

EARLY RESULTS OF A CONTROLLED TRIAL OF THERMAL ANULOPLASTY FOR INTERNAL DISC DISRUPTION

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Objectives

Intradiscal thermal anuloplasty (IDTA) is a therapeutic innovation specifically designed for the treatment of internal disc disruption (IDD). It involves threading a flexible electrode percutaneously into the disc, so that it passes circumferentially around the inner surface of the annulus fibrosus. Heating the electrode denatures the collagen of the annulus, and coagulates the nerve endings in it. The present study was undertaken to evaluate the efficacy of this procedure.

Methods

Of 110 patients presenting with low back pain during a nine months period in 1998, 53 satisfied the diagnostic criteria for IDD prescribed by the International Association for the Study of Pain. Of these, 36 consented to undergo IDTA. The remaining 17 patients were denied permission by their insurance companies to undergo IDTA, and constituted a control group. The control therapy consisted of an established physical therapy rehabilitation program. Baseline measures were obtained from all patients with respect to visual analog pain score (VAS), Oswestry disability score, and drug consumption. The same instruments were administered to all patients at two weeks, 6-8 weeks, and 12 weeks after treatment.

Results

Of the control group, only one patient obtained resolution of their pain, and two were improved by about 20%. The remaining 14 patients remained in as much pain, and as disabled as before treatment, or worse. Of the 36 patients treated with IDTA only four obtained no relief of pain. The remaining 32 patients obtained varying degrees of relief. Their mean VAS dropped from 8.0 to 2.7. Some 50% of patients obtained a reduction by five on the 10-point VAS; 90% of patients obtained a reduction of at least three, and 53% of patients achieved a VAS of two or less. Improvement in VAS correlated with concomitant reduction in use of opioids and improvements in Oswestry scores.

Conclusions

In patients with rigorously established diagnosis, IDTA seems to be an effective therapy for IDD. The failure rate is 11%; but some 60% of patients obtain profound reduction of their pain. By continuing to monitor the patients the stability of pain-relief and rate of recurrence will be determined. Improvements in technique are expected to improve success rates.

THE PILATES BASED EXERCISE PROGRAMME IN THE MANAGEMENT OF LOW BACK PAIN

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Objectives

The Pilates programme was developed to help elite ballet dancers improve their fitness, agility and reduce the risk of injury during performance. This method teaches control of spinal movement during activities of daily living. This method is used by therapists in the management of low back pain in both Australia and the United States. To date, there has not been any report of the clinical outcome of this programme. The aim of this study was to evaluate the results of this form of therapy in the management of low back pain.

Methods

This study was a prospective study of consecutive series of 180 patients referred to three physiotherapy practices from January 1997 to July 1998. The patients were referred from the practice of one surgeon (RDF). Diagnosis was made by the referring surgeon from the history, examination, and relevant imaging (MRI, CT or radiographs). All patients had a Low Back Outcome Score (LBOS) completed at initial assessment. The duration of follow up was from four months to 12 months. Outcome was determined by questionnaire, either postal or by telephone. The questionnaire examined the patient's subjective responses to the treatment, their understanding of the treatment principles and whether or not they completed the course. They also filled out a LBOS form.

Results

The mean improvement in the LBOS was 7.1 points. Of those that completed the course, the mean improvement in their score was 10.1 points while those that did not complete, had a mean follow up LBOS of 5.3 points. Patients who understood the concepts had an improvement of 6.8 points. Patients who felt subjectively better had an improvement of 10.5 points. With respect to clinical grouping, the maximum improvement in patients was with spondylolisthesis (mean 16 points), degenerative (mean 8.1 points), discogenic (mean 5.4 points.) while the lowest was in patients with facet joint disease (mean three points)

Conclusions

The clinical impression that Pilates was beneficial in the management of low back pain has been confirmed by this study. The average improvement in the LBOS following fusion for back pain from this unit is 14 points. In this context the results of this study are encouraging and merit the conduct of the randomised prospective trial.

