

# Thoracolumbar spine fractures: Is there a problem?

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Every physician who treats injured patients has a responsibility to detect and appropriately manage thoracolumbar spinal column injuries. Fractures of the thoracolumbar spine are relatively common, so clinicians must give them every consideration both to protect from secondary spinal cord injury and to appreciate the extent of the patient's injuries. Other extraspinal as well as noncontiguous injuries to the spinal column are frequently present. Unfortunately, thoracolumbar spine fractures are often missed or diagnosed late in clinical series. In an era of cost-containment, not all responsive patients require full thoracolumbar spine radiographs. In awake, alert, nonintoxicated patients with simple injury mechanisms, these fractures can be ruled out through physical examination, if the patient has no physical findings and does not have other serious injuries. However, concern has recently been raised that some patients may have "asymptomatic" fractures that may be missed without radiography. The evidence reveals that fractures are not truly asymptomatic but may be masked by other distracting injuries, making them fractures occult rather than asymptomatic. Clinicians and subsequently their patients will always be at risk if this important distinction is forgotten.

Tout médecin qui traite des patients traumatisés doit repérer et prendre en charge comme il se doit les traumatismes de la colonne thoracolombaire. Les fractures de la colonne thoracolombaire sont relativement courantes et c'est pourquoi les cliniciens doivent y accorder toute l'attention voulue à la fois pour protéger la moelle épinière contre les traumatismes secondaires et pour comprendre l'étendue des traumatismes subis par le patient. Il y a souvent présence d'autres traumatismes non contigus de la colonne vertébrale et ailleurs. Malheureusement, il arrive souvent que les fractures de la colonne thoracolombaire ne soient pas décelées ou soient diagnostiquées vers la fin de la série d'examen cliniques. En cette époque de compression des coûts, les patients qui réagissent n'ont pas tous besoin de radiographies de la colonne thoracolombaire au complet. Chez les patients éveillés, alertes et non intoxiqués, victimes d'un mécanisme traumatisant simple, il est possible d'exclure ces fractures par l'examen physique si le patient ne présente aucun symptôme physique et n'a pas d'autre traumatisme grave. On a toutefois soulevé des préoccupations récemment en affirmant que certains patients peuvent avoir des fractures «asymptomatiques» que l'on risque de ne pas diagnostiquer sans radiographie. Les données probantes révèlent que les fractures ne sont pas vraiment asymptomatiques, mais qu'elles peuvent être voilées par d'autres traumatismes qui détournent l'attention et en font des fractures occultes plutôt qu'asymptomatiques. Les cliniciens et, par conséquent, leurs patients, seront toujours exposés si l'on oublie cette distinction importante.

**T**he responsibility to detect and appropriately manage spinal column injuries is borne by every physician treating the injured patient. Imaging the potentially injured spine as well as transporting and caring for the injured patient with a still suspect spine is a major resource and personnel commitment in all phases of trauma care, especially in the intensive care unit. There are distinctive features of the thoracic (T1-T10), thoracolumbar junction (T11-L1) and lumbar (L2-L5) segments of interest to the clinician.<sup>1</sup> The thoracic

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spine is stabilized and strengthened by the rib cage, requiring a large force to disrupt it.<sup>2</sup> Once disrupted though, any translation or dislocation is poorly tolerated neurologically because of the small size of the canal relative to the spinal cord, and up to 50% of patients with such injuries have neurologic findings.<sup>2,3</sup> The thoracolumbar junction is susceptible to injury because of the more mobile lumbar and relatively immobile thoracic segments.<sup>2</sup> The lumbar spine is composed of the largest vertebrae, but the facet joints are more sagittally orientated, providing less resistance to anterior-posterior translation.<sup>2</sup> For practical reasons, in the early resuscitation of the multiply injured patient, the spinal segments below the cervical level are simply considered as a thoracolumbar spine (TLS) unit.

