

■ TRAUMA

Is a fracture of the transverse process of L5 a predictor of pelvic fracture instability?

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In the management of a pelvic fracture prompt recognition of an unstable fracture pattern is important in reducing mortality and morbidity. It is believed that a fracture of the transverse process of L5 is a predictor of pelvic fracture instability. However, there is little evidence in the literature to support this view. The aim of this study was to determine whether a fracture of the transverse process of L5 is a reliable predictor of pelvic fracture instability.

We reviewed our hospital trauma database and identified 80 patients who sustained a pelvic fracture between 2006 and 2010. There were 32 women and 48 men with a mean age of 40 years (10 to 96). Most patients were injured in a road traffic accident or as a result of a fall from a height. A total of 41 patients (51%) had associated injuries. The pelvic fractures were categorised according to the Burgess and Young classification. There were 45 stable and 35 unstable fractures. An associated fracture of the transverse process of L5 was present in 17 patients; 14 (40%) of whom had an unstable fracture pattern. The odds ratio for an unstable fracture of the pelvis in the presence of a fracture of the transverse process of L5 was 9.3 and the relative risk was 2.5.

A fracture of the transverse process of L5 in the presence of a pelvic fracture is associated with an increased risk of instability of the pelvic fracture. Its presence should alert the attending staff to this possibility.

Pelvic fractures are associated with significant morbidity and mortality.¹ Their orthopaedic management remains a challenge, as has recently been highlighted in the BOAST guidelines.² The early recognition and prompt treatment of an unstable fracture is of the utmost importance. Although it is often apparent both clinically and radiologically that a pelvic fracture is unstable, the increased use of pelvic binders by paramedical staff means that in some circumstances instability may not immediately be apparent.

It is believed by pelvic surgeons that a fracture of the transverse process of L5 is an indicator of pelvic instability. This association is explained by the fact that the iliolumbar ligament runs from the transverse process of L5 to the iliac crest, and as a result may avulse the transverse process during a high-energy injury. However, there is little evidence in the literature to support this belief.³⁻⁵ The aim of our study was to determine whether a fracture of the transverse process of L5 is a reliable predictor of pelvic fracture instability.

Patients and Methods

A total of 80 patients who sustained a fracture of the pelvis between 2006 and 2010 were identified from the hospital's trauma

database. There were 32 females and 48 males, with a mean age of 40 years (10 to 96). Their data were collected prospectively. Patient demographics, mechanism of injury, associated injuries and the need for surgical intervention were recorded. Most patients sustained their injuries either in a road traffic accident or as a result of a fall from height. Other mechanisms of injury included falling downstairs and falling from a horse. In all, 41 patients (51%) had a total of 80 associated injuries (Table I). The most common associated injuries were to the chest or abdomen and fractures of long bones.

All fractures of the pelvis were categorised by the senior author (JL) according to the Burgess and Young classification.⁶ They were then subclassified into stable (lateral compression (LC) 1, LC 2, anterior posterior compression (APC) 1) and unstable (LC 3, APC 2, APC 3, vertical shear (VS)) fracture patterns. Every patient had a CT scan on admission. The presence of a fracture of the transverse process of L5 was recorded.

Statistical analysis. The data were analysed using the chi-squared test. The relative risk and odds ratios for the L5 transverse process

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Table I. Patient demographics and associated injuries

Parameter	Number
Mean age (yrs) (range)	40 (10 to 96)
Male:female	48:32
Mechanism of injury (n)	
Road traffic injury	47
Fall from height	11
Crush	9
Other	13
Associated injuries (n)	
Head	8
Spine fracture	8
Chest	14
Intra-abdominal	7
Long-bone fracture	16
Acetabular fracture	10
Other	17

Table II. Fracture stability and the presence of a fracture of the transverse process of L5

Classification*	No L5 transverse process fracture	L5 transverse process fracture
Stable	42	3
LC 1	33	3
LC 2	6	0
APC 1	3	0
Unstable	21	14
LC 3	2	0
APC 2	8	2
APC 3	2	0
VS	6	10
Combined	3	2

* LC, lateral compression; APC, anterior posterior compression; VS, vertical shear

fracture as a predictor of pelvic fracture instability were calculated. A p -value < 0.05 was considered statistically significant.