ANALYSIS OF THE INTERVERTEBRAL DISC HEIGHT POST MORTEM

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Introduction

The hydrostatic force in a healthy intervertebral disc is equivalent to its water content. In the body, the intervertebral discs are under a compressive load due to body weight and muscle tension. The compressive load and hydrostatic force equilibrate, resulting in water being transported into or out of the disc. On death and removal of the spine, the compressive force is removed. The disc will then imbibe water, increasing its height and thus reducing its range of motion as the ligaments and other soft tissues surrounding the joint are stretched. Mechanical tests on spinal motion segments need to take this disc height change into account if they are to predict conditions in life. This paper documents the disc height change in sheep post mortem.

Methods

15 sheep were killed and dissected immediately. Their lumbar spines were removed and pop rivets inserted into the transverse processes and the anterior aspect of the vertebral body. The spines were divided into three groups. Group 1 were frozen immediately, Group 2 were frozen five hours after death and Group 3 were frozen nine hours after death. Digital vernier callipers were used to take measurements between consecutive rivets for the motion segments L1/L2, L3/L4 and L5/L6. These measurements were taken immediately upon removal of the spine, prior to freezing and after four weeks frozen at -20°C .

Results

The difference in measurements can be attributed to disc height change as the bone dimensions are not altered post mortem. The change in disc height measured at the vertebral body differed significantly from the transverse process measurements and were treated separately. The mean disc height changes are shown in Figure 1 for the transverse process measurements and Figure 2 for the anterior body measurements. The disc height changes are calculated as the difference in the

measured value prior to freezing or while frozen to the initial post mortem measurements.

Discussion

Disc height tends to increase with extended periods of time at room temperature as the disc imbibes water and swells. Before freezing, the posterior portion of the disc tends to swell more than the anterior portion, suggesting the posterior disc is more compliant than the anterior disc. While frozen, the posterior portion reduces in height while the anterior portion increases. It is important that these changes are analysed and understood to ensure the intervertebral disc is returned to its in vivo height prior to mechanical testing.

IMPLANTABLE INTRATHECAL NARCOTIC PUMPS – A 7 YEAR EXPERIENCE

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Objective

To assess outcomes of implantation of narcotic pumps for non-malignant pain.

Method

Retrospective review of patient records by author.

Included

All patients who were personally trialled for suitability for implantation by a three lumbar puncture narcotic series including placebo control for the period May 1992 to April 1998.

Excluded

Patients who had implantation in another institution, or in whom the trials were not personally conducted

Results 28 patients were included in the study
18 workers compensation funding
10 private health funding

Types of pump:

SynchroMed (18 ml)	17
Infusaid (50 ml)	8
IsoMed (35 ml)	3

Narcotic currently used:

Morphine	9
Dilaudid	10
Morph+Clonidine	1
Fentanyl	1
Pethidine	1

Adverse Events:

Explanted for poor analgesic effect	3
Explanted for ?infection ?allergy	2
Pump motor stall (SynchroMed)	1
Refill error with neurological sequelae	1

Complication rate 25%

Pain relief (rated by author)

Excellent	12/28 (43%)
Some relief	9/28 (32%)
No benefit/adverse effects	7/28 (25%)

Conclusions

Implantable intrathecal narcotic pumps are generally regarded by patients as successful in providing excellent to reasonable analgesia in situations where oral narcotics are either ineffective or unable to be used because of adverse effects. In this series the major complication rate was 25% over a seven year period.

As most of the explantations occurred early in the seven year follow-up period, the author is hopeful of improvement in this complication rate over time.

THE INTERVERTEBRAL DISC: THE EFFECT OF COMPRESSION AND A PROSTHETIC DISC NUCLEUS

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Objectives

(1) It is commonly held that high forces applied to the intervertebral disc, and joints in general, play a role in causing disc degeneration. To this end we developed a canine model; (1) to study the effect of compressive force on the disc; and (2) to determine the effect of an introduction of a prosthetic disc nucleus (PDN) on the intervertebral disc matrix and the endplate. The specific aim of (2), is to design a prosthesis that would act as a surrogate nucleus, in the event of disc degeneration (or prolapse).