### Clinical associations

Clinicians must be aware of the presence of TLS fractures, both to protect the spine-injured patient and to appreciate the complete extent of the patient's injuries. There are frequent associations of known TLS fractures that are generally related either to the degree of force or to the mechanics of the forces necessary to fracture a healthy spinal column. Other serious injuries may be present in up to 60% to 80% of acute TLS fractures<sup>3,4</sup> and include head, chest, abdominal, pelvic and major long bone injuries.<sup>5,6</sup> The frequency of noncontiguous fractures of the spine has also been reported as being more than 10% to 15%, confirming a need for imaging the complete spine once an injury is found at any level.<sup>1,3,7,8</sup>

There are also instances in which recognition of the mechanism of injury or the fracture pattern may alert the clinician to consider specific injuries. TLS fractures in 11 out of 13 patients in a series of motorcyclists were all associated with a similar ejection over the handlebars and subsequent axial load to the spine.<sup>9</sup> The

association of Chance and flexion-distraction fractures, automobile seat-belt use and the "belt stripe sign," with subsequent intra-abdominal visceral injuries alone may approach 70%.<sup>10,11</sup> Another interesting, but rare, association is that of the "seat belt aorta," in which partial and full-thickness injuries to the aorta complement the triad of TLS fracture, visceral injury and abdominal wall contusion.<sup>12,13</sup> Inaba and associates<sup>14</sup> recently described a further 5 cases of abdominal aortic injuries that were all associated with distraction TLS fractures.

### Clinical approach: asymptomatic versus occult

Do we have a problem approaching the TLS as clinicians? There is an established literature that confirms that all levels of spinal injuries and other serious associated injuries are not infrequently missed in clinical series.<sup>15-18</sup> A lot more attention has been paid to the issue of the cervical spine in acute trauma, yet TLS fractures have been reported as the most common osseous spine injuries in certain trauma populations.<sup>4,9,11</sup> Despite the wide promulgation and availability of continuing trauma education such as the Advanced Trauma Life Support (ATLS) course of the American College of Surgeons Committee on Trauma, the diagnosis of TLS fractures continues to be problematic. A rate of missed or delayed diagnosis of TLS fractures was reported as 16.5% in a contemporary series from a recognized North American trauma centre.<sup>7</sup> A missed injury rate of this magnitude is alarming given our supposition that these injuries are too important to miss. This is worrisome, considering that in one large review secondary (presumably preventable) deficits occurred in 10.5% of patients with missed spinal injuries compared with only 1.4% of patients whose injuries were identified on initial screening.<sup>19</sup>

Furthermore, cases in which the

TLS injury was truly felt by those involved to have been "asymptomatic" have been reported,<sup>9</sup> even in conscious, alert patients.<sup>20</sup> These concerns were recently renewed: in 1998, the South West Region Major Trauma Outcome Study Group, representing 6 hospitals in England, reported a series of 6 patients with multiple trauma in whom back pain and bony tenderness were absent.<sup>21</sup> In each of these cases a diagnosis of the thoracolumbar injury was either missed or delayed. Besides the obvious concern regarding irreversible but preventable neurologic sequelae of the missed injury, there may also be a failure to aggressively search for other injuries that are associated with these fractures.

Most clinicians would agree on the "usual" indications for obtaining radiographs: neurologic deficit, diminished levels of consciousness, physical findings or other spinal fracture.<sup>5,22-24</sup> Similarly, most clinicians would not disagree on waiting for sobriety to clear the spine of an intoxicated patient. The controversial area remaining would be that of the "distracting remote injury." The ATLS course of the American College of Surgeons Committee on Trauma is the guidance that most clinicians will seek. In a potentially heretical manner though, the South West Region group further suggested a potential weakness in the ATLS manual that leaves some ambiguity regarding who needs a complete mandatory radiography of the TLS. It is further suggested that the rationale for multisystem injuries representing a distracting focus and thus masking the results of the physical examination of the spine is not well explained in this chapter. The manual does state near the beginning of the chapter that, in a neurologically normal patient, "the absence of pain or tenderness along the spine virtually excludes the presence of a significant spinal injury," without further elaboration.<sup>1</sup> The important question not addressed is Is there a chance

that TLS fractures may be clinically silent, and will they be missed by a reliance on clinical rather than radiologic examination in some patients? Pragmatists might distil this argument of whether a patient might have an asymptomatic injury into a question regarding who needs screening radiographs. The issue is essentially one of who should routinely undergo radiography and who can be spared after being involved in a blunt trauma.

