The Reliability and Validity of the Thoraco Lumbar Injury Classification and Severity score

A Systematic Review

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By

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List of Abbreviations

Abb.	Full term
AO	Arbeitsgemeinschaft für Osteosynthesefragen
AS	Ankylosing Spondylitis
CoK	Cohen's Kappa value
CT	Computed Tomography
DISH	Diffuse Idiopathic Skeletal Hyperostosis
Fig	Figure
GCS	Glasgow Coma Scale
k	Cohen's Kappa value
Mech	Mechanism of injury
Morph	Morphology of injury
MRI	Magnetic Resonance Imaging
Pa	Observer Agreement
Pc	Chance Agreement
PLC	Posterior Longitudinal Ligament
SpC	Spearman's Correlation Coefficient
STIR	Short Tau Inversion Recovery
STSG	Spine Trauma Study Group
TBI	Traumatic Brain Injury
TLICS	Thoracolumbar Injury Classification and Severity System
TLISS	Thoracolumbar Injury Severity Score
TLST	Thoracolumbar Spine Trauma
TTT	Treatment

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Introduction

INTRODUCTION

The classification of thoracolumbar injuries remains controversial, and no clear consensus has been reached despite various classification systems being used during the past several decades. This review will evaluate the evidence available to date regarding the most promising classification so far, the Thoraco-Lumbar Injury Classification and Severity Score (TLICS score); to assess its reliability and validity. Classification systems are helpful to identify common attributes within a group to predict the behavior or outcome without sacrificing too much detail, being clinically relevant, reliable, and accurate[1]. An ideal spine injury classification is expected to provide details regarding injury severity, its pathogenesis, and causative biomechanical forces involved, in addition to clinical, neurological, and radiological characteristics of the injury[2].

Although Bohler[3] introduced his sentinel scheme in 1929, the first published thoracolumbar injury classification in the English literature was by Watson- Jones in 1938[4]. He identified three distinct fracture types: the simple wedge fracture, the comminuted fracture, and the fracture dislocation. In 1949, Nicoll[3] further classified these injuries as anterior wedge fractures, lateral wedge fractures, and isolated neural arch fractures and characterized two basic groups of injury: stable and unstable fractures. He asserted that the fracture gap caused by the comminution of the vertebral body and injury of

the posterior ligamentous complex (PLC) could induce instability[3].

In 1970, Holdsworth[5] defined a burst fracture as any vertebral body compression fracture that disrupted the posterior vertebral wall and proposed the first classification based on mechanism of injury. He recognized the importance of the traumatic forces causing distinct fracture patterns, described as flexion, flexion and rotation, extension, and compression. Holdsworth also conceptualized the anterior column as resisting compressive loads and the PLC resisting tensile forces acting as a tension band. Kelly and Whitesides[6] formally presented the two-column concept in 1968, whereby the entire vertebral body and intervertebral disc were considered as the anterior column, and the posterior column comprised the neural arch and PLC. With the development of CT spine imaging, Denis[7] proposed the three-column theory of spinal stability in 1983. He introduced the concept of the middle column between the PLC and the anterior longitudinal ligament, the anterior wall of the vertebral body and the anterior annulus fibrosus. This middle column comprised the posterior wall of the vertebral body, the posterior longitudinal ligament, and posterior annulus fibrosus. Denis further classified major spinal injuries into four different categories: compression, burst, seatbelt type injuries, and fracture-dislocations[7].

In 1994, Magerl et al.[8] divided fractures into three types based on major external forces placed on the vertebral body

(compression, distraction, and rotation). They reported the AO (Arbeitsgemeinschaft für Osteosynthesefragen) classification using the 3-3-3 principle that divides thoracolumbar injury into a total of 53 fracture groups. In the 3-3-3 classification system each type is further subdivided into three additional groups, and these groups are each separated yet again into three more subgroups with specifications, or even further as required[8].

In 2005, Vaccaro et al.[1] introduced the Thoracolumbar Injury Severity Score (TLISS), a scoring system that focused on injury mechanism rather than morphologic features and is the predecessor of the Thoracolumbar Injury Classification and Severity Score (TLICS). The TLISS was based on three major injury components: the mechanism of injury, the integrity of the PLC, and the patient's neurologic status. This was the first classification to include the neurologic status of the patient. Poor reproducibility with respect to injury mechanism led to modification of the TLISS scoring system and resulted in a transition to the TLICS, in which the fracture mechanism was replaced by the morphologic injury description[9]. This modification removes the subjective determination of the dynamic injury mechanism that is often difficult to interpret on static posttraumatic images and that is largely based on subjective criteria, and incorporates more objective findings from imaging studies for facilitating accurate diagnosis of these fracture patterns[10].

AIM OF THE WORK

To critically review previous thoracolumbar classification systems, to discuss the proposal of the new Thoracolumbar Injury Classification and Severity Score (TLICS), to review the steps taken thus far in assessing the reliability and validity of this system.

Objectives

Primary Objectives: Assessing Interrater and intrarater reliability of the TLICS/TLISS scoring system for thoracolumbar trauma, and the validity of such scoring system in aiding clinical decision making in the settings of thoracolumbar trauma.

Secondary objectives: Detecting limitations of the TLICS/TLISS scoring system as a communicable tool for clinical decision making in the trauma settings.