

Journal club: 23 February 2012

Attendees: Mr D.Allan, Mr D.Russell, Mr A.Brydone, Miss N.Sciberras
West of Scotland Journal Club

Theme: Surgery of the Spine

- 1. Weinstein JN, Lurie JD, Tosteson TD, Hanscom B, Tosteson ANA, et al.**
Surgical versus nonsurgical treatment for lumbar degenerative spondylolisthesis.
NEJM 2007; 356: 2257-70.
- 2. Denis F.**
The three column spine and its significance in the classification of acute thoracolumbar spinal injuries.
Spine 1983;8:817-31.
- 3. Vaccaro A. R., Lehman Jr. R. A., Hurlbert R. J., Anderson P. A., Harris M., Hedlund R et al.**
A new classification of thoracolumbar injuries: the importance of injury morphology, the integrity of the posterior ligamentous complex, and neurologic status. *Spine*. 2005;30:2325-33.

Surgical versus nonsurgical treatment for lumbar degenerative spondylolisthesis.

Reviewer: Mr Alistair Stewart Brydone

1. Purpose

This trial set out to determine the best treatment for patients with symptomatic degenerative spondylolisthesis by randomizing patients to surgical and non-surgical treatments.

2. Methods

Patients were enrolled between 2000 and 2005 in 13 institutions. All patients had: (1) 12 wks of symptoms (Neurogenic claudication or radicular leg pain with associated neurological signs); (2) spinal stenosis evident on cross-sectional imaging; and (3) degenerative spondylolisthesis on lateral standing X-ray. This trial was conducted in 13 institutions and patients were seen by trained nurses and given a choice of entering the randomized controlled trial or observational study. All patients receiving surgery underwent posterior decompressive laminectomy \pm posterolateral fusion with iliac bone crest graft \pm pedicle screw fixation. The main outcomes measures used in this trial were patient assessed symptom severity scores. Patients were reviewed at 6 weeks, 3 months, 6 months, 1 year, and 2 years. These included (amongst others): the SF-36 (a 36-item general health survey of bodily pain and physical function with 0 being the worst of the scale and 100 the best); the Oswestry Disability Index (0 best and 100 worst, American Academy of Orthopaedic Surgeons/Modems version); satisfied with symptoms; satisfied with treatment; and self-rated major improvement in progress. The Oswestry Disability Index (ODI) is composed of 10 questions, which can each score 5, and the total score is converted to a percentage of the maximum possible total (from the questions answered). A change of 10% (i.e. a score difference of 5) is considered clinically meaningful. They performed a power analysis was conducted using a

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two-tailed Student's t-test, powered at 85% to obtain a score difference of 10 (10%) on SF-46 bodily pain, and determined that 150 patients were required in each arm.

3. Results

There were numerous differences in the baseline patient characteristics. Patients not having surgery were older and had worse symptom scores. As the patients in the observational group had the option to choose their treatment, and the randomised group had the option to change their treatment, significant cross over was observed. 74.8% of patients who definitely preferred non-surgical treatment had non-surgical treatment and 97.0% of patients who definitely preferred surgical treatment had surgery, regardless of the previous randomisation. 86% patients had grade I (<25% slip) and 14% grade II (25-50% slip) spondylolisthesis. In the surgical group, 9% experienced dural tear and there was a 13% reoperation rate.

The as-treated analysis presented data on 235 non-surgical patients and 419 surgical patients, and showed a significant advantage for surgery based on the patient assessed outcomes at two years. SF-36 and ODI scores improved for both surgical and non-surgical patients (see table). A larger improvement was observed in the surgical group, although the importance of the difference is lessened as the baseline scores started significantly poorer. Intention to treat analysis showed no improvement in the treatment outcomes.

