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Original Investigation

Is the Thoracolumbar Injury Classification and Severity Score (TLICS) Superior to the AO Thoracolumbar Injury Classification System for Guiding the Surgical Management of Unstable Thoracolumbar Burst Fractures without Neurological Deficit?

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ABSTRACT

AIM: To determine whether the Thoracolumbar Injury Classification and Severity Score (TLICS) and the Arbeitsgemeinschaft für Osteosynthesefragen (AO)Spine Thoracolumbar Injury Classification System have any superiority to each other regarding the reliability of their recommendations in the surgical management of unstable thoracolumbar burst fractures.

MATERIAL and METHODS: Fifty-five consecutive patients with thoracolumbar burst fractures undergoing instrumentation between 2010 and 2015 were analyzed retrospectively. TLICS and AO systems were compared based on patients' American Spinal Injury Association (ASIA) scores and they were analyzed for their safety and reliability.

RESULTS: A total of 55 patients were studied. Neurological deficits were detected in 18 patients and the remaining 37 patients had normal neurological functions. All the patients with neurological deficits received >4 points according to TLICS. There were 14 patients with incomplete spinal cord injury and all of them received >4 points according to TLICS ($p<0.01$). On the other hand; 8 of these 14 patients received 4 points according to the AO system. None of the 37 patients without neurological deficit received <4 points of TLICS whereas 18 of these 37 patients received 3 AO points, to whom AO recommends conservative treatment despite the fact that they had unstable burst fractures ($p<0.01$).

CONCLUSION: Recommendations of TLICS might be more reliable than those of AO particularly for guiding the surgical management of unstable thoracolumbar burst fractures without neurological deficit. However, this conclusion needs to be verified with further multicenter prospective studies.

KEYWORDS: Thoracolumbar injury, Thoracolumbar burst fracture, Thoracolumbar injury classification and severity score, AOSpine thoracolumbar injury classification system

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INTRODUCTION

Controversies still exist regarding the classification and scoring systems and their ability to provide an ideal treatment strategy in thoracolumbar injuries. There is no consensus on their recommendations in unstable thoracolumbar burst fractures (4). There are two widely accepted classification systems to guide surgeons in thoracolumbar spinal injury. The Thoracolumbar Injury Classification and Severity Score (TLICS) has been described by the Spinal Trauma Study Group to establish a standard way of approach in the decision-making process (20). Injury morphology, integrity of the posterior ligamentous complex (PLC), and neurological condition of the patients are evaluated and they receive points accordingly. However; it is criticized for the fact that almost all the studies regarding the TLICS and its safety belong to the authors that have developed the system (4).

Another widely accepted system to classify the thoracolumbar injuries was described by Magerl et al. (12) in 1994, and is known as the Arbeitsgemeinschaft für Osteosynthesefragen (AO) Spine System. AO is a more detailed system regarding the fracture morphology, describing more than 50 subtypes of fractures (8). Although widely used, the AO system is criticized for its undervaluing the severity of neurological damage and PLC injury. Furthermore, AO is claimed to have low inter- and intra-observer agreement due to its complexity and thus, it is difficult to incorporate into daily clinical practice (14).

The greatest controversy exists about the management of unstable burst fractures without neurological deficit. There is no clear data in the literature regarding the superiority of the classification systems for this subgroup of thoracolumbar fractures. For this reason, we calculated the TLICS, AO and American Spinal Injury Association (ASIA) scores of our patients with unstable thoracolumbar burst fractures. We compared TLICS and AO systems, and aimed to determine whether TLICS and AO have any superiority to each other in terms of the reliability of their recommendations for guiding the surgical management of unstable thoracolumbar burst fractures.

MATERIAL and METHODS

Fifty-five patients with thoracolumbar burst fractures undergoing thoracolumbar pedicle screw fixation between 2010 and 2015 were analyzed retrospectively. Computed tomography (CT) and magnetic resonance imaging (MRI) scans of the patients were analyzed to identify the morphology of the injury. T1-weighted, T2-weighted, T1-weighted fat suppressed, T2-weighted fat suppressed and Short Tau Inversion Recovery (STIR) sequences (Figure 1A-C) were analyzed to evaluate PLC injury as suggested in the literature (11,17).

