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February 2006

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Recommended Citation

Vaccaro, Alexander R.; Lim, Moe R.; Hurlbert, R. John; Lehman, Ronald A.; Harrop, James; Fisher, D. Charles; Dvorak, Marcel; Anderson, D. Greg; Zeiller, Steven C.; Lee, Joon Y.; Fehlings, Michael G.; Oner, F. C.; and Spine Trauma Study Group, "Surgical Decision Making for Unstable Thoracolumbar Spine Injuries: Results of a Consensus Panel Review by the Spine Trauma Study Group" (2006). *Department of Orthopaedic Surgery Faculty Papers*. Paper 17.
<http://jdc.jefferson.edu/orthofp/17>

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Surgical Decision Making for Unstable Thoracolumbar Spine Injuries

Results of a Consensus Panel Review by the Spine Trauma Study Group

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Objectives: The optimal surgical approach and treatment of unstable thoracolumbar spine injuries are poorly defined owing to a lack of widely accepted level I clinical literature. This lack of evidence-based standards has led to varied practice patterns based on individual surgeon preferences. The purpose of this study was to survey the leaders in the field of spine trauma to define the major characteristics of thoracolumbar injuries that influence their surgical decision making. In the absence of good scientific data, expert consensus opinions may provide surgeons with a practical framework to guide therapy and to conduct future research.

Methods: A panel of 22 leading spinal surgeons from 20 level I trauma centers in seven countries met to discuss the indications for surgical approach selection in unstable thoracolumbar injuries. Injuries were presented to the surgeons in a case scenario survey format. Preferred surgical approaches to the clinical scenarios were tabulated and comments weighed.

Results: All members of the panel agreed that three independent characteristics of thoracolumbar injuries carry primary importance in

surgical decision making: the injury morphology, the neurologic status of the patient, and the integrity of the posterior ligaments. Six clinical scenarios based on the neurologic status of the patient (intact, incomplete, or complete) and on the status of the posterior ligamentous complex (intact or disrupted) were created, and consensus treatment approaches were described. Additional circumstances capable of altering the treatments were acknowledged.

Conclusions: Decision making for the surgical treatment of thoracolumbar injuries is largely dependent on three patient characteristics: injury morphology, neurologic status, and posterior ligament integrity. A logical and practical decision-making process based on these characteristics may guide treatment even for the most complicated fracture patterns.

Key Words: spinal trauma, classification systems, clinical pathways, surgical approach

(*J Spinal Disord Tech* 2006;19:1–10)

Received for publication December 21, 2004; accepted July 21, 2005.

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Supported by the Spine Trauma Study Group and funded by an educational/research grant from Medtronic Sofamor Danek.

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To make management decisions on any clinical problem, clinicians rely on evidence-based standards, their personal experience, and the experience of their mentors. Unfortunately, in thoracolumbar spine injuries, there are currently no widely accepted evidence-based standards to guide surgeons to choose the optimal surgical treatments. A recent review of the literature concluded that most of studies on surgical treatments for thoracolumbar injuries fail to adequately discuss or provide evidence attesting to the relative merits of each method.¹

When treating a patient with a thoracolumbar spine injury, the surgeon must decide whether the injury requires an operation. If an operation is required, s/he must decide whether a decompression is warranted in addition to stabilization. Furthermore, s/he must decide whether the surgical task can be optimally accomplished via an anterior, posterior, or combined approach. In the absence of good scientific data to guide decision making, expert consensus opinions may have value. The purpose of this study was to compile the experiences of the world's leading experts in the field of spine trauma. The members of the Spine Trauma Study Group were surveyed to

define the major characteristics of thoracolumbar spine injuries that influence their surgical decision making. These characteristics and the way they influence treatment are presented in a user-friendly format to help guide surgeons in choosing the most appropriate therapy.

METHODS

Twenty-two spine surgeons from 20 level I trauma centers in the United States, Canada, Australia, Germany, Mexico, India, and the Netherlands were brought together to discuss their individual treatment algorithms in the management of thoracolumbar spine injuries (Spine Trauma Study Group [STSG]). A structured round table discussion was undertaken to define the injury characteristics that most influence their choice of surgical approach selection in unstable injuries. Through an open discussion, these characteristics were examined for independence and further refined and simplified. Finally, combinations of the characteristics were presented to the group again in the form of six clinical case scenarios to survey the group for their preferred surgical approach.

RESULTS

Injury Characteristics That Influence Surgical Decision Making

Although many biomechanical considerations of thoracolumbar injuries were acknowledged to play a role in selecting the optimal surgical approach, the STSG identified three main injury characteristics as most important and largely independent of each other: injury morphology, neurologic status, and integrity of the posterior ligamentous complex. There was a consensus agreement that these three factors constituted the most important considerations in deciding the type of surgical approach. However, opinions varied as to how little or how much other variables influence surgical decisions borne from

these three characteristics. The panel conceded that the other injury variables were not universal but rather surgeon specific and often controversial. The panel further observed that no compelling medical evidence was available to substantiate or negate their importance to clinical outcome. Surgeon “comfort,” though subjective and unquantifiable, was acknowledged to be important in the final choice of surgical procedure.