Methods

(1) To study the effect of compressive force in the disc, pairs of stainless steel coil springs were stretched and attached to produce a compressive force (range 70 N to 250 N) across the lumbar intervertebral discs (L1/L2 and L3/L4) of sixteen dogs. Dogs were killed between thirteen and twenty-seven weeks later. The discs (L1/L2 and L3/L4) were excised and assessed using immunohistochemistry and ELISA. T13/L1 and L4/L5 were used as controls. (2) Eight other dogs had prosthetic disc nuclei (PDNs) implanted (two hydrogel capsules) in L2/L3, while L1/L2 served as a control. These dogs were kept for periods ranging from 5-27 weeks then killed. The lumbar spines were removed and the discs together with the prostheses were analysed using histological and biochemical techniques.

Results

The main result was for the dogs that had springs attached for the largest number of weeks. For the nucleus, but not the anulus, Spearman rank correlations revealed a strong correlation between increases in force and force-weeks (i.e. force times the number of weeks), and changes in proteoglycan and collagen (L1/L2 and L3/L3) as compared to the controls (T13/L1 and L4/L5). (2) For the dogs that had PDNs implanted, three dogs retained both implants, three dogs retained one implant, while both implants were extruded in two dogs

Conclusion

(1) These experiments suggest that high compressive force applied to the disc over a period of time initiates changes in proteoglycan and collagen 2) A prosthetic disc nucleus (PDN) can be inserted and retained in the lumbar intervertebral disc of the dog.

MICROENDOSCOPIC DISCECTOMY

P. Moloney

Microendoscopic discectomy (MED) for nerve root compression is a relatively new procedure representing minimally invasive access to the spinal column. The technique was developed by Smith and Foley of Memphis, Tennessee. The instruments and technology were developed by Sofamor Danek, USA. The technique has a very steep learning curve and this paper represents experience of the author's first 30 consecutive cases.

Preliminary results suggest very good outcomes with low morbidity and reduced hospital stay. Convalescent time is reduced. In this series there were two early failures where the procedure was abandoned and a routine fenestration and partial discectomy performed. Headache due to CSF leak was a problem early in the series due to puncturing of the dura by the primary probe. No re-exploration for CSF leak or

other complications were necessary. Hospital stay averaged two days. Cost in disposables is moderately high but this is offset by decreased hospital stay and speedy convalescence.

The paper will discuss the technique highlighting pitfalls and suggested avenues to minimise complications.

Results including preliminary outcomes, hospital stay, complications, operating time, convalescence and return to work are presented. Overall, the technique is seen as an excellent form of treatment of prolapsed intervertebral disc.

THE NATIONAL SCOLIOSIS SELF-DETECTION PROGRAMME – A PRACTICAL APPROACH TO THE SCHOOL SCREENING DILEMMA

T.K.F. Taylor

This programme was first introduced in 1997 in response to the withdrawal of resources in the public health sector throughout the country. School screening programmes have been largely abandoned in government schools.

The programme is based on self-detection and education of general practitioners in detection of curvature and the principles of management. It is the policy of the Society that school screening, if it is to be carried out, should be done for girls in Year 7. This year the programme will see the distribution of a simple self-detection brochure to the 121,000 Year 7 girls in Australia. When a girl or her parents think she may have a curve, they are encouraged to consult their family doctor. An education programme for general practitioners has been undertaken via the Australian Family Physician. A paper on scoliosis and a ready-reference sheet have been distributed to 22,000 general practitioners. The aim is to have the family doctor assume the responsibility for management of minor curves (<20°). Examination of the spine and the forward bend test should be part of routine physical examination of adolescents. The programme is supported by the Royal Australian College of General Practitioners.

THE MANAGEMENT OF “DE NOVO” DEGENERATIVE SCOLIOSIS

T.G. Lowe

“De Novo” degenerative lumbar scoliosis is a common problem developing in patients over fifty years of age. The demographic, pathogenesis and clinical findings in this group of patients are discussed. Radiographic differences between “De Novo” scoliosis and idiopathic scoliosis are presented. A thorough medical workup is needed before treatment is initiated. Non-operative treatment includes physical therapy, NSAIDs, osteoporosis treatment, weight reduction, corsets, and occasionally epidural steroids.

Operative treatment is based on the general health of the patient, the severity of the deformity, and the nature of the disability (back pain, neurological, or combined). Operative treatment options and results are presented.