Patients received 1–10 points from both TLICS and AO scoring systems according to three parameters (fracture morphology, neurological condition, and PLC integrity). Both systems recommend conservative treatment for 1–3 points, surgical or conservative treatment for 4 points, and surgical treatment for 5–10 points.

The International Standards for Neurological Classification of Spinal Cord Injury, published by the American Spinal Injury Association (ASIA) was used to determine the neurological status of the patients (10). The patients were grouped as

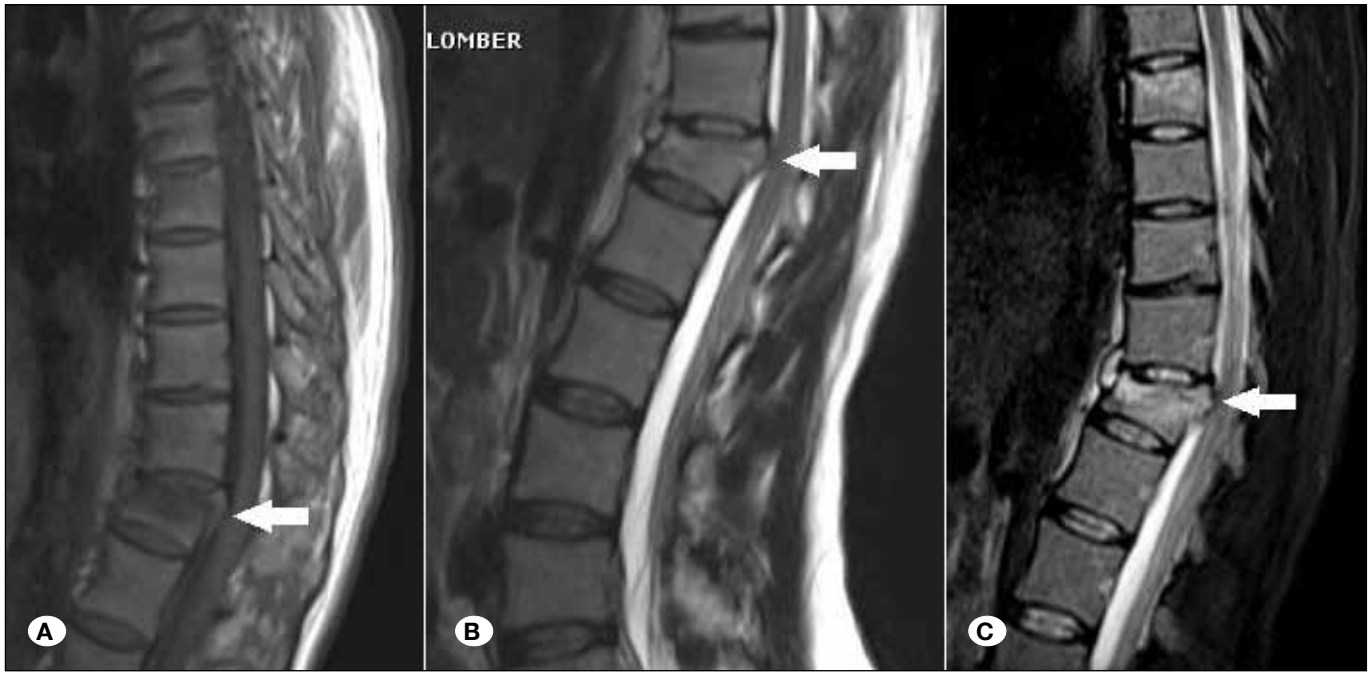

Figure 1: A) T1-weighted fat suppressed thoracic MRI reveals the posterior longitudinal ligament injury indicated with white arrow. **B)** T2-weighted thoracolumbar MRI reveals the posterior longitudinal ligament injury indicated with white arrow. **C)** T2-weighted short tau inversion recovery MRI of thoracolumbar region reveals the posterior longitudinal ligament injury indicated with white arrow.

without neurological deficit (ASIA E), with neurological deficit (ASIA A, B, C, and D), and incomplete spinal cord injury (ASIA B, C, D). Complete spinal cord injury corresponds to ASIA A.