Injury Morphology

The STSG universally agreed that the mechanism of injury (such as axial compression, translation/rotation, or distraction) was an independent variable in influencing surgical decision making. Of the various injury morphologies, the translation and distraction morphologies were felt to specifically and independently dictate surgical approach. The distraction morphology is seen in flexion distraction injuries (as in a Chance fracture; Fig. 1A) or distraction extension injuries (as in patients with diffuse idiopathic skeletal hyperostosis or ankylosing spondylitis; see Fig. 1B). The translation morphology is seen in fracture-dislocations (Fig. 2A) and severe shear injuries (see Fig. 2B). Independent of neurologic status or integrity of the posterior ligaments, distraction and translation injuries are managed optimally with an initial posterior approach for realignment and stabilization, followed, if necessary, by an anterior decompression and/or stabilization.²⁻⁴ Stand-alone anterior procedures were not recommended in distraction injuries. The STSG reached a consensus that the use of a primary posterior approach in distraction and translation injuries was most appropriate.

Neurologic Status

The neurologic status of the patient was defined as reflecting the condition of the spinal cord, cauda equina, and nerve roots. The status of the spinal cord was defined as intact (ASIA E), an incomplete injury (ASIA D, C, and B), or a complete injury (ASIA A). Patients with isolated root deficits without a true spinal cord injury were considered with ASIA E

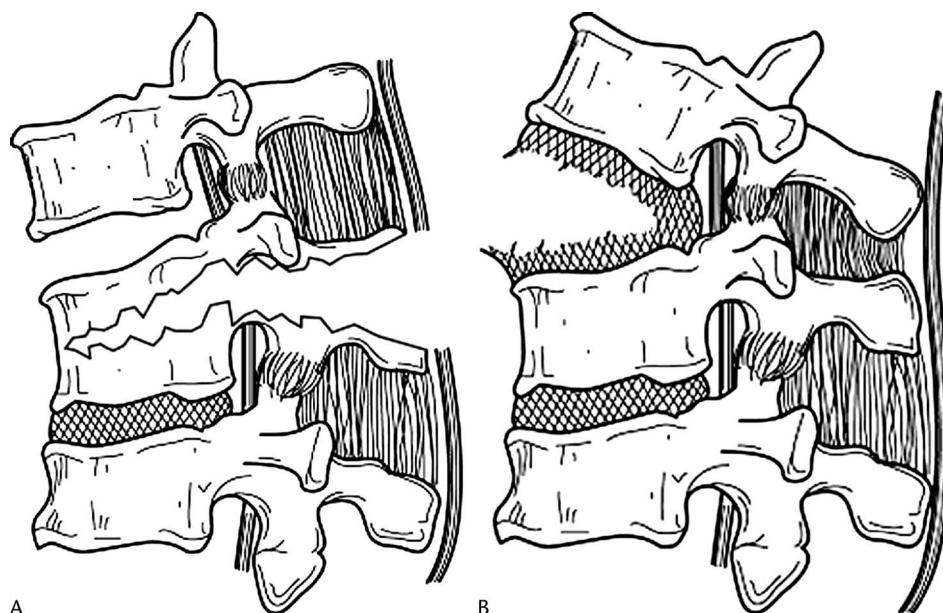


FIGURE 1. A, Flexion distraction injury through bone. B, Distraction extension injury.

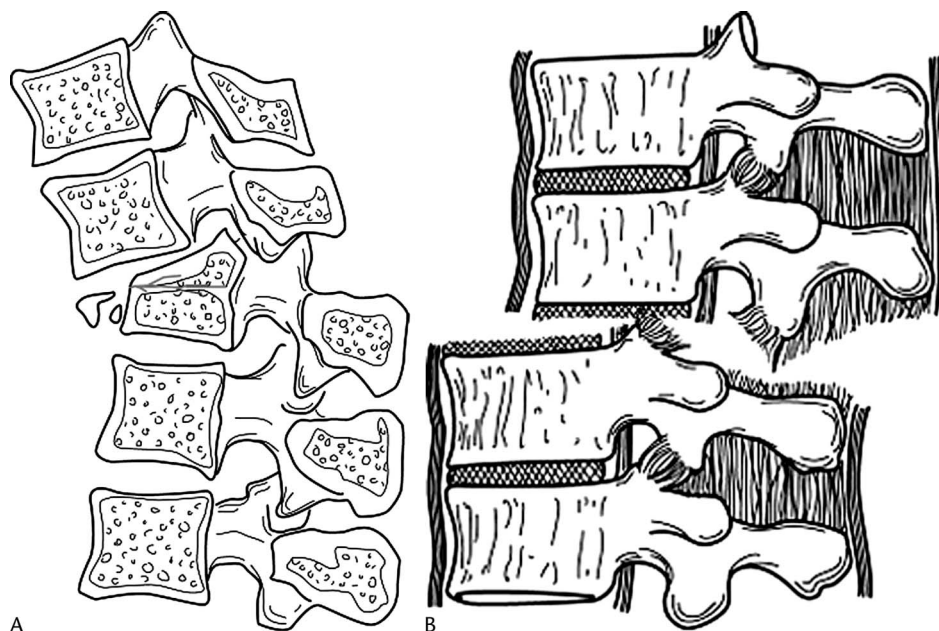


FIGURE 2. A, Flexion distraction translational injury. B, Translation injury.

grades. Patients with cauda equina deficits were considered an incomplete injury with ASIA B–D grades.

