

John E. O'Toole, MD, MS\*  
 Michael G. Kaiser, MD†  
 Paul A. Anderson, MD‡  
 Paul M. Arnold, MD§  
 John H. Chi, MD, MPH||  
 Andrew T. Dailey, MD#  
 Sanjay S. Dhall, MD\*\*  
 Kurt M. Eichholz, MD##  
 James S. Harrop, MD§§  
 Daniel J. Hoh, MD¶¶  
 Sheeraz Qureshi, MD, MBA|||  
 Craig H. Rabb, MD\*#  
 P. B. Raksin, MD\*\*\*

\*Department of Neurological Surgery, Rush University Medical Center, Chicago, Illinois; †Department of Neurosurgery, Columbia University, New York, New York; ‡Department of Orthopedics and Rehabilitation, University of Wisconsin, Madison, Wisconsin; §Department of Neurosurgery, University of Kansas School of Medicine, Kansas City, Kansas; ||Department of Neurosurgery, Harvard Medical School, Brigham and Women's Hospital, Boston, Massachusetts; #Department of Neurosurgery, University of Utah, Salt Lake City, Utah; \*\*Department of Neurological Surgery, University of California, San Francisco, San Francisco, California; ##St. Louis Minimally Invasive Spine Center, St. Louis, Missouri; §§Departments of Neurological Surgery and Orthopedic Surgery, Thomas Jefferson University, Philadelphia, Pennsylvania; ¶¶Lillian S. Wells Department of Neurological Surgery, University of Florida, Gainesville, Florida; |||Department of Orthopaedic Surgery, Weill Cornell Medical College, New York, New York; ##Department of Neurosurgery, University of Utah, Salt Lake City, Utah; \*\*\*Division of Neurosurgery, John H. Stroger, Jr Hospital of Cook County and Department of Neurological Surgery, Rush University Medical Center, Chicago, Illinois

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#### Correspondence:

John E. O'Toole, MD, MS,  
 Department of Neurosurgery,  
 Rush University Medical Center,  
 1725 West Harrison St, Suite 855,  
 Chicago, IL 60612.  
 E-mail: [john\\_otoole@rush.edu](mailto:john_otoole@rush.edu)

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 Congress of Neurological Surgeons

## Congress of Neurological Surgeons Systematic Review and Evidence-Based Guidelines on the Evaluation and Treatment of Patients with Thoracolumbar Spine Trauma: Executive Summary

**BACKGROUND:** The thoracic and lumbar (“thoracolumbar”) spine are the most commonly injured region of the spine in blunt trauma. Trauma of the thoracolumbar spine is frequently associated with spinal cord injury and other visceral and bony injuries. Prolonged pain and disability after thoracolumbar trauma present a significant burden on patients and society.

**OBJECTIVE:** To formulate evidence-based clinical practice recommendations for the care of patients with injuries to the thoracolumbar spine.

**METHODS:** A systematic review of the literature was performed using the National Library of Medicine PubMed database and the Cochrane Library for studies relevant to thoracolumbar spinal injuries based on specific clinically oriented questions. Relevant publications were selected for review.

**RESULTS:** For all of the questions posed, the literature search yielded a total of 6561 abstracts. The task force selected 804 articles for full text review, and 78 were selected for inclusion in this overall systematic review.

**CONCLUSION:** The available evidence for the evaluation and treatment of patients with thoracolumbar spine injuries demonstrates considerable heterogeneity and highly variable degrees of quality. However, the workgroup was able to formulate a number of key recommendations to guide clinical practice. Further research is needed to counter the relative paucity of evidence that specifically pertains to patients with only thoracolumbar spine injuries.

The full version of the guideline can be reviewed at: [https://www.cns.org/guideline-chapters/congress-neurological-surgeons-systematic-review-evidence-based-guidelines/chapter\\_1](https://www.cns.org/guideline-chapters/congress-neurological-surgeons-systematic-review-evidence-based-guidelines/chapter_1).

