retrospective study using the STAR (Scandinavian Total Ankle Replacement), the authors reported on their first 200 consecutive cases. The STAR is a three-component mobile weight-bearing uncemented prosthesis that is widely used in Europe but is not FDA-approved. The article showed a prosthesis survival rate of

93.3% at 5 years and 80.3% at 10 years. This is in keeping with results from other studies using the STAR implant. Survival rates worsened in malaligned joints (more than 15% valgus or varus deformities). The study was not able to show correction of malalignment using the implant (due to radiographic difficulties), nor was it able to prevent progression of subtalar arthritis. Unfortunately, the results did not include the patients' age, activity levels or the cause of arthritis necessitating the surgery.

The literature shows that TAR is a viable alternative for the treatment of symptomatic end-stage arthritis in selected patients. **Current criteria** for TAR in the osteoarthritis group include:

- middle-aged or elderly patients (not the vigorously active patient)
- good anatomical alignment (less than 15% valgus or varus of the ankle)
- functional range of movement (30° with a minimum of 5° of dorsiflexion) as replacement does not improve movement

The inflammatory group (i.e. rheumatoid arthritis) seems to benefit more than the osteoarthritis group. This might be due to less stress being exercised on the other joints that would most likely also be involved. Even the stiff foot seems to benefit from TAR.

The jury is, however, still out on this matter and we shall have to wait for long-term results. Hopefully, future results will also improve with better designs and improved techniques.

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The management of ankle fractures in the elderly

Eric J Strauss, Kenneth A Egol

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The management of ankle fractures in the frail and elderly remains a big challenge for the treating orthopaedic surgeon. The dilemma is the question of whether to treat these fractures surgically or conservatively.

The main problems facing the surgeon are the common co-morbidities, the multiple drugs the patient is often using, poor skin integrity and the atrophied subcutaneous tissues and muscles, peripheral vascular insufficiency as well as the weak quality of osteoporotic bones.

The article identifies the problems alluded to and argues for the surgical fixation of geriatric displaced ankle fractures as evidenced by the current literature reviews. It points to the conflicting view that disputes the elderly ankle fracture as a typical fragility fracture of the osteoporotic patient population. Its incidence is found to peak in the postmenopausal active female up to the age of 65 years, when it reaches a plateau. Typically, the patients are obese, have a propensity to fall and may be diabetic.

The goals of managing the displaced geriatric ankle fracture are seen as the achievement of a functionally stable and painless ankle, early resumption of the activities of daily living and the avoidance of deterioration following the otherwise prolonged bed rest associated with conservative treatment.

There are three suggested strategies for the surgical treatment of these fractures:

1. Augmentation of the conventional plate-and-screws fixation with fibular intra-medullary k-wire fixation which would have the following benefits:
 - reducing fracture displacement
 - resisting torsional forces.
2. The possible use of limited skin incisions where the skin is found to be compromised employing new locking-plates technology which has the added benefit of:
 - improved stable fixation on osteoporotic bone
 - resisting the bending and torsional forces
 - further preventing the toggling and pull-out of conventional screws.
3. Calcium-phosphate cement augmentation of the defective bone that would enhance better screw purchase, screw strength and screw stability.

Postoperative care should not neglect the following core elements of the appropriate quick rehabilitation:

- wound care with the appropriate dressings, early immobilisation and timely removal of sutures or clips especially in diabetics
- limb cast or removable brace
- physiotherapy with isometric exercises
- weight bearing at six weeks.

Management of distal humeral fractures in the elderly

Eric J Strauss, Michael Alaia, Kenneth A Egol

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Fractures of the distal humerus in the elderly are uncommon. The authors of this article quote the known figure of an incidence of 2% to 6% of all fractures in an adult population. Most surgeons would treat these fractures surgically with open reduction and internal fixation for the purposes of achieving an accurate restoration of the normal anatomical joint surfaces, stability and early functional range of movements.

The challenge with this type of fracture is its complex anatomy, amount and pattern of comminution and the intra-articular extension. In the geriatric group, the poor bone stock and poor tolerance of prolonged immobilisation pose an even bigger challenge to any form of management. The authors postulate that the functional outcome of (a) primary arthroplasty and (b) open reduction and internal fixation in the elderly are both good and comparable. In some series, the reported complication rate for internal fixation is 30%, including implant loosening and failure, non-union or pseudoarthrosis, infection, heterotopic ossification and stiffness. The correct use of 90°/90° reconstruction plates or locking plates is a better option.

The conservative methods of addressing this problem, including the 'bag of bones technique' for severely comminuted fractures, are reserved for stable non-displaced fractures, patients with previous neurological injuries or non-functional limbs. The authors do, however, warn against the associated complications of joint stiffness, poor function and painful pseudoarthrosis.

Those orthopaedic surgeons who prefer primary elbow arthroplasty point to the reported complication rate of internal-fixation methods of treatment, the poor quality of osteoporotic bone and severe comminutions as a justification for their option. The new and improved elbow replacement prosthetic designs and improved surgical techniques have erased the original problems of loosening and lack of stability, wound infections and neurological symptoms. The stringent indications for primary elbow arthroplasty are outlined as the following:

- patients above 65 years with highly comminuted fractures are not amenable to open reduction and internal fixation
- significant bone loss or osteopaenia
- patients with pre-existing (symptomatic) osteoarthritis.