Integrity of Posterior Ligamentous Complex

The posterior ligamentous complex was defined as the supraspinous and interspinous ligaments, the ligamentum flavum, and the facet joint capsules. Disruptions of these ligaments tend to occur in concert rather than in isolation, so it was agreed to consider them for stability purposes as a single entity. To help determine surgical approach, they were defined to be either intact or disrupted. Disrupted posterior ligaments can be seen as a facet perch/dislocation, interspinous widening, or magnetic resonance imaging MRI evidence of ligament discontinuity. Integrity of the posterior ligamentous complex was universally felt to be of much more clinical significance than, and independent of, the integrity of the posterior bony elements. Instances of posterior bony element disruption become clinically significant when associated with neurologic injury. Hence, posterior bony disruption (such as in a bone-only Chance fracture) is considered indirectly with neurologic injury as the priority.

Clinical Scenarios

Six clinical scenarios were reconstructed from the various permutations of the neurologic status and posterior ligamentous status. Participating surgeons were surveyed with respect to their preferred management strategies when constrained to the six scenarios. Agreement was high in most situations. The observations are detailed for each of the six clinical situations and summarized as follows.

1. Neurologically Intact/Posterior Ligaments Intact

All panel members agreed that a neurologically intact patient with an intact posterior ligamentous complex rarely requires surgical intervention (Fig. 3).^{5,6} This clinical situation is most commonly seen in compression or burst fractures. The

latter can involve fracture of the pedicles, lamina, or facets as well. Bracing is commonly employed in the treatment of these fractures as much as a reminder and impediment to the patient as for any biomechanical advantages.⁷ The natural history of these fractures leads to healing with some degree of radiographic progression of kyphosis over the first few weeks following the trauma.⁶ The vertebral body settling and increased kyphosis are usually of little or no clinical consequence.⁶ If surgery is selected for accelerated rehabilitation purposes in these cases, the majority (59%) of surgeons felt that a posterior approach (open or minimally invasive) was preferred.^{8,9} The remaining surgeons (41%) felt that an anterior approach was preferred to reconstruct the injured anterior column.¹⁰

Surgical intervention may also be appropriate in a neurologically intact patient (no cord or cauda equina injury) without posterior ligamentous disruption who has a peripheral root deficit. This clinical scenario is rare and most commonly seen in low lumbar fractures (L4, L5). In this situation, if surgery, rather than observation, is undertaken,¹¹ a posterior approach is preferred to allow direct decompression of the affected nerve and stabilization of the fracture at the same time. Ninety-five percent of participating surgeons felt this approach to be most appropriate. A degree of late collapse was noted to be expected especially if the anterior column is severely comminuted.^{12,13}

2. Neurologically Intact/Posterior Ligaments Disrupted

Most thoracolumbar injuries involving disruption of the posterior ligaments include severe compression fractures, burst fractures, distraction injuries, or translational injuries (Fig. 4).^{14,15} The degree of spinal malalignment is usually minimal in the neurologically intact patient.¹⁶ Ninety-one percent of participating surgeons agreed that a neurologically intact patient with radiographic evidence of compromised posterior ligaments would be best stabilized by a posterior approach.

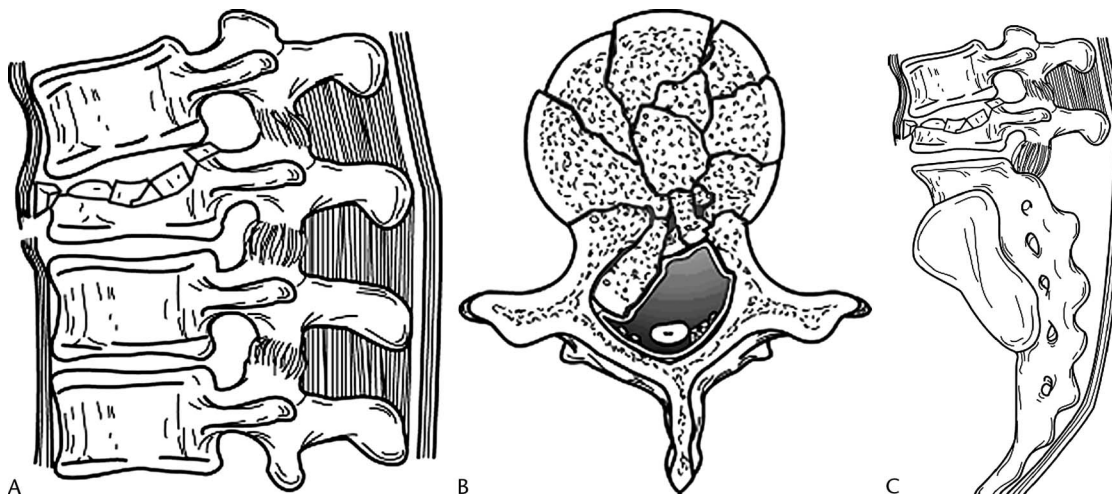


FIGURE 3. A, Burst injury without disruption of the posterior ligamentous complex. B, Nerve root injury in the setting of an L5 burst injury. Transaxial view. C, Isolated nerve root injury in the setting of an L5 burst injury, sagittal view.