POSTERIOR SPINAL FUSION USING SMALL FIXATION SYSTEMS IN PROGRESSIVE JUVENILE SCOLIOSIS

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Objectives

Posterior spinal fusion for progressive scoliosis in the juvenile age group has largely been performed without fixation. The recent availability of smaller implants has allowed the senior author to fuse progressive scoliosis with fixation devices thereby allowing shorter time in plaster as well as achieving significant correction of the deformity. This preliminary study reviews six patients treated by posterior spinal

fusion using small fixation systems with references to the degree of correction, operating times, blood loss and post operative immobilisation.

Methods

Six consecutive patients aged between 3+2 and 9+8 years (mean 6 years and 10 months) with progressive scoliosis were treated with posterior spinal fusion using small fixation systems. All patients had autogenous as well as allogenic bone grafting. In five cases anterior fusion was also undertaken one week earlier as a staged procedure.

All patients were reviewed along with the radiographs and the degree of correction was measured. The duration of posterior surgery and the intraoperative blood loss were reviewed. The mean duration of follow up was 12 months (range 7 - 24 months).

Results

The preoperative lateral curve ranged from between 37 and 85 degrees (mean 57.8 degrees). Significant correction was achieved in all cases with the mean improvement of 26.5 degrees which was an improvement of 48% (range 22.5 – 70%). The mean operating time for the posterior fusion was 161 minutes with mean blood loss of 171 millilitres. Perioperative urinary tract infection was the only complication encountered.

Conclusions

The use of fixation device in posterior spinal fusion in juvenile scoliosis allows significant correction of the curve. This is achieved through a short operating time with minimal blood loss. So far, the procedure has been without any major complications and has allowed the patients to spend less time immobilised in the cast.

THE PATHOLOGICAL CHANGES RESULTING FROM INTRATHECAL INJECTION OF DEPOT-STERIODS IN SHEEP

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Study Design

A pathological analysis of the spinal cord and meninges in sheep subjected to an intrathecal injection of commonly used depot-steroids combined with bupivacaine.

Objectives

To determine if pathological changes occur when commonly used depot-steroid/bupivacaine combinations are injected intrathecally in sheep. To compare the frequency of these changes between agents using Ringers Solution as a control.

Background data

Controversy exists regarding the safety of epidural depot-steroids because of the risk of intrathecal injection of these agents. Previous studies have supported the safety of these substances when injected epidurally. There are few studies analysing the pathological changes subsequent to intrathecal injections and no studies on the pathological changes subsequent to the intrathecal injection of these substances combined with bupivacaine.

Methods

114 sheep were divided into 5 groups. Each group had either Depomedrol (group A), Depomedrol and bupivacaine (group B), Kenacort and bupivacaine (group C), Celestone Chronodose and bupivacaine (group D) or Ringers Solution (group E) injected intrathecally using a sterile no touch technique. The animals were sacrificed at one month, a laminectomy was performed, the spine and meninges were removed and sent to a neuropathologist blind to the injectate. Macroscopic and microscopic analyses were undertaken. Specimens were divided on the basis of inflammation

being present or absent. Logistic regression was used to compare the groups using Ringers solution group as the reference. The odds ratios, their 95% confidence intervals, and p-values for comparison against the ringers solution group were calculated.

Results

No abnormality other than inflammation was found in any of the specimens. 2/10 sheep in group A, 5/29 in group B, 2/28 in group C, 8/20 in group D and 2/27 in group E showed inflammatory change. Group D had a significantly greater chance (OR:8.3, p=0.014) of developing inflammatory change. Groups A and D had odds ratios of 3.1 and 2.6 respectively, which were not statistically significant. Group C had an odds ratio of 0.97.

Conclusion

Intrathecal injection of Depomedrol, Depomedrol/bupivacaine and Kenacort/ bupivacaine does not result in a significantly higher incidence of arachnoiditis in sheep than the intrathecal injection of Ringers solution. The argument that inadvertent intrathecal injection of Depomedrol combined with bupivacaine will invariably cause arachnoiditis is not supported. Celestone Chronodose combined with bupivacaine was found to cause a significantly higher incidence of inflammation when compared to Ringers Solution. On the basis of this study, we suggest that injections performed around the spine where intrathecal spread is possible should not contain Celestone Chronodose combined with bupivacaine. This includes epidural, facet joint and root sleeve injections.