**KEY WORDS:** Clinical practice guideline, Lumbar fracture, Thoracic fracture, Thoracolumbar fracture

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### Goals and Rationale

Traumatic injuries of the thoracic and lumbar spine (“thoracolumbar”) occur in approximately 7% of all blunt trauma patients and comprise 50% to 90% of the 160 000 annual traumatic spinal fractures in North America.<sup>1-5</sup> Long-term

care of patients with persistent disability after thoracolumbar trauma represents a significant burden on society's healthcare resources.<sup>1,2,4-6</sup> For the purposes of this guideline, “thoracolumbar” includes the distinct regions of the rigid thoracic spine (T1-10), transitional thoracolumbar junction (T10-L2), and flexible lumbar spine (L3-5).

There remains a lack of consensus on a number of issues surrounding the care of these patients including classification, evaluation, medical management, and nuances of operative management.<sup>1-3,5-11</sup> The American Association of Neurological Surgeons (AANS)/Congress

**ABBREVIATIONS:** AANS, American Association of Neurological Surgeons; CNS, Congress of Neurological Surgeons; COI, conflict of interest

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of Neurological Surgeons (CNS) Section on Disorders of the Spine and Peripheral Nerves and the Section on Neurotrauma and Critical Care workgroup employed the available evidence base and a rigorous guideline elaboration methodology to develop a clinical practice guideline regarding the care of patients with thoracolumbar trauma using the available evidence base and employing a rigorous guideline elaboration methodology.

## METHODS

Specific patient, intervention, comparison, outcome (PICO) questions of pressing clinical relevance were formulated prior to any literature search or evidence abstraction. The guidelines task force performed a systematic review of the literature relevant to the diagnosis and treatment of patients with thoracolumbar trauma that utilized multiple search terms and databases. Evidence from included articles was abstracted into evidentiary tables and graded for level of evidence, and recommendations were then elaborated based on this evidence using a modified version of the North American Spine Society's evidence-based guideline development methodology (<https://www.spine.org/ResearchClinicalCare/QualityImprovement/ClinicalGuidelines>). "A" recommendations indicate a test or intervention is "recommended"; "B" recommendations "suggest" a test or intervention; and "C" recommendations indicate a test or intervention or "is an option." "Insufficient Evidence" statements clearly indicate that "there is insufficient evidence to make a recommendation for or against" a test or intervention. Task force consensus statements clearly state that "in the absence of reliable evidence, it is the task force's opinion that" a test or intervention may be considered.

## GUIDELINE APPROVAL PROCESS

The completed guideline was submitted to the AANS/CNS Joint Guidelines Review Committee for both peer review for publications and for societal endorsement. After revisions, the final guideline was approved and endorsed by the executive committees of both the AANS and CNS prior to publication of the summaries in *Neurosurgery*. The full version of the guideline can be reviewed at: <https://www.cns.org/guidelines/guidelines-evaluation-treatment-patients-thoracolumbar-spine-trauma>.

## RECOMMENDATIONS

### Classification of Injury

#### Questions

1. Are there classification systems for fractures of the thoracolumbar spine that have been shown to be internally valid and reliable (ie, do these instruments provide consistent information between different care providers)?
2. In treating patients with thoracolumbar fractures, does using a formally tested classification system for treatment decision-making affect clinical outcomes?

### Recommendations

1. A classification scheme that uses readily available clinical data (eg, computed tomography scans with or without magnetic resonance imaging) to convey injury morphology, such as Thoracolumbar Injury Classification and Severity Scale or the AO Spine Thoracolumbar Spine Injury Classification System, should be used to improve characterization of traumatic thoracolumbar injuries and communication among treating physicians.

Strength of Recommendation: Grade B

2. There is insufficient evidence to recommend a universal classification system or severity score that will readily guide treatment of all injury types and thereby affect outcomes.