A combined anterior/posterior procedure was preferred by 9% of surgeons because of concerns over anterior spinal support. The working group acknowledged that in those uncommon situations where additional anterior column support is required because of a severely comminuted fracture, a combined anterior/posterior approach may be considered.^{12,17,18}

3. Neurologically Incomplete or Cauda Equina Injury/Posterior Ligaments Intact

This clinical scenario is most commonly encountered in severe burst fractures but may be seen in a distraction extension injury or a flexion distraction injury through bone only (Figs. 1, 3A and C, and 5). A neurologically incomplete patient (ASIA B–D) without evidence of posterior ligamentous disruption is best served by spinal cord or cauda equina decompression to allow for maximal neurologic recovery, assuming the presence of objective neural element compression.^{19,20} In thoracolumbar spine injuries, this decompression is most

directly achieved through an anterior approach facilitating removal of the retropulsed vertebral body.^{21,22} Reconstruction and stabilization of the spine are safely achieved through the same surgical procedure with the use of a strut graft or cage and a side-mounted plate or rod system.²³ Ninety-one percent of the study group agreed that an anterior approach is the preferred surgical approach in a patient with an incomplete cord or cauda equina deficit whose posterior ligaments are intact. As previously stated, for injuries with a distraction or translation morphology, regardless of neurologic status or posterior ligamentous status, an initial posterior approach is preferred to provide stabilization prior to the decompression anteriorly.

In cases of high thoracic injury or low lumbar injury where anterior internal fixation may not be safely placed owing to the position of the great vessels,²⁴ an anterior or posterolateral decompression and arthrodesis followed by a posterior stabilization procedure may be preferred.

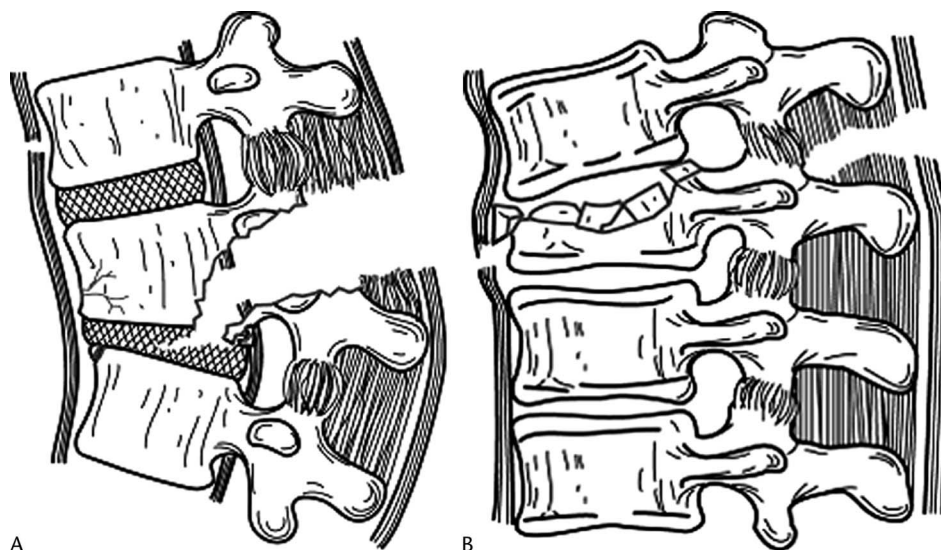


FIGURE 4. A, Flexion distraction injury partially through soft tissue. B, Burst fracture with disruption of the posterior ligamentous complex.

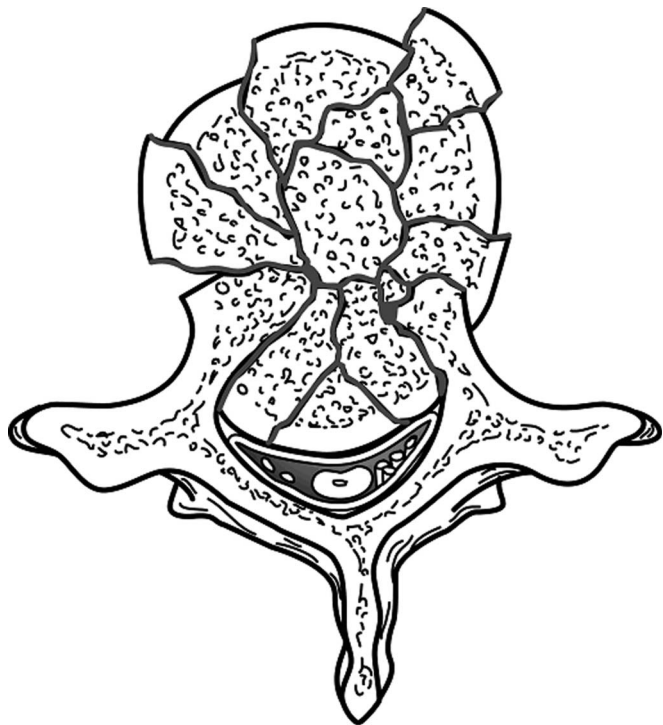


FIGURE 5. Transaxial view of burst injury with an incomplete cord injury with an intact posterior ligamentous complex.

4. Neurologically Incomplete or Cauda Equina Injury/Posterior Ligaments Disrupted

An incomplete neurologic deficit with disruption of the posterior ligaments is most commonly seen in severe burst fractures, flexion distraction injuries (through posterior ligaments instead of bone), and translational injuries (Figs. 2, 4, and 6). In a burst-type injury accompanied by incomplete spinal cord/cauda equina injury with documented neural compression, an anterior decompression is warranted. Because of the presence of a compromised posterior ligamentous complex, the anterior vertebral reconstruction may require augmentation via posterior stabilization. In translational or distraction injuries, an initial posterior reduction for alignment and stability is recommended followed by a posterolateral or anterior decompression in the presence of residual canal compromise. The study group acknowledged the decompression takes priority over stabilization except in translation and distraction injuries where initial realignment was recommended, which may in and of itself serve to relieve any neurologic compression. The need for combined anterior and posterior (360°) approaches was agreed upon by 82% of participating surgeons in a severe burst injury with incomplete neurologic injury and disruption of the posterior ligaments.