MAGNETIC RESONANCE IMAGING OF VERTEBRAL DISCITIS PRE-MORTEM, POST-MORTEM, AND AFTER FREEZING AND THAWING

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Objectives

MRI is the investigation of choice in the treatment of discitis. However, it is expensive and difficult to access frequently for animal studies. In addition MRI of frozen then thawed specimens is common in research studies; no study has correlated the images in the living animal with the post-mortem and thawed specimens. Therefore the aim of this study was to correlate the MRI signal changes between a pre- and post- mortem specimen, both immediately after death and then after the specimen is thawed to room temperature after being frozen.

Methods

In an ovine discitis model, MRI images were correlated in a pre-mortem, post-mortem and frozen then thawed dissected specimen. A single adult sheep had two lumbar discs inoculated with staph epidermidis, leading to discitis. The sheep was anaesthetised and the lumbar spine imaged with a Siemens Magnetom Vision MRI. Immediately post mortem an identical series of images were obtained. The lumbar spine was then dissected out, frozen and then thawed prior to repeating the earlier sequences.

Results

Multiple T1 and T2 sequences were performed. The anatomy of the endplates was disrupted, there were infective changes within the nucleus pulposus, and a gradient of inflammatory changes across the vertebral body. T1 SGE and T1 FSE images provide clear delineation of spinal structures and the freezing and thawing process did not degrade the images.

Conclusion

The MR appearances of spinal tissues, which have been frozen and then thawed, correlate well with those in the live animal confirming the validity of this method of investigation. Specimens can be dissected, frozen and stored until numbers and timing are appropriate to optimise research time in a busy clinical unit.

PREVENTING VERTEBRAL ENDPLATE FAILURE IN DISCITIS

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Objectives

Pyogenic discitis can spread through the bony endplate to the vertebral body and, in some cases, an epidural abscess may develop. Presently, the most common treatment is intravenous antibiotics. MRI allows the diagnosis of discitis to be made as early as the sixth day after inoculation. We investigated the possibility that early diagnosis and aggressive treatment, including intradiscal antibiotics, can prevent endplate destruction.

Methods

12 two-year-old Merino wethers were inoculated at two or three lumbar levels with staph epidermidis, using an open anterior approach. Treatment was commenced prior to end plate destruction, on day seven.

The sheep were treated with a long acting cephalosporin, in one of three ways:

- intradiscal injection, (again via an open anterior approach)
- intravenous delivery for 14 days
- intradiscal injection followed by intravenous therapy for 14 days.

Histology was obtained 42 days after infection.

Results

Every infected, but untreated, animal developed osteomyelitis. Intradiscal or intravenous antibiotics starting at day seven prevented 25% of subjects developing bone infection. Combining regimes more than double the efficacy of treatment.

Conclusion

If CT or MRI show the endplate to be intact, combined intradiscal and intravenous antibiotics will have a significant effect on preservation of the endplate, and hence lead to lower morbidity.

A COMPARISON OF CERVICAL AND THORACIC INJURIES IN 45 AUTOPSY SPINES

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Introduction

In previous autopsy studies of 234 cervical spines, 146 were from blunt trauma fatalities. Death was from motor vehicle trauma in 95 and from falls or blows in 51. Injuries were observed in 138 of the cervical spines and these have been described in previous publications (J. Musculoskeletal Pain 1996, 4:61; Injury 1998, 29:335). In 45 of the specimens, in addition to the cervical spine, the T1-6 segment of the

thoracic spine was also sectioned. This presentation describes the thoracic injuries and compares them with the cervical injuries.

Methods

The 46 spines were carefully removed by an experienced, forensic pathology technician, each specimen extending from the skull base to T6. Spines were fixed in formalin for one week, x-rayed, embedded in 6.5% gelatin, frozen on dry ice at -70°C and cut in 2.5 mm sagittal slices on a band saw in two blocks (C1 to T1 and T1 to T6) with a special guide to ensure regular section thickness. Sections were viewed and photographed using a dissecting microscope.