Strength of Recommendation: Grade Insufficient

### Radiological Evaluation

#### Questions

1. Are there radiographic findings in patients with traumatic thoracolumbar fractures that can predict the need for surgical intervention?
2. Are there radiographic findings in patients with traumatic thoracolumbar fractures that can assist in predicting clinical outcomes?

### Recommendations

1. Because magnetic resonance imaging has been shown to influence the management of up to 25% of patients with thoracolumbar fractures, providers may use magnetic resonance imaging to assess posterior ligamentous complex integrity, when determining the need for surgery.

Strength of Recommendation: Grade B

2. Due to a paucity of published studies, there is insufficient evidence that radiographic findings can be used as predictors of clinical outcomes in thoracolumbar fractures.

Strength of Recommendation: Grade Insufficient

### Neurological Assessment

#### Questions

1. Which neurological assessment tools have demonstrated internal reliability and validity in the management of patients with thoracic and lumbar fractures (ie, do these instruments provide consistent information between different care providers)?
2. Are there any clinical findings (eg, presenting neurological grade/function) in patients with thoracic and lumbar fractures that can assist in predicting clinical outcomes?

### Recommendations

1. Numerous neurological assessment scales (Functional Independence Measure, Sunnybrook Cord Injury Scale,

and Frankel Scale for Spinal Cord Injury) have demonstrated internal reliability and validity in the management of patients with thoracic and lumbar fractures. Unfortunately, other contemporaneous measurement scales (ie, American Spinal Cord Injury Association Impairment Scale) have not been specifically studied in patients with thoracic and lumbar fractures.

Strength of Recommendation: Grade C

2. Entry American Spinal Injury Association Impairment Scale grade, sacral sensation, ankle spasticity, urethral and rectal sphincter function, and AbH motor function can be used to predict neurological function and outcome in patients with thoracic and lumbar fractures.

Strength of Recommendation: Grade B

### Pharmacological Treatment

#### Question

1. Does the administration of a specific pharmacologic agent (eg, methylprednisolone) improve clinical outcomes in patients with thoracic and lumbar fractures and spinal cord injury?

#### Recommendation

1. There is insufficient evidence to make a recommendation; however, the task force concluded, in light of previously published data and guidelines, the complication profile should be carefully considered when deciding on the administration of methylprednisolone.

Strength of Recommendation: Grade Insufficient

### Hemodynamic Management

#### Question

1. Does the active maintenance of arterial blood pressure after injury affect clinical outcomes in patients with thoracic and lumbar fractures?

#### Recommendations

1. There is insufficient evidence to recommend for or against the use of active maintenance of arterial blood pressure after thoracolumbar spinal cord injury.

Level of Evidence: Grade Insufficient

2. However, in light of published data from pooled (cervical and thoracolumbar) spinal cord injury patient populations, clinicians may choose to maintain mean arterial blood pressures > 85 mm Hg in an attempt to improve neurological outcomes.

Consensus Statement by the Workgroup

### Prophylaxis and Treatment of Thromboembolic Events

#### Questions

1. Does routine screening for deep venous thrombosis prevent pulmonary embolism (or venous thromboembolism-associated morbidity and mortality) in patients with thoracic and lumbar fractures?
2. For patients with thoracic and lumbar fractures, is one regimen of venous thromboembolism prophylaxis superior to others with respect to prevention of pulmonary embolism (or venous thromboembolism-associated morbidity and mortality)?
3. Is there a specific treatment regimen for documented venous thromboembolism that provides fewer complications than other treatments in patients with thoracic and lumbar fractures?

#### Recommendations

1. There is insufficient evidence to recommend for or against routine screening for deep venous thrombosis in preventing pulmonary embolism (or venous thromboembolism-associated morbidity and mortality) in patients with thoracic and lumbar fractures.

Strength of Recommendation: Grade Insufficient

2. There is insufficient evidence to recommend a specific regimen of venous thromboembolism prophylaxis to prevent pulmonary embolism (or venous thromboembolism-associated morbidity and mortality) in patients with thoracic and lumbar fractures.