Three dissenting surgeons felt posterior decompression and fixation was adequate alone, whereas one preferred anterior decompression and fixation alone. Although the working group acknowledged that unequivocal class I evidence was lacking, the large majority of the participating surgeons felt strongly that in the setting of an incomplete spinal cord injury with anterior canal compromise in a burst-type injury, indirect

decompression (via ligamentotaxis) or posterior/posterolateral decompression is not as effective in ensuring optimal neural decompression as an anterior decompression with structural grafting.²² Whereas an anterior-only approach may be considered in the setting of posterior ligamentous disruption,¹⁰ the biomechanical properties of anterior reconstruction alone may not be favorable because of the loss of the posterior ligamentous complex. Low lumbar (L4, L5) and high thoracic spine (T2, T3) fractures may prevent safe and reliable direct anterior decompression or instrumentation. In these instances, posterolateral decompression with posterior instrumentation was felt to be a reasonable choice by the panel.

5. Neurologically Complete/Posterior Ligaments Intact

Most instances of complete spinal cord injury in which the posterior ligaments remain intact are represented by severe burst fractures (see Figs. 1 and 3A). A flexion distraction injury entirely through bone or a distraction extension injury with the injury line passing only through the posterior elements can also result in this clinical scenario. Nervous system insult is typically from spinal column elements anterior to the canal or canal compromise due to translation. Decompression to regain neurologic function is generally felt to be of little or no benefit.²¹ Hence, surgical treatment limited to a posterior approach aimed at stabilization and realignment may be appropriate. However, among the members of the focus group, this clinical scenario invoked the widest split in preference of approach. Whereas 55% of the group indicated a preference for a posterior-only approach, 45% indicated a preference for an anterior approach. The latter group cited restoration of CSF flow as their primary objective as an attempt to avoid the incidence of posttraumatic syringomyelia.²⁵⁻²⁷ Depending upon the degree of comminution of the anterior column fracture, some surgeons preferred anterior reconstruction simply for the biomechanical advantage of reconstructing the injured column. The focus group acknowledged the need for further study in this direction.

6. Neurologically Complete/Posterior Ligaments Disrupted

Severe compressive burst injuries, translational injuries, and distraction injuries all contribute to this type of clinical presentation (Figs. 2, 4, and 7). Neurologically complete patients with posterior ligament disruption display the most destructive fracture patterns due to the magnitude of forces necessary to create this type of outcome. The surgical approach to these injuries is based on principles common to the other groups; in the absence of salvageable neurologic function, a posterior exposure and fixation procedure is the surgical pathway of choice. This may involve some degree of open reduction and realignment as well. Seventy-three percent of participating surgeons direct their practices in this way. Restoration of CSF flow through an anterior-only approach (augmented by internal fixation) was felt appropriate by 18%. Recognizing the extreme biomechanical instabilities in these types of fractures, 9% of the working group surgeons favored a combined anterior and posterior procedure, noting the opportunity provided in such instance to not only restore CSF flow