Description of injuries

The common sub-axial cervical injuries were disc tears and facet haemarthroses. Disc tears ranged from anterior annular tears to complete linear avulsions of the disc from the vertebral body along the disc vertebral junction. Facet haemarthroses were associated with injury to the synovial or fibrous capsule or with articular cartilage or subchondral bone fractures some with partial detachment of the articular cartilage. Fourteen of the 45 thoracic spines showed either wedge compression fractures of the vertebral bodies or fracture dislocations with pedicle or laminar fractures. Three T1-6 spines showed no visible injuries. Most thoracic spines showed relatively minor injuries with no obvious deformity. The most commonly observed minor injuries were facet haemarthroses (in 36 spines) and bone bruising with trabecular microfractures (31 spines) usually with vertebral end plate fracture. The neat linear disc avulsions observed in the cervical spine were rarely seen in the thoracic spine but there was often bleeding into the thoracic discs from the vertebral end plate injury (28 spines). Facet haemarthroses were sometimes associated with facet fractures (12 spines), usually without displacement. The nature of the injuries suggested that axial compression was a common mechanism of injury.

Comment

In patients with chronic pain from severe neck sprains, persisting interscapular pain is often a major complaint and the question arises as to whether the pain is referred from the cervical spine or arising locally from thoracic injuries. To the best of our knowledge the relative frequency of cervical and thoracic injuries has never been investigated in an autopsy series. This study suggests the possibility that thoracic injuries may be responsible for persisting interscapular pain in such patients more often than we have previously suspected.

HEAD AND NECK SYMPTOMS IN DEMOLITION DERBY DRIVERS WHO ARE SUBJECTED TO MULTIPLE WHIPLASH INJURIES

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Design

A retrospective questionnaire about headache, neck pain and other symptoms associated with whiplash was given to female demolition derby drivers and age- and sex- matched controls

Methods

The frequencies of headache and neck pain in 57 female demolition derby drivers, were compared with those of age- and sex-matched controls randomly selected from a general practice database. The controls were otherwise well and had attended solely for routine gynaecological assessment.

Results

There was a 56% response rate (33/59) from the Drivers, and 96% (66/69) from the Control group. Drivers had a lower frequency of self-reported neck pain (OR 0.45; 95% CI 0.17-1.15) and headache (OR 0.25; 95% CI 0.06-0.96) than the Control group. Similar results were found when a worst case analysis was performed.

Conclusions

This retrospective survey suggests that females may sustain repeated and unexpected impacts in motor vehicles in non-adversarial circumstances, without an increased risk of head or neck pain when compared to age- and sex-matched controls.

NEUROLOGICAL COMPLICATION AND POST-OPERATIVE WOUND INFECTIONS IN THE SPINAL DEFORMITY PATIENT

T.G. Lowe

Neurological sequelae and wound infection are two of the most common complications following surgery for spinal deformity.

Neurological complications include cord injuries as well as cauda equina – nerve root injuries. The aetiology can be vascular, mechanical, or a combination. Certain types of deformities and procedures carry a high risk for neurological monitoring during surgery (cord and cauda equina). Treatment protocols are well established for all types of neurological injuries.

Postoperative wound infection is related to local factors at the operative site, systemic patient related factors, operating room environment, and procedural factors. The diagnosis is often based on a high index of suspicion and includes selection of appropriate laboratory studies. Treatment is surgical with antibiotic coverage based on cultures. The aetiology, pathogenesis, and treatment of late onset infection with spinal instrumentation is discussed.

THE ACCURACY AND EFFICACY OF LUMBAR MEDIAL BRANCH NEUROTOMY FOR ZYGAPOPHYSIAL JOINT PAIN

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Objectives

A study was undertaken of 15 carefully selected patients to determine the efficacy of lumbar medial branch neurotomy for zygapophysial joint pain. Pre-operative and post-operative electromyography was performed in order to determine the accuracy of denervation.