An evidence-based approach to answering the question is hampered by the low quality of evidence that consists entirely of observational case series (level V evidence).<sup>25</sup> There is a range of opinions. Several groups have suggested that the TLS can be clinically cleared in the face of other serious injuries, if the patient is otherwise awake, alert and not intoxicated. Terregino and colleagues<sup>26</sup> looked at 183 clinically evaluable patients in whom there were 17 TLS fractures, whose only symptoms predictive of a TLS fracture were pain and tenderness. They also reported that distracting injuries elsewhere were not predictive of injury. Samuels and Kerstein<sup>22</sup> retrospectively reviewed 99 charts, in which 15 patients had a TLS fracture. Of 55 charts in which the patient had a negative clinical examination of the back there were no missed fractures. Based on this information they concluded that a negative physical examination was reliable and recommended that in the absence of pain or clinical evidence of injury, TLS films were unnecessary. It is important for the critic to note that between them these 2 reports contain only 32 patients with actual fractures who were potentially amenable to physical examination.<sup>22,26</sup> Neither series reported how severely injured their patients were, but the low incidence of fractures in the second suggests a low injury severity. These 2 reports minimize or disregard the concept of the remote painful distracting injury. The concept was first

well-described in regard to cervical spine fractures by Hoffman and associates in 1992.<sup>27</sup> It was necessary to add this factor as an independent predictor in order to capture all the fractures in a population of 1000 blunt trauma victims.<sup>27</sup> Although this study cannot be directly generalized to the TLS, the concept is important.

Other authors have recommended routine complete TLS radiographs in certain settings, partially based on mechanistic factors and the presence of other serious injuries. In a retrospective analysis from Birmingham, the common features of those in whom TLS fractures were missed consisted of high-velocity blunt trauma mechanisms, decreased loss of consciousness and head injuries, and pelvic or lower extremity injuries.<sup>23</sup> The recommendation seems obvious given the altered level of consciousness, but the concept of additional injury being an operational factor is relevant. Fortunately, larger series elaborate further. Frankel and associates<sup>24</sup> found that 40% of 65 patients with TLS fractures had neither back pain nor tenderness. These patients had both associated injuries and high blood ethanol levels, making it hard to attribute an exact reason for the absence of symptoms and signs. Based on their identified risk factors, these authors recommended routine radiographs in all patients with the "usual indications" or a highly suspect mechanism of injury.<sup>24</sup> They further stated that "the absence of back pain does not exclude significant thoracolumbar trauma."<sup>24</sup> Cooper and associates<sup>5</sup> reported a review from Maryland's Shock Trauma Center of 183 TLS fractures in which 110 patients who were neurologically intact and had a Glasgow Coma Scale score between 13 and 15, were considered amenable to clinical examination. Thirty-four (31%) of these patients were recorded as having no pain or tenderness, yet all had fractures. The absence of clinical findings was significantly related to the presence of

another major injury in this group, defined as any Abbreviated Injury Score of 3 or more.<sup>5</sup>

Meldon and Moettus<sup>7</sup> reviewed 145 TLS fractures and found that there were 27 (19%) patients who had no pain or tenderness on presentation, all of whom had an altered sensorium, concomitant major distracting injury or a neurologic deficit. Major injury was a highly significant predictor of the presence of a TLS fracture without there being recorded symptoms, although only association rather than causality could be proven by this methodology. These authors stressed the important point that the term *asymptomatic* should be distinguished from *occult* in regard to TLS fractures. Although both may not be appreciated by a patient, an occult fracture has some other factor to account for this. The designation of a fracture as asymptomatic though (if it exists) should be reserved for an awake, alert patient without intoxication or other major injuries, who does not complain of back pain or tenderness and is neurologically intact.<sup>7</sup> A strict application of this definition provides a conceptual basis for interpreting seemingly conflicting recommendations.

## Recommendations

Is there a problem, then, with our concept of who is at risk of TLS fractures? It appears that the majority of evidence from the literature does recognize the potential pitfall of absent or "unappreciated" pain with thoracolumbar fractures and guides us by recommending appropriate radiography.<sup>24</sup> When one further studies the relevant ATLS chapter it is later recommended during the discussion of thoracolumbar junction fractures that "any patient with an altered LOC or cognitive dysfunction (GCS <15), multi-system injuries, or a palpable gap or tenderness. . ." be radiographed and protected.<sup>1</sup> Clinicians, and subsequently their patients, will always be at risk if we forget the im-

portance of distracting injuries, confuse occult with asymptomatic and let down our guard in maintaining a high awareness and a low threshold for obtaining a complete spinal radiographic series. It is imperative that this is done expediently so that patients can be quickly moved from hard, unprotected supine boards less we add the early complication of ischemic skin breakdown. TLS fractures are common, often missed and may be present in an awake patient who is responsive to the clinician. If this is forgotten there can be serious problems for everyone. Clinicians can safely rule out TLS fractures clinically as long as occult is distinguished from asymptomatic. Thus, a patient must be neurologically intact without symptoms or abnormal findings, nonintoxicated, without another serious injury (including another spinal injury) to be a candidate for clinical clearance. Otherwise complete spinal radiography is recommended.

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