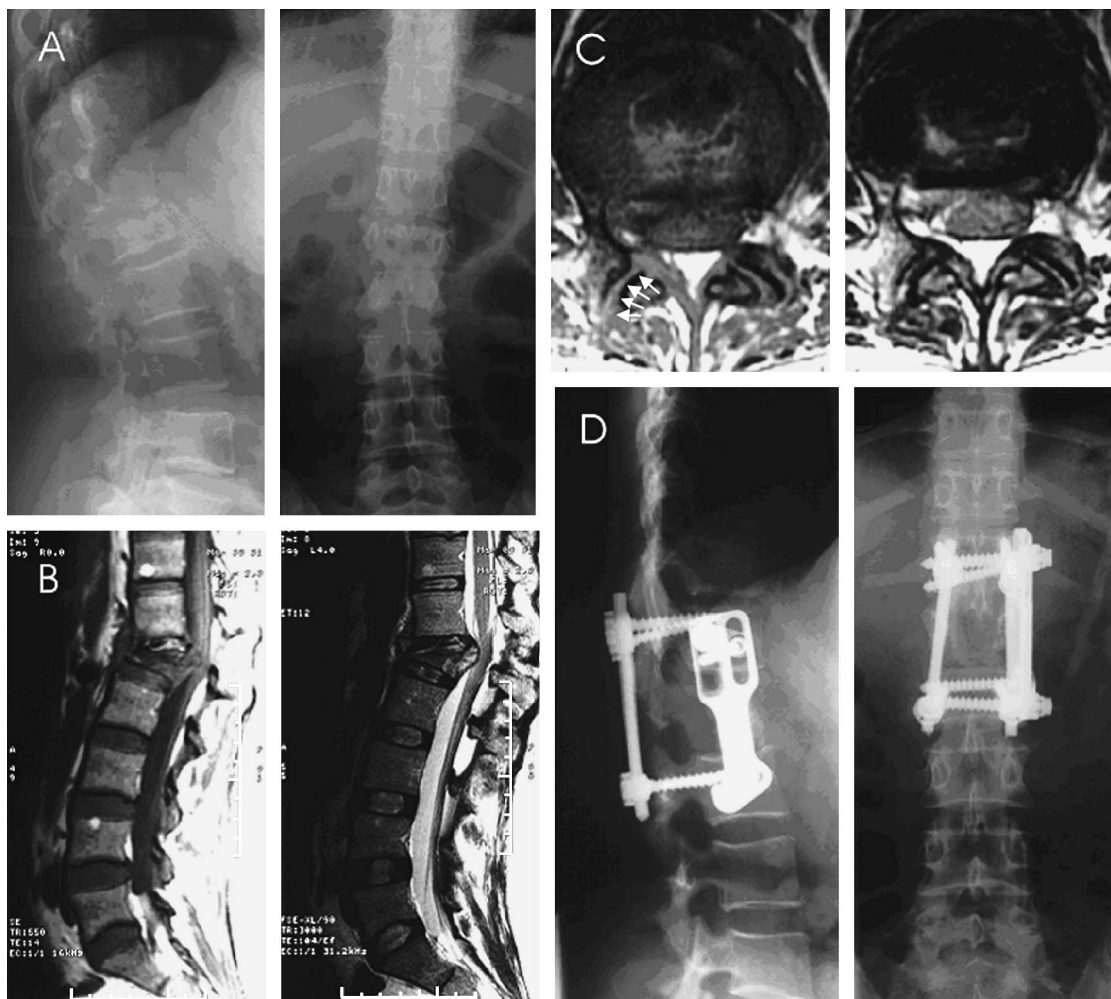


FIGURE 6. Incomplete neurologic deficit with disruption of the posterior ligamentous complex. A 36-year-old woman presented with an L1 burst fracture as a result of a motor vehicle accident. She had an incomplete spinal cord (conus medullaris) injury. A, Lateral radiograph demonstrates wedging of the L1 vertebral body. The anteroposterior view shows splaying of the L1 pedicles in addition to lateral angulation through the fracture site. B, Sagittal T1-weighted (left) and T2-weighted (right) MR sequences confirm the retropulsed bony fragment with continued cord compression. Widening of the T12–L1 interspinous space is apparent on the T1 sequence. C, Axial T1-weighted (left) and T2-weighted (right) MR images through the T12–L1 facet joints. Diastasis and hemorrhage of the facet joints can be appreciated particularly on the T1-weighted sequences (arrows), confirming posterior ligamentous disruption. D, Three-month follow-up radiographs following a combined (360°) anterior and posterior surgical approach for decompression, realignment, and stabilization. The patient still experiences some lower limb paresthesias but is ambulatory with full motor strength and normal bowel and bladder function.

but limit the number of motion segments included in the posterior instrumentation because of the anterior construct.

Summary

In summary, the morphology of injury, neurologic status, and integrity of the posterior ligaments can help guide the surgical management of thoracolumbar injuries. In most instances, incomplete neurologic deficits warrant anterior decompression if a posterior alignment is not effective in relieving neurologic compromise. Disruption of the posterior ligaments requires a posterior approach in the majority of cases. When both of these circumstances are present at the same time, a combined 360° approach is merited. Other characteristics of the fracture pattern can influence the choice of

approach but are rare compared with typical presentations. The various clinical scenarios and the approach preference percentages of the STSG are outlined in Table 1.

DISCUSSION

The optimal surgical approach to treat acute thoracolumbar spine injuries is controversial. A recent systematic literature review of 132 papers concluded that most of studies on surgical approaches for thoracolumbar injuries are inadequate.¹ Conclusive clinical studies are not currently available to assist the surgeon in deciding the optimal method of treating thoracolumbar injuries.

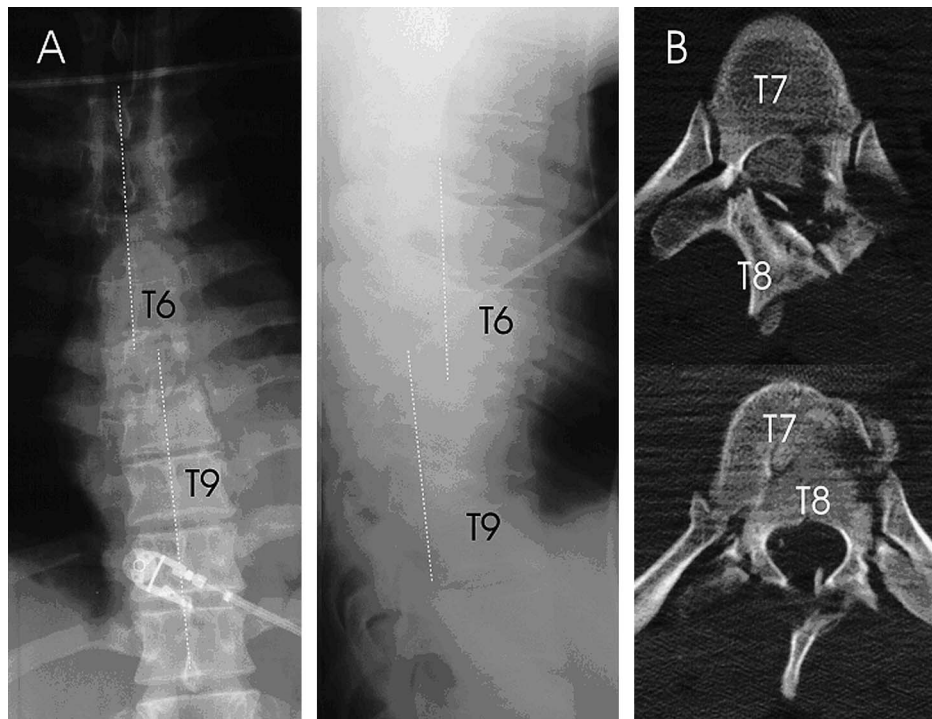
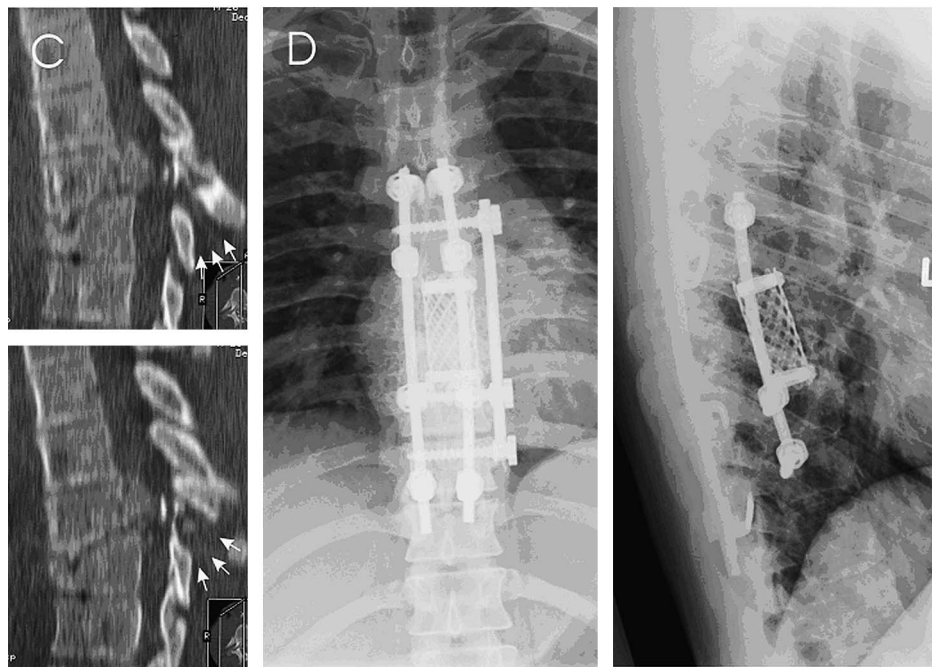