	SF-36 (Bodily pain)	SF-36 (Physical function)	Oswestry disability index
Surgical group (pre-op)	29.2 ± 16.8	30.5 ± 20.5	45.0 ± 16.6
Surgical group (2 yrs post-op)	59.1 ± 1.2	57.1 ± 1.3	20.8 ± 1.0
Change	+29.9	+26.6	-24.2
Non surgical group (pre-op)	34.4 ± 16.7	40.3 ± 23.9	36.2 ± 18.5
Non-surgical group (2 yrs post-op)	46.1 ± 1.5	56.9 ± 1.5	28.7 ± 1.2
Change	+11.7	+8.3	-7.5

The nonsurgical interventions were not pre-specified by the trial. 42% received physical therapy, 45% epidural steroid injection, 51% non-steroidal anti-inflammatory drugs, and 34% opioid therapy. More patients in the randomized cohort visited a surgeon, received injections and used narcotics ($P<0.05$). The trial also noted that patients <65 improved sooner after surgery, L3/L4s had better outcomes than L4/L5s, and patients without further education had poorer outcomes. The study was however not designed for subgroup analysis.

4. Conclusions

Patients with persistent neurogenic claudication from degenerative spondylolisthesis who had surgical intervention showed substantially greater improvement in pain, function and satisfaction than patients who had non-surgical treatment.

4. Critique

Strengths

Well designed

Large multicentre trial

Very applicable to clinical practice

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Patient centred decision-making enhanced the trial's appeal

Interesting demonstration of intention-to-treat vs. as-treated analysis in surgical trials

Methodological Concerns

Remain uncertain of the clinical burden of this disease to society

The radiological criteria for spondylolisthesis and lumbar stenosis was not well described

Large numbers of cross over negated randomisation

The difference in baseline scores was not well discussed

Specification of non-surgical treatment with minimum guidelines may have improved outcomes

Clinical relevance

- Very relevant for this group of patients and for spinal surgeons
- As a result of this trial the North American Spine Society Guidelines (NASS 2011) enhanced their grade of treatment recommendation for 2008

The three column spine and its significance in the classification of acute thoracolumbar spinal injuries.

Reviewer: Mr David Russell

Summary

1. Purpose

Introduce the concept of middle osteoligamentous complex formed by the posterior wall of the vertebral body, posterior longitudinal ligament and posterior annulus fibrosus. Present the correlation between 3 column classification system and injury severity and therapeutic indications. Controversy regarding 2 column classification and relation to stability existed at the time of publication.

2. Methods

Author analysed history of injury, x-rays, CT scan and operation notes. 120 operation notes available, 53 CT scans. Pathological fractures were excluded.

Age mean 32.3, range 17-75. Rationale / biomechanical concept: based on biomechanical and cadaveric work, complete rupture of posterior ligamentous complex alone does not produce instability in flexion, rotation, shear or extension. Additional rupture of the posterior longitudinal ligament and posterior annulus fibrosis may lead to instability at least in flexion. This hypothesis renders the 2 column classification inadequate in relating stability.

3. Results

Denis classifies the injuries as follows:

Minor (single element of a single column) n=70

Major: divided into compression (n=197), burst fractures (n=59), fracture dislocations (67), seat-belt type spinal injuries (n=19)

Correlation of Injury Type and Neurology

Compression fractures – no neurological compromise

At T1&2 brachial plexus and L4&5 lumbosacral plexus injuries may be seen. Patients with isolated spinous process fractures have cord contusions, especially at the conus.

Compression fractures did not appear to present with neurology.

52.5% of the burst fracture group (31/59) were neurologically intact on examination with 'one in two' remembering transient leg numbness/weakness. 28 with persistent deficits included only 1

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complete paraplegia at low thoracic level. The remainder had incomplete paraplegias and none demonstrated dural tear on operative exploration. None of the seat belt injuries demonstrated neurological compromise. 25% of the fracture dislocation shear type injuries were intact, of the other 75% (42/56), approximately half were complete neurological injuries. All shear type fracture dislocations were complete paraplegics (n=7), and 3 of the 4 flexion-distraction injuries were incomplete paraplegics, the remainder being neurologically intact.