The contraindications would include active infection, contaminated open fractures and associated neurological injuries.

The concluding statement is that at present there is no strong evidence supporting one treatment option over the other and that the surgeon's experience and judgement should be the best guide until larger comparative studies have become available. For the average orthopaedic surgeon, the gold standard of care remains open reduction and internal fixation with good stabilisation and early restoration of motion.

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The effect of an unplanned excision of a soft-tissue sarcoma on prognosis

CR Chandrasekar, *et al*

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The authors report on 316 patients referred to a tumour centre for further management of soft tissue sarcomas after unplanned excision of previously unsuspected malignancies. The patients were re-staged and the operative site re-excised attempting to achieve a wide excision margin. Adjuvant radiotherapy was used in 37% patients. It was used in all later patients unless they had low grade tumours and a wide re-excision had been achieved.

Forty-one per cent of the re-excision specimens showed no residual tumour. Nevertheless local tumour recurred in 10% of the patients.

Fifty-nine per cent of re-excision specimens showed residual tumour, but a wide excision margin was achieved in only 79% of cases, demonstrating the difficulty of planning and performing adequate salvage surgery.

Risk factors for residual tumour were high grade sarcomas (72%), deep tumours (68%) and tumours larger than 5 cm (68%). There was an 83% risk of residual tumour if these three factors were combined.

Local recurrence followed re-excision in 29% of deep and 16% of superficial tumours. If a wide margin was achieved, high grade tumour recurrence rates were the same whether residual tumour had been present (25%) or not (23%).

Marginal excision of high grade tumours resulted in 67% recurrence emphasising the absolute importance of wide excision even at revision surgery.

The effect of radiotherapy could not be assessed.

Overall 5-year survival was 77%, with 24% of patients developing metastases. Poor prognostic factors were high grade tumours, presence of residual tumour at revision, and failure to achieve a wide re-excision margin.

The primary treatment for soft-tissue sarcomas is adequate surgical excision. Few of them are sensitive to chemo- or radiotherapy to any degree. Incomplete excision will result in local recurrence and metastasis of these tumours, and this will occur in the majority of unplanned operations.

The authors note that unplanned excision of soft tissue sarcomas occurs in 19% to 53% of patients referred to tumour centres. It certainly is very common in South Africa, and dealing with these compromised cases is a major challenge. Re-excision after injudicious, unplanned surgery often requires sacrifice of structures that might have been otherwise spared (often ending in amputation) leading to unnecessary disability.

This article shows that salvage surgery can be effective if performed at a tumour centre by experienced surgeons. The ideal situation, however, would be that surgeons should refer the high risk patients with a mass larger than 5 cm, a tumour increasing in size, or a tumour deep to the deep fascia for evaluation by a tumour surgeon, rather than performing inadequate surgery themselves.

SPORT lumbar intervertebral disk herniation and back pain

Adam M Pearson, *et al*

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The purpose of this multi-centre study was to relate back pain following lumbar disc herniation to the method of treatment, and the location and type of disc herniation.

A total of 1 191 patients with at least 6 weeks of sciatica and radiologically confirmed disc herniation were studied prospectively. Of them, 775 patients were treated by standard discectomy and 416 were treated conservatively by conventional methods. Patients were evaluated at enrolment, then 3 months, 1 year and 2 years afterwards, using questionnaires, etc. based on the Maine Lumbar Spine Study (MLSS) to allow comparison of the studies.¹ Primary outcomes were changes in SF-36 and Oswestry Disability Index (ODI), and secondary outcomes were changes in severity of back and leg pain.

Follow-up was good with 96% re-evaluated at least once, and 80% of surgical and 79% of non-surgical patients followed for 2 years. Within this 2-year period, 775 patients underwent surgery, while 416 received conservative treatment.

Dural tears (3%) and infections (2%) were the commonest surgical complications. By 2 years 6% of surgical cases required re-operation for recurrent herniation.

Back pain decreased significantly more in surgical patients than in conservative cases, although the difference was less marked by 2 years. In 25.5% of surgical cases and 17.6% of

conservative cases ($P = 0.009$) there was no back pain reported at 2 years.

Similarly, leg pain improved in both groups but more so after surgery. This improvement was significantly greater than improvement in back pain, and surgical patients improved more rapidly, achieving final status between 3 and 12 months.

Disc protrusion patients (27%) had less severe symptoms than extrusion/sequestration cases, and were less likely to undergo surgery (56% vs 64% $P = 0.0009$).

Central herniations had worse back pain at enrolment, but had similar rates of improvement to lateral herniation.

Surgical results were independent of the type of herniation (protrusion, extrusion or sequestration) and the site of herniation (central or lateral) at 2 years.

This paper is important as it documents the improved prognosis for back and leg pain of lumbar disc herniation treated surgically rather than conservatively. However the differences between surgical and conservative treatment are less significant as time progresses, demonstrating that conservative treatment remains a realistic option.

It also shows that results of surgery are independent of the type and localisation of the herniation.

The results are similar to those reported in the MLSS, although in the SPORT study conservative results were better than in the MLSS study, so the benefits of surgery are less clear.

Reference

1. Atlas SJ, Deyo RA, Keller RB, *et al*. The Maine Lumbar Spine Study. II. 1-year outcomes of surgical and non-surgical management of sciatica. *Spine* 1996;21:1777-86.