Statistical analysis was performed using Number Cruncher Statistical System (NCSS) 2007 Statistical Software (NCSS LLC, Kaysville, Utah, USA). Agreement between AO and TLICS systems was measured using Kappa and Marginal homogeneity test. A p value of <0.05 was considered significant.

RESULTS

Considering the inclusion criteria, 55 patients met the criteria (35 males and 20 females) with a mean age of 45.3 years ranging from 16 to 81 years.

TLICS score was 4 in 18 patients, and >4 in 37 patients. There was no patient with a TLICS score of <4. Of the patients with ASIA E (burst fracture without neurological deficit), 18 of 37 received 4 points, 19 received >4 points, and nobody received <4 points (p<0.01). On the other hand; all of the patients with neurological deficit (ASIA A, B, C, and D) received 6 points or more with a mean of 6.85 points according to TLICS. All of 4 patients with ASIA A (complete spinal cord injury) had 7 points of TLICS each. All of the 14 patients with incomplete spinal cord injury (ASIA B, C, and D) received >4 (6 and more) points of TLICS (Table I).

AO score was <4 points in 18 patients, 4 points in 27 patients, and >4 points in 10 patients. Of the 37 patients with ASIA E (burst fracture without neurological deficit), 18 received <4 points, and the remaining 19 received 4 points. There was no patient with AO score of >4 points (p<0.01). All of the patients with neurological deficit (ASIA A, B, C, and D) received 4 points or more with a mean of 5.28 points according to AO. All of 4 patients with ASIA A (complete spinal cord injury) had 6 points of AO each. Of the 14 patients with incomplete spinal cord injury (ASIA B, C, and D), 8 received 4 points and 6 received >4 points of AO (Table I).

DISCUSSION

Various classification and scoring systems of spinal trauma have been proposed to help surgeons make more reliable decisions. AO is one of the most popular systems to classify thoracolumbar injuries, and was described by Magerl et al. (12) in 1994. In 2005, Vaccaro et al. (20) proposed a new classification of thoracolumbar injuries that particularly emphasized the neurological condition of the patients. These two popular systems have been analyzed and compared in many studies so far regarding their reliabilities, advantages and shortcomings.

Almost all spinal systems consider thes morphology of the fracture, stability of the vertebra and the degree of neurological injury to standardize the management on a numerical basis. The main focus of the treatments in spinal injuries is the preservation and -if possible- improvement of neurological functions. So, the neurological condition of the patient is one of the most important parameters to be evaluated. If a system cannot guide and help neurological maintenance and improvement, the system is to be questioned. An online survey assessing the opinions of the experts about the classification systems conducted by Chhabra et al. (1) revealed that the current systems do not meet the desired objectives appropriately. They concluded that there is still no ideal classification system and many experts tend to shift back to simpler traditional systems rather than current complex systems. Moreover, the shortcomings of the current classification systems leaded the surgeons to use some new

Table I: The Association Between AO and TLICS Systems Based on ASIA Scores

	ASIA		
	No deficit	**Deficit**	**Incomplete SCI**
	(ASIA E)	**(ASIA A,B,C,D)**	**(ASIA B,C,D)**
AO			
<4; n(%)	18 (48.6)	0	0
4; n(%)	19 (51.4)	8 (44.4)	8 (44.4)
>4; n(%)	0	10 (55.6)	6 (42.9)
TLICS			
<4; n(%)	0	0	0
4; n(%)	18 (48.6)	0	0
>4; n(%)	19 (51.4)	18 (100)	14 (100)
Marginal Homogeneity Test; p	**0.001****	**0.005****	**0.005****

***p<0.01*

***AO:** Arbeitsgemeinschaft für Osteosynthesefragen, **TLICS:** Thoracolumbar Injury Classification and Severity Score, **SCI:** Spinal Cord Injury, **ASIA:** American Spinal Injury Association.*

determinants like fracture comminution, canal encroachment and local kyphotic deformity (9). It is clear that more studies are needed to assess the current classification systems and there is still a need for ideal classification systems which would be more practical and simpler (1,21). In our study, we analyzed the reliability of the recommendations of both TLICS and AO systems, on the basis of the patients' ASIA scores with special emphasis on unstable burst fractures without neurological deficits.