FIGURE 7. Complete neurologic deficit with disruption of the posterior ligamentous complex. This 26-year-old man sustained a T7–T8 translation injury from a motor vehicle accident. He had complete T6 spinal cord injury. A, Anteroposterior and lateral radiographs taken on admission demonstrate both coronal and sagittal plane translation. B, Axial computed tomography sequences show severe comminution with complete canal compromise. C, Sagittal computed tomography images confirm destruction of the posterior ligaments (arrows). D, One-year follow-up radiographs. The patient was treated with an initial posterior realignment and stabilization followed by an anterior vertebrectomy of T7 and T8 with reconstruction with a titanium cage and local autograft. The spinal canal was reconstituted with a dural patch posteriorly. A posterior-only operation without canal reconstruction would also have been appropriate.



Proof of treatment superiority is best obtained through multicenter randomized prospective clinical trials with a sufficient number of patients to directly compare outcomes of the different treatment options. Such clinical evidence currently does not exist for several reasons. A simple, accurate, and widely accepted classification system to help stratify patients with thoracolumbar injuries is not currently available. Multiple all-encompassing classification systems have been described in the past, but because of the extremely varied presentations

of these injuries, these systems are too complex for daily practical use.^{28,29} In addition, trauma populations are notoriously difficult to study owing to inconsistent follow-up with the treating surgeon. These difficulties in executing well-designed multicenter trials for thoracolumbar trauma may explain why class I clinical evidence is still unavailable.

In the absence of conclusive studies to guide surgical decision making, expert consensus opinions may have value. A panel of experts in the field of spine trauma was brought

TABLE 1. Results of STSG Panel on Surgical Approach to Thoracolumbar Spine Trauma

Morphology	Neurologic Status	PLC Status	Anterior	Posterior	Combined	Comments
—	Intact	Intact	(41%)*	(59%)*	—	Nonoperative‡
—	Intact	Disrupted	—	91%‡	9%	
—	Incomplete	Intact	91%†‡	5%	5%	
—	Incomplete	Disrupted	5%	14%	82%‡	Posterolateral decompression and posterior stabilization if anterior access/instrumentation not feasible
—	Complete	Intact	45%‡	55%‡	—	
—	Complete	Disrupted	18%	73%‡	9%	
Distraction or translation	—	—	—	100%‡§	—	

Percentages indicate the preferences of the members of the STSG. PLC, posterior ligamentous complex.

*Only if surgery chosen to accelerate rehabilitation. Posterior approach if nerve root lesion (95%).

†Add posterior instrumentation if anterior instrumentation not feasible.

‡Dominant preferences.

§Morphology dictates initial posterior stabilization.

together as the STSG. The STSG concluded that the morphology of injury, the neurologic condition of the patient, and the integrity of the posterior ligaments were most important in dictating surgical treatment. Common clinical scenarios with permutations of these characteristics were then presented to the STSG, and preferred treatments and rationale behind choosing these treatments were discussed. Consensus clinical recommendations were then generated based on available level II–IV evidence and principles established by time and experience. The guidelines within this management scheme may help surgeons take a more objective approach to decision making in thoracolumbar trauma and may also help to facilitate further clinical research. Prospective clinical investigations to validate these findings of the STSG are currently underway.

Decompression

Injuries involving the thoracic or lumbar spine in patients with an incomplete or indeterminate neurologic status should generally be treated more aggressively with a decompression procedure to maximize the full potential for recovery. Because the majority of thoracolumbar fractures present with anterior neural compression, decompression is usually best accomplished via an anterior approach.^{19,21,30,31} However, in certain circumstances, a posterior approach for decompression may be indicated.