Correlation of Injury Type and Stability:

States only minimal and moderate compression fractures should be classed stable and have an intact posterior column allowing early ambulation without fixation / external support. Instability in the first degree is mechanical without neurological compromise and can be present in severe compression fractures and seatbelt injuries where the middle or anterior column act as a hinge respectively. These may be braced in extension or require open fixation. Instability in the second degree refers to burst fractures where neurology may not be present, but axial loading even in cast may increase neural compression. In this cohort, 6 of 29 non-operatively treated patients developed a neurological deficit. Instability in the third degree refers to severe, neurologically impaired burst fractures and fracture dislocation. These warrant surgical decompression and stabilization.

4. Conclusions

Author builds a case for proposing the middle column as the primary determinant of stability, not the posterior column.

5. Critique

Strengths

Large series

Good anatomical description of injury and relation to stability

Many arguments supporting the condition of the middle column being the main determinant of stability after injury

Introduces soft tissues

Methodological Concerns

Retrospective

Single series

Lack of 3D imaging to accurately demonstrate fracture types in all cases, understanding that these may not have been warranted clinically

Data presentation not completely clear and conclusions drawn often with little support from the data

A new classification of thoracolumbar injuries: the importance of injury morphology, the integrity of the posterior ligamentous complex, and neurologic status.

Reviewer: Nadia Claire Sciberras

Summary

1. Purpose

The aim of this paper was clearly defined. This was to devise a practical, yet comprehensive, classification system for thoracolumbar (TL) injuries that assists in clinical decision-making in terms of the need for operative versus non-operative care and surgical treatment approach in unstable injury patterns.

2. Methods

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The authors performed a literature review on thoracolumbar spine trauma. Data was obtained from selected articles and this was reviewed by forty surgical spine experts from fifteen level one trauma institutions who were asked to tabulate major limitations for each classification system. The experts were further polled for characteristics of thoracolumbar spine trauma that they deemed were essential for clinical judgement and decision-making. The deficiencies in current systems were combined with these essential characteristics and a classification system was produced. It was agreed that the classification system had to include:

1. A description of the major morphometric features
2. An analysis of injury severity
3. An assessment of mechanical and neurologic aspects of injury
4. Reproducibility
5. Usefulness in prospective research settings
6. Flexibility to evolve through future clinical studies.

The new classification was validated through surveys sent to two groups: a single institution and to the Spine Trauma Study Group. Following some minor modifications, the new classification system entitled Thoracolumbar Injury Classification and Severity Score (TLICS) was applied to a common series of clinical situations discussed among all of the investigators to ensure the elimination of any remaining apparent limitations.

3. Results

Three variables were identified as being critical to clinical decision-making as these were thought to be independent predictors of clinical outcome:

1. Morphology of the injury
2. Integrity of Posterior Ligamentous Complex (PLC)
3. Neurologic status of patient

Subgroups were identified within each category and these were arranged from least to most significant. Scores were attributed to each subgroup and the final score, called the Injury Severity Score, dictated the clinical management. Furthermore, a methodology was developed to determine the optimum operative approach for surgical injury patterns.

4. Conclusions

Numerous classifications are available, such as the American Spinal Injury Association (ASIA) classification, the AO classification and the Denis classification with the latter two being the commonest classification systems used. However there has been lack of acceptance of any classification due to difficulty in applying them to clinical practice. In addition to facilitating decision-making, the authors claim that the TLICS classification may also facilitate communication about thoracolumbar injuries whilst its ease of use will make it an ideal tool for research purposes.

5. Critique

Strengths

The paper addressed an important clinical question

Clinical experience – the classification evolved from a previous classification from the same authors

40 spine experts from different institutions and different countries

The classification system was validated

Methodological Concerns

Although authors validated the classification, no results of inter/intra observer analysis were given

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The classification was applied to a series of clinical situations to validate treatment management, but the number of cases used was not given