Strength of Recommendation: Grade Insufficient

3. There is insufficient evidence to recommend for or against a specific treatment regimen for documented venous thromboembolism that would provide fewer complications than other treatments in patients with thoracic and lumbar fractures.

Strength of Recommendation: Grade Insufficient

4. Based on published data from pooled (cervical and thoracolumbar) spinal cord injury populations, the use of thromboprophylaxis is recommended to reduce the risk of venous thromboembolism events in patients with thoracic and lumbar fractures.

Consensus Statement by the Workgroup

### Nonoperative Care

#### Question

1. Does the use of external bracing improve outcomes in the nonoperative treatment of neurologically intact patients with thoracic and lumbar burst fractures?

#### Recommendation

1. The decision to use an external brace is at the discretion of the treating physician, as the nonoperative management of

neurologically intact patients with thoracic and lumbar burst fractures either with or without an external brace produces equivalent improvement in outcomes. Bracing is not associated with increased adverse events compared to not bracing.

Strength of Recommendation: Grade B

### **Operative vs Nonoperative Treatment**

#### *Questions*

1. Does the surgical treatment of burst fractures of the thoracic and lumbar spine improve clinical outcomes compared to nonoperative treatment?
2. Does the surgical treatment of nonburst fractures of the thoracic and lumbar spine improve clinical outcomes compared to nonoperative treatment?

#### *Recommendations*

1. There is conflicting evidence to recommend for or against the use of surgical intervention to improve clinical outcomes in patients with thoracolumbar burst fracture who are neurologically intact. Therefore, it is recommended that the discretion of the treating provider be used to determine if the presenting thoracic or lumbar burst fracture in the neurologically intact patient warrants surgical intervention.

Strength of Recommendation: Grade Insufficient

2. There is insufficient evidence to recommend for or against the use of surgical intervention for nonburst thoracic or lumbar fractures. It is recommended that the decision to pursue surgery for such fractures be at the discretion of the treating physician.

Strength of Recommendation: Grade Insufficient

### **Timing of Surgical Intervention**

#### *Question*

1. Does early surgical intervention improve outcomes for patients with thoracic and lumbar fractures?

#### *Recommendations*

1. There is insufficient and conflicting evidence regarding the effect of timing of surgical intervention on neurological outcomes in patients with thoracic and lumbar fractures.

Strength of Recommendation: Grade Insufficient

2. It is suggested that “early” surgery be considered as an option in patients with thoracic and lumbar fractures to reduce length of stay and complications. The available literature has defined “early” surgery inconsistently, ranging from <8 h to <72 h after injury.

Strength of Recommendation: Grade B

### **Surgical Approaches**

#### *Question*

1. Does the choice of surgical approach (anterior, posterior, or combined anterior-posterior) improve clinical outcomes in patients with thoracic and lumbar fractures?

#### *Recommendations*

1. In the surgical treatment of patients with thoracolumbar burst fractures, physicians may utilize an anterior, posterior, or a combined approach as the selection of approach does not appear to impact clinical or neurological outcomes.

Strength of Recommendation: Grade B

2. With regard to radiological outcomes in the surgical treatment of patients with thoracolumbar fractures, physicians may utilize an anterior, posterior, or combined approach because there is conflicting evidence in the comparison among approaches.

Strength of Recommendation: Grade Insufficient

3. With regard to complications in the surgical treatment of patients with thoracolumbar fractures, physicians may utilize an anterior, posterior, or combined approach because there is conflicting evidence in the comparison among approaches.

Strength of Recommendation: Grade Insufficient

### **Novel Surgical Strategies**

#### *Questions*

1. Does the addition of arthrodesis to instrumented fixation improve outcomes in patients with thoracic and lumbar burst fractures?
2. How does the use of minimally invasive techniques (including percutaneous instrumentation) affect outcomes in patients undergoing surgery for thoracic and lumbar fractures compared to conventional open techniques?