Methods

From a population of 41 patients with uncomplicated chronic low back pain, clinically consistent with zygapophysial joint pain, 15 were selected who obtained greater than 80% relief of pain on each occasion following diagnostic blocks using lignocaine and bupivacaine. Each proceeded to treatment by percutaneous radiofrequency medial branch neurotomy. Before and after operation, electromyography of the multifidus was performed using needle electrodes. Clinical outcome was measured at six weeks, three months, six months and 12 months using visual analogue pain scales, the McGill pain questionnaire, a Roland-Morris inventory, the SF 36 general health questionnaire, and the North American Spine Society treatment expectations.

Results

All but two patients obtained relief of their pain, which was sustained over the follow-up period. The visual analogue scales dropped from a mean of 5.2, with a range of 2 to 9 before treatment, to a mean of 0.9, with a range of 0.0 to 6.9, at 12 months. Some 60% of the patients obtained at least 90% relief of their pain at 12 months, and 87% obtained at least 60% relief. Improvement in pain correlated strongly with improvements in objective measures of disability. Relief was associated with denervation of the multifidus in those segments whose medial branches had been coagulated. Pre-operative electrical stimulation, and measurement of impedance, was not associated with outcome.

Conclusions

Lumbar medial branch neurotomy is an effective means of reducing pain in patients carefully selected on the basis of controlled diagnostic blocks. Adequate coagulation of the target nerves can be achieved by carefully placing the electrode in correct position as judged radiologically. Electrical stimulation is superfluous in correctly placing the electrode. Notwithstanding its efficacy, the procedure is applicable to only a minority of patients with chronic low back pain.

EVALUATION OF NEW METHOD FOR DETERMINING TRANSLATION OF LUMBAR SPINAL SEGMENTS

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Objectives

The conventional method for determining the translation of a lumbar vertebra involves measuring the horizontal displacement of the posterior inferior corner of the vertebra from its extension position to its flexion position. This displacement, however, is not a true measure of translation, for it is confounded by the rotatory motion of the vertebra. The true translation must be measured using a point that does not rotate. The centre of reaction is such a point. The present study was undertaken to establish the reliability of a new method of determining translation using the centre of reaction, and to report the magnitude of translation of lumbar vertebrae.

Methods

Flexion-extension lumbar radiographs were obtained of 20 asymptomatic young males. Each was traced, and the location of the instantaneous axis of rotation of each segment was plotted. From each axis the centre of reaction was plotted by geometric construction, and the translation of this point was measured. The reliability of the method of construction was determined by comparing the constructions performed by two observers on 20 randomly selected segments.

Results

The centres of reaction were found, on the average, to lie slightly behind the midpoint of the inferior endplate of each lumbar vertebra. The technique for determining the centre of reaction had excellent inter-observer reliability, with a Pearson correlation coefficient of 0.995; and was not subject to errors in construction of the instantaneous centre of rotation. For segments L2 to L4 the range of translation was 3.3 (± 1.5) mm; at L5 it was 2.3 (± 1.9) mm.

Conclusions

The new method for determining translation proved highly reliable. It yielded mean ranges of translation somewhat larger than those found by previous methods. Moreover, up to 6 mm of translation of a lumbar segment can occur in normal subjects, which is limit of normal substantially greater than that previously estimated. Lumbar segments translate to a greater extent than previously appreciated. Errors in previous techniques have underestimated the magnitude of true lumbar translation.

A MECHANICAL ANALYSIS OF POLYAXIAL PEDICLE SCREWS

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Purpose

Transpedicular implants for posterior stabilisation of the spine are increasing in popularity. Polyaxial pedicle screws offer advantages over standard monoaxial pedicle screws in terms of positioning. The present study examines the static

properties of five different polyaxial screws in compression-bending, tension-bending and torsional following ASTM F 1717.

Methods

Five titanium alloy polyaxial pedicle screw systems were tested following ASTM F1717 guidelines in compression-bending, tension-bending and torsion (N=5 per test). The five systems examined were: Moss Miami, Synergy Open System, Synergy Closed System, Tenor and XIA. Load and displacement data and mode of failure were recorded for each test. The load at a 2% offset (N), stiffness (N/mm), ultimate displacement limit and ultimate load limit were determined for all groups for compression-bending and torque at 2% offset (Nmm), torsional stiffness (Nmm/degree) for the torsional testing.