Results

There were 45 stable and 35 unstable fractures: in 17 there was an associated fracture of the transverse process of L5 (Table II). Overall, 14 of the 35 unstable injuries (40%) had a fracture of the transverse process, compared to only three of the 45 stable fractures (7%). This difference is statistically significant ($p = 0.001$). The relative risk and odds ratio for the L5 transverse process fracture as a predictor of the presence of an unstable fracture of the pelvis were 2.5 and 9.3, respectively.

All stable pelvic injuries were treated conservatively, but 25 of the 35 unstable injuries required surgery. The other ten unstable fractures were treated conservatively, either because the patients were not fit enough for fixation or because of a delay in referral.

Four patients died as a result of their injuries; only one of these had a fracture of the transverse process of L5.

Discussion

This study confirms that in patients with a fracture of the pelvis the presence of a fracture of the transverse process of L5 is associated with an increased risk of instability of the fracture of the pelvis. Its presence on a plain radiograph or CT scan should alert the attending staff to the possibility of an unstable fracture pattern that may not initially be obvious. The importance of this lies in the fact that fractures of the pelvis are associated with significant morbidity and mortality¹ which may be as high as between 10% and 20% in an unstable injury. In this group of patients haemorrhage is the major cause of death. However, as the forces required to cause pelvic disruption in a young person are high, associated injury is common and accordingly advanced trauma life support protocols⁷ should be followed rigorously, treating life-threatening injuries in order of priority.

Whereas it is often apparent both clinically and radiologically that a fracture of the pelvis is unstable, the increased use of pelvic binders as an emergency measure by paramedics means that in some circumstances disruption to the posterior structures may not be immediately obvious. The early recognition of an unstable fracture pattern helps guide both immediate and definitive treatment as attempts are made surgically to stabilise the disrupted pelvic ring. Anything that can assist this diagnostic process is of value, especially as the trauma team might not include an experienced orthopaedic or pelvic surgeon.

The basis of the association between a fracture of the L5 transverse process and pelvic instability lies in an understanding of the anatomy and biomechanics of the pelvis. Studies have shown that the posterior sacroiliac complex is more important to the stability of a pelvic fracture than the anterior structures. Tile⁴ likened the posterior ligamentous structures to a 'suspension bridge' with the posterior superior iliac spines as the pillars, the sacroiliac ligaments the suspension bars and the sacrum the bridge. The iliolumbar ligaments join the transverse processes of L5 to the iliac crest, further enhancing the suspensory mechanism. Thus identification of disruption of the posterior structures is instrumental in determining pelvic instability. Avulsion (from the iliolumbar ligament) or shear of the transverse process of L5 can occur with posterior disruption and should alert the attending staff to a possible unstable fracture pattern.

Fractures of the transverse processes of the lumbar vertebrae may also occur as a result of direct blunt trauma, violent lateral flexion-extension forces, and psoas avulsion.⁸ The association between a fracture of the transverse process of L5 and pelvic fracture instability has been alluded to,³⁻⁵ but this observation lacked validation. Our study is the first to attempt to verify this association. Its strengths lie with the prospective nature of the data collection and the numbers involved.

It is well documented that there is a strong association between transverse process fractures and abdominal injury. One study reports an association of up to 50%.⁹ In our study this was 12% (2 of 17). Thus, whenever one sees a fracture of the transverse process of L5, there should be an awareness of a probable associated intra-abdominal injury.

In conclusion, although it is not pathognomonic of pelvic fracture instability, a fracture of the transverse process of L5 is associated with a significantly increased risk of this problem. Its presence should alert those attending of the possibility of an unstable injury.

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