Thoracolumbar Trauma Classification

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KEYWORDS

- Spine trauma • Thoracolumbar trauma • Thoracolumbar injury • Spine injury classification
- AOSpine thoracolumbar spine injury classification system
- The thoracolumbar injury classification system (TLICS)

KEY POINTS

- Useful thoracolumbar injury classifications allow meaningful and concise communication between surgeons, trainees and researchers; although many have been proposed, none have obtained universal acceptance.
- Regional treatment algorithms for spine trauma are often similar in regions that use the same classification systems.
- The AOSpine Thoracolumbar Spine Injury Classification System was developed recently.
- Given the unique and globally inclusive development process used in the design of the AOSpine classification, there is cautious optimism for global acceptance.

INTRODUCTION

An ideal spine injury classification permits clear, easy, accurate, and reproducible communication between surgeons, residents, fellows, researchers, and other health care professionals. Many historical classifications were either mechanistic or based solely on the radiographic morphology of the injury. In an effort to more accurately guide treatment and possibly predict long-term outcomes, multiple recent classifications have been developed that consider the patient's entire clinical picture. Although many thoracolumbar injury classifications have been proposed, currently there is no single, globally accepted classification. In North America, many surgeons use the Thoracolumbar Injury Classification System (TLICS)[1,2]; in contrast, many European surgeons commonly use the Magerl system.[3–7] Most recently the AOSpine Thoracolumbar Injury Classification system was published and validated;[8–14] however, it remains unclear if this classification will be able to achieve global acceptance. The failure of surgeons to agree on a unified classification system for these

injuries may initially seem unimportant, but the lack of a universal classification system has resulted in dramatically different treatment algorithms for similar fractures throughout the world; furthermore, the regional treatment algorithms tend to be similar in areas that use the same classification system.[2,5,6,10,15–17]

HISTORICAL CLASSIFICATIONS

The first published thoracolumbar injury classification in the English literature was by Watson-Jones in 1938. He identified 3 distinct fracture types—the simple wedge fracture, the comminuted fracture, and the fracture dislocation—and he recommended different treatments for these fracture types.[18] Additionally in the middle of the 20th century, many unique thoracolumbar fractures were identified, and a different treatment algorithm was proposed for the individual fractures. One such injury is the Chance fracture, which was originally described in 1948 by G.Q. Chance as a flexion injury resulting in a wedge deformity of the vertebral body that may result in the disruption of the

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posterior elements.[19] Another classic thoracolumbar fracture is the burst fracture. The term burst fracture was coined by Holdsworth in 1970 in a series of more than 1000 spinal injuries, and he defined a burst fracture as any vertebral body compression fracture that disrupted the posterior vertebral wall.[20] In the same publication, Holdsworth proposed the first mechanistic classification. He divided fractures into 6 basic types (simple wedge, dislocation, rotational fracture–dislocation, extension, burst, and shear injuries). Perhaps the most important and controversial finding in this publication was that Holdsworth reported that all fractures with an intact posterior ligamentous complex (PLC) were stable. Although this classification offered basic treatment guidelines, the classification has never been validated independently, and so although the term burst fracture has persisted, the remainder of the classification is no longer used.[20–22]

TWO- AND THREE-COLUMN CLASSIFICATIONS

Kelly and Whiteside[23] proposed the next major classification in 1968 when they divided the spine into 2 columns. The anterior column, which they considered the entire vertebral body and intervertebral disc, and the posterior column, which comprised the neural arch and ligamentous complex. They postulated that any injury that involved only one of the columns was stable, but any injury resulting in disruption of both columns was unstable.[23] This classification was never validated independently, and it was challenged in 1983 when Denis published a comprehensive classification for thoracolumbar fractures based off of 412 patients with a thoracolumbar injury. The Denis classification is commonly thought of as dividing each spinal segment into 3 columns: the anterior column—from the anterior longitudinal ligament through the anterior two-thirds of the vertebral body; the middle column—from the posterior third of the vertebral body/intervertebral disc to the posterior longitudinal ligament; and the posterior column—everything posterior to the posterior longitudinal ligament. However, the classification actually divides fractures into 4 major types (compression fractures, burst fractures, seatbelt-type injuries, and fracture–dislocations), and then subdivides each fracture into 1 of 16 total subtypes (Table 1). The 3-column theory was described in the same publication as an alteration to the 2-column theory of stability proposed by Kelly and Whiteside[23,24]; Denis reported that the individual fracture pattern should not dictate treatment, but rather the treatment was determined by

Table 1 The Denis classification	
Compression (may be anterior or lateral)	
Type A	Coronal split of the anterior column
Type B	Fracture of the superior endplate of the anterior column
Type C	Fracture of the inferior endplate of the anterior column
Type D	Anterior cortex fracture with intact endplates
Burst	
Type A	Fracture involving both endplates and the posterior wall
Type B	Fracture involving the superior endplate and the posterior wall
Type C	Fracture involving the inferior endplate and the posterior wall
Type D	Burst fracture associated with significant rotation
Type E	Lateral Burst fracture which involves the both endplates and the posterior wall, but only involves the left or right side
Seatbelt type	
Type A	Single-level osseous injury
Type B	Single-level ligamentous injury
Type C	Two-level injury with osseous involvement of the middle column
Type D	Two-level injury with ligamentous involvement of the middle column
Fracture–dislocations	
Type A	Flexion with rotation
Type B	Shear injury
Type C	Flexion distraction injury

From Denis F. The three column spine and its significance in the classification of acute thoracolumbar spinal injuries. Spine (Phila Pa 1976) 1983;8:817–31; with permission.

the integrity of the middle column. Denis proposed that isolated anterior or poster column injuries were stable, but if the injury resulted in concomitant disruption of the middle column, the fracture was unstable.[24] This 3-column concept of stability achieved widespread acceptance, and to this day is responsible for many surgeons recommending operative treatment of thoracolumbar burst fractures in a neurologically intact patient[14,24]; despite its widespread use and moderate to substantial interobserver reliability of identifying the 4 main types of fractures,[25] when attempting to classify the fractures into these subtypes, the reliability is