Results

No screw shaft failures were observed in any of the static testing. Figure 1 (not shown) presents a summary of typical load versus displacement curves for the compression-bending testing. These curves reveal a failure by slippage of the polyaxial mechanism in the Moss Miami, Synergy Open, Synergy Closed and XIA systems. This mechanism produced a characteristic reduction in load during displacement. The Tenor system did not present this failure mode in compression or tension bending. Torsional data did not reveal any great differences between systems.

Discussion

Data from the current study employed a standard testing protocol (ASTM F1717) to examine the mechanical behaviour of five different polyaxial pedicle screw systems in a corpectomy model tested in compression-bending, tension-bending and torsion. This standard does not intend to define the clinical performance of these devices, but does provide a mechanical basis for comparison. Similar mechanical behaviour was observed in terms of mechanism of failure for all systems except the Tenor, which did not slip in compression-bending or tension-bending. All systems demonstrated similar stiffness in the initial part of the load versus displacement curves.

A THREE DIMENSIONAL SIMULATION STUDY OF THE MECHANICS OF THE THORACOLUMBAR FASCIA

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Objectives

A three dimensional simulation study was instigated to investigate the moment generating potential and stabilising effect of the thoracolumbar fascia on the lumbar vertebrae.

Methods

Three fibre directions from the thoracolumbar fascia were included in the model. These represented the middle layer, and the deep and superficial laminae of the posterior layer of the fascia. Lines of action of the fibres in the transverse plane were estimated from CT scans to ensure they represented the anatomy of living subjects. This was particularly important for the laminae of the posterior layer since they wrap around the posterior of the erector spinae muscles. A variety of force allocation methods were investigated since there is no data relating to how the lateral raphe distributes the forces (either between layers or along its length) which are produced by the transverse abdominis, and the portions of the latissimus dorsi and internal obliques which form the fascia.

Results

The thoracolumbar fascia only attaches directly to L2, L3 and L4. However, it is capable of producing moments about all intervertebral joints from L2/L3 to L5/S1 due to the attachment of the lateral raphe to the iliac crest and the linking of the vertebrae through the intervertebral discs. The action of an individual group of fibres attaching to a specified vertebra can have different effects at different levels of the spine. For instance, in the upright posture the superior fibres of the posterior layer which attach to L2 act caudomedially and produce a flexion moment about L2/L3, but produce extension moments about L3/L4, L4/L5 and L5/S1. The combined extension moment generated by all three fibre directions is largest at the L5/S1 level where a moment of approximately 15Nm is produced.

Conclusions

This study is the first reported study of the action of the thoracolumbar fascia in three dimensions. It includes the middle and posterior layers of the fascia, with two laminae used to represent the posterior layer. Results indicate that the moments produced by contraction of the transverse abdominis, internal obliques and latissimus dorsi need to be considered when investigating the overall moments exerted on the spine particularly at lower lumbar levels. In the upright posture lateral bending and axial twist moments are zero due to the symmetry of the body. However, in altered postures moments produced by the fascia have the potential to stabilise the spine.

THE SUCCESSFUL TREATMENT OF VERTEBRAL ARTERY THROMBOSIS AND EVOLVING HEMIPARESIS WITH STREPTOKINASE FOLLOWING A FRACTURE-DISLOCATION OF THE CERVICAL SPINE

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Objective

To report a case of vertebral artery thrombosis in an adult male which occurred about 18 hours after a fracture-dislocation of the cervical spine with marked posterior displacement of the proximal segment.

Methods

A detailed clinical history will be presented together with detailed description of clinical progress, radiological finding and streptokinase treatment.

Results

The patient suffered an unusual fracture-dislocation of the cervical spine following a motor cycle accident. Initially, he presented with a mild central cord syndrome, which settled over eight hours. About 18 hours after his injury, he developed right-sided hemiparesis with right facial palsy, slurred speech and a decreasing level of consciousness. He was investigated by cerebral and vertebral artery imaging. A vertebral artery thrombosis was diagnosed and treatment by streptokinase infusion. The thrombosis dissolved and the patient made a full recovery.

Conclusion

This is the first such successful management of this complication at our institution. All previous cases have resulted in the death of the individual. We conclude that early diagnosis and prompt intervention may have contributed to our patient's survival. A review of the literature will be presented.