Various studies have focused on the reliability and safety of TLICS and AO (7,8,15,18,19,21). Patel et al. (16) reported that TLICS had an excellent validity, with 95.4% agreement between the treatment performed and TLICS suggestions. When compared with historical controls TLICS has been demonstrated to correlate with treatment suggestions and provide either the maintenance or improvement of patients' neurological status (5). Joaquim et al. (4) found that the treatment recommendations of TLICS matched surgical treatment in 47 of 49 patients (96%). However, it should be noted that almost all the papers that mention the safety and reliability of TLICS belong to the authors that have developed the system. In a recent review article, the authors emphasized the need for well-designed multicenter prospective studies to improve the evidence of the safety of TLICS (3). On the other hand, AO is more inclusive regarding the detailed assessment of the fracture morphology describing more than 50 subtypes of fractures although this complexity limits its clinical utility in daily practice (8). A correlation between TLICS and AO systems has also been reported in the literature which opposes the idea of the superiority of the systems to each other (4).

Joaquim and Patel stated that patients with incomplete injuries received a higher severity score according to TLICS, emphasizing the importance of prompt decompression for neurological improvement (7). In our series, there was no patient receiving <4 points of TLICS. Of the 37 patients without neurological deficit, 18 received 4 points, 19 received >4 points, and nobody received <4 points. All of the patients with incomplete spinal cord injury, for whom surgery is suggested by TLICS, received 5 points or more. These findings are consistent with the current literature and they reveal the success of TLICS in guiding the management of unstable burst fractures with incomplete spinal cord injury.

On the other hand, it is well known from the literature that patients with incomplete spinal cord injury have a chance of neurological recovery (2,6,13,22). Classifications and scoring systems regarding spinal fractures, like TLICS and AO, aim to determine optimal treatment strategies both not to harm the patients and to enhance their chances of neurological improvement. In the series of Joaquim et al. (5), most of the patients with incomplete deficits improved during the follow-up period. So, the patients with incomplete spinal cord injury are the ones that are most likely to achieve neurological improvement. In our series, there were 14 patients with incomplete spinal cord injury. All of these patients had >4 points of TLICS with a mean of 6.85. However, the mean score of these patients was 5.28 according to AO and more impressively; 8 of them received 4 points according to AO classification system. AO suggest 'conservative-surgical' strategy to this group instead of 'surgical'. This result makes the authors conclude that these patients would probably lose their chances of neurological improvement if they were not operated due to suggestions based on AO system. It is accepted that 'conservative' is not a reliable option for an unstable thoracolumbar burst fracture with incomplete spinal cord injury. However, although these findings are significant, it is still difficult to reach definite conclusions due to a shortage of multicenter prospective studies about this controversial issue.

Another problem with the classification systems exists for the patients with unstable burst fractures without neurological deficit (3,7). A study carried out by Joaquim et al. found a correlation between TLICS and AO systems, yet they stated that the issue of burst fractures without neurological deficit still remains controversial (4). Ultimately, a lack of clear data regarding the reliability of the classification systems for this subgroup of thoracolumbar fractures raises a need for new studies. In our series, 37 patients had unstable burst fractures but no neurological deficit. Of these 37 patients, there was no patient receiving <4 points according to TLICS. However, 18 of these 37 patients had 3 points according to AO, to whom AO system recommends 'conservative' treatment option. Given that all of our patients had unstable thoracolumbar burst fractures, this recommendation of AO does not seem safe and reliable. This difference, which might make TLICS more reliable than AO, results possibly from the fact that TLICS pays more attention and gives a higher point to neurological damage and posterior ligamentous complex injury.

CONCLUSION

Recommendations of TLICS might be more reliable than those of AO particularly for guiding the surgical management of unstable thoracolumbar burst fractures without neurological deficit. However, it is still difficult to reach definite conclusions about the superiority of TLICS since the debate about the ideal classification system is going on. Furthermore, these conclusions need to be verified with further multicenter prospective studies.

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