#### *Recommendations*

1. It is recommended that in the surgical treatment of patients with thoracolumbar burst fractures, surgeons should understand that the addition of arthrodesis to instrumented stabilization has *not* been shown to impact clinical or radiological outcomes, and adds to increased blood loss and operative time.

Strength of Recommendation: Grade A

2. Stabilization using both open and percutaneous pedicle screws may be considered in the treatment of thoracolumbar burst fractures as the evidence suggests equivalent clinical outcomes.

Strength of Recommendation: Grade B

## CONCLUSION

Ultimately, this clinical practice guideline serves as a critical reference for clinicians caring for adult patients with thoracolumbar trauma. This synthesis of the most contemporary evidence using rigorous methodology provides the reader with an important resource to address key questions in routine clinical practice. As with all evidence-based guidelines, however, it should be implemented in conjunction with clinician expertise and patient preferences.

## Disclosures

These evidence-based clinical practice guidelines were funded exclusively by the CNS and the Section on Disorders of the Spine and Peripheral Nerves in collaboration with the Section on Neurotrauma and Critical Care, which received no funding from outside commercial sources to support the development of this document.

## Conflict of Interest

The task force members were required to report all possible conflicts of interest (COIs) prior to beginning work on the guideline, using the COI disclosure form of the AANS/CNS Joint Guidelines Committee, including potential COIs that are unrelated to the topic of the guideline. The CNS Guidelines Committee and Guideline Task Force Chairs reviewed the disclosures and either approved or disapproved the nomination. The CNS Guidelines Committee and Guideline Task Force Chairs are given latitude to approve nominations of Task Force members with possible conflicts and address this by restricting the writing and reviewing privileges of that person to topics unrelated to the possible COIs. The COI findings are provided in detail in the companion introduction and methods manuscript ([https://www.cns.org/guideline-chapters/congress-neurological-surgeons-systematic-review-evidence-based-guidelines/chapter\\_1](https://www.cns.org/guideline-chapters/congress-neurological-surgeons-systematic-review-evidence-based-guidelines/chapter_1)). The authors have the following potential conflicts of interest: Dr Anderson: Aesculap—Consultant, SI Bone—Stock shareholder, Sparte—Stock shareholder, Expanding Orthopedics—Stock shareholder, Titan Spine—Stock shareholder, RTI—Other, Stryker—Other, Lumbar Spine Research Society—Board officer position (President). Dr Arnold: Medtronic—Consultant, Sofamor Danek—Consultant, Spine Wave—Consultant, InVivo—Consultant, Stryker Spine—Consultant, Evoke Medical—Stock shareholder, Z-Plasty—Stock shareholder, AO Spine North America—Sponsored or reimbursed travel (for self only). Dr Chi: DePuy Spine—Consultant, K2M—Consultant. Dr Dailey: K2M—Grants/Research support/Consultant, Zimmer Biomet—Consultant, Medtronic—Consultant. Dr Dhall: Globus Medical—Honorarium, Depuy Spine—Honorarium. Dr Harrop: DePuy Spine—Consultant, Asterias—Other/Scientific advisor, Tejin—Other/Scientific advisor, Bioventus—Other/Scientific advisor, AO Spine—Board, trustee, or officer position. Dr O'Toole: Globus Medical—Consultant fee, RTI Surgical—Consultant, Theracell, Inc.—Stock shareholder.

## Disclaimer of Liability

This clinical systematic review and evidence-based guideline was developed by a multidisciplinary physician volunteer task force and serves as an educational tool designed to provide an accurate review of the subject matter covered. These guidelines are disseminated with the understanding that the recommendations

by the authors and consultants who have collaborated in their development are not meant to replace the individualized care and treatment advice from a patient's physician(s). If medical advice or assistance is required, the services of a competent physician should be sought. The proposals contained in these guidelines may not be suitable for use in all circumstances. The choice to implement any particular recommendation contained in these guidelines must be made by a managing physician in light of the situation in each particular patient and on the basis of existing resources.

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