Direct posterior decompression is possible via the transpedicular or the lateral extracavitary approaches. Although these techniques can result in an adequate anterior decompression, they are technically demanding and not considered “routine.”^{32–35} Some of the indications for direct posterior decompression include comminuted posterior elements with symptomatic posterior neural compression, a posterior epidural hematoma requiring evacuation, the repair of dural tears associated with a burst and lamina fractures, or the presence of a contraindication for an anterior decompression.³⁶ The anterior spinal canal can also be decompressed posteriorly indirectly via ligamentotaxis with pedicle screw instrumentation. However, this technique is not reliable in achieving adequate decompression.^{22,30,37,38}

Debate continues over the indications for decompression in patients with a complete neurologic injury (ASIA A). Surgical goals in this patient population are somewhat different because meaningful neurologic improvement is generally not expected.²¹ Unlike the cervical spine where surgery may facilitate local recovery in the zone of injury, this issue is not relevant to the thoracic spine.³⁹ However, there is emerging evidence that decompression in complete paraplegic patients may reduce late complications such as posttraumatic syrinx and chronic pain.^{25–27}

Anterior Approach

The anterior approach to thoracolumbar spine injuries allows the surgeon to directly decompress the spinal canal, restore anterior column stability, and re-establish the normal sagittal contour of the injured spine.^{23,40} Anterior approaches are indicated in complete neurologic injury with intact posterior ligaments and incomplete neurologic injury with intact posterior ligaments (see Table 1). An anterior approach allows for restoration of spinal alignment via the placement of anterior structural support in form of allo/autograft or prefabricated prosthetic replacements. In addition, a stand-alone anterior approach minimizes the number of motion segments requiring fusion to one above and one below the fractured vertebrae. An anterior approach also avoids further iatrogenic trauma to the posterior paraspinal musculature and is associated with lower rates of wound and instrumentation-related complications.⁴¹

Exceptions to the above indications include injuries in the high thoracic or lower lumbar (L3–L5) spine. In these situations, the anterior approach is technically more difficult because of the major vessels and instrumentation is not feasible.²⁴ Therefore, many surgeons approach fractures in this region using a posterolateral decompression and posterior stabilization. Alternatively, decompression is achieved anteriorly followed by posterior instrumentation. In the lumbar spine, the absence of the spinal cord and the greater cross-sectional area of the spinal canal make a posterior approach more feasible with less danger to the neural elements as compared with the thoracic spine or thoracolumbar junction. Relative contraindications for an anterior approach include

severe pulmonary disease, severe chest or abdominal injuries, and morbid obesity or prior abdominal surgery where anterior exposure can be difficult.⁴²

Posterior Approach

The posterior approach in thoracolumbar spine fractures has the advantage of being familiar to the spine surgeon, avoiding vital visceral/vascular structures, and allowing safe surgical re-exploration. The indications for a posterior approach are distraction or translation morphology without neural compression or when neural compression is relieved by reduction, isolated nerve root deficit with intact posterior ligaments, intact neurologic status and disrupted posterior ligaments, complete neurologic injury and intact posterior ligaments, and complete neurologic injury and disrupted posterior ligaments (see Table 1).

Exceptions to the above indications include situations when anterior vertebral body support is lost through significant comminution. In this setting, circumferential fusion may be necessary as a stand-alone posterior approach may result in late kyphosis and failure of instrumentation.^{12,13,17}

Combined Anterior and Posterior Approach

Circumferential 360° procedures are indicated in the setting of incomplete neurologic injury and disrupted posterior ligaments and distraction or translation injuries where a secondary anterior decompression or stabilization is required after primary posterior stabilization (see Table 1). The anterior approach provides for excellent decompression and vertebral column reconstruction. However, by itself, it may not resist further destructive flexion forces when the posterior ligaments have been rendered incompetent.⁴³ Hence, an additional posterior approach for the purpose of reconstructing the tension band is important.⁴⁴ Other circumstances can occasionally lead to the need for a combined anterior and posterior approach such as, for example, the presence of significant osteoporosis requiring internal fixation anteriorly and posteriorly or in the setting of a low lumbar or high thoracic injury allowing where anterior instrumentation is not safe owing to anatomic constraints.

CONCLUSIONS

We have presented a simple surgical decision-making framework for the management of thoracolumbar injuries based on expert opinion and established principles. Whereas many variables influence the choice of surgical approach, the morphology of injury, the neurologic status of the patient, and the integrity of the posterior ligamentous complex were identified as the three major injury characteristics that guide surgical decisions. These guidelines may also promote further clinical research by simplifying existing classification and treatment schemes.

ACKNOWLEDGMENTS

The authors thank the other members of the Spine Trauma Study Group for their participation in round table discussions, completion of the surveys, suggestions, and contributions to the many iterations of this text: Carlos Villanueva, MD, PhD, Ahmet Alanay, MD, Paul Arnold, MD,

John Dimar, MD, Michael Fehlings, MD, PhD, John France, MD, Ralf-Herbert Gahr, MD, PhD, Timothy Kuklo, MD, Allan Levi, MD, PhD, Steven Ludwig, MD, Ignacio Madrazo, MD, Y. Raja Rampersaud, MD, Glenn Rechtine, MD, David Schwartz, MD, Lali Sekhon, MD, PhD, Christopher Shaffrey, MD, and John Sledge, MD.

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