Indications for Nonsurgical Treatment of Thoracolumbar Spine Fractures: WFNS Spine Committee Recommendations

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Thoracolumbar spine is the most injured spinal region in blunt trauma. Literature on the indications for nonoperative treatment of thoracolumbar fractures is conflicting. The purpose of this systematic review is to clarify the indications for nonsurgical treatment of thoracolumbar fractures. We conducted a systematic literature search between 2010 to 2020 on PubMed/MEDLINE, and Cochrane Central. Up-to-date literature on the indications for nonoperative treatment of thoracolumbar fractures was reviewed to reach an agreement in a consensus meeting of WFNS (World Federation of Neurosurgical Societies) Spine Committee. The statements were voted and reached a positive or negative consensus using the Delphi method. For all of the questions discussed, the literature search yielded 1,264 studies, from which 54 articles were selected for full-text review. Nine studies (4 trials, and 5 retrospective) evaluating 759 participants with thoracolumbar fractures who underwent nonoperative/surgery were included. Although, compression type and stable burst fractures can be managed conservatively, if there is major vertebral body damage, kyphotic angulation, neurological deficit, spinal canal compromise, surgery may be indicated. AO type B, C fractures are preferably treated surgically. Future research is necessary to tackle the relative paucity of evidence pertaining to patients with thoracolumbar fractures.

Keywords: Thoracolumbar fractures, Conservative treatment, Indications for nonoperative treatment, Compression fractures, Burst fractures, Neurological deficit

INTRODUCTION

Thoracolumbar spine fractures occur in every 7/10 blunt trauma cases and make up to 9/10 of the spinal fractures recorded.¹,⁵ Every 1 in 4 thoracolumbar spine fracture patients have concomitant spinal cord injury.¹,⁴ Long-term care in cases with persistent disability post thoracolumbar fractures indicates a significant burden on healthcare funding.¹,²,⁴,⁶ Furthermore, such cases often have numerous visceral and bony injuries, and therapeutic decision-making can be quite demanding.⁶,⁶

For the aims of these recommendations, “thoracolumbar” includes the rigid thoracic (T1–10), transitional thoracolumbar junction (T10–L2), and flexible lumbar spine (L3–5).² This transition from the rigid thoracic spine with its link to ribs and sternum to the more mobile lumbar spine subjects the thoracolumbar region to significant biomechanical stress.³,⁸ Neurological injuries quite often will further complicate the thoracolumbar junction fractures.⁸,¹⁰ The probability of deficit in neurological function depends on the type of fracture. In a multicentric study, the occurrence of deficit of neurological function varied from 22% to 51% depending on the fracture type (22% in type A, 28% in type B, and 51% in type C fracture, ac-
Traditional classification protocols are described based on the morphology of the fracture, trauma mechanism, deficit of the neurological function, and damage to posterior ligamentous complex (PLC). There remains an absence of agreement on a few key areas such as indications for surgery and nonsurgical treatment of thoracolumbar fractures, as well as surgical stabilization's superiority over conservative therapy for thoracolumbar burst fractures. The World Federation of Neurosurgical Societies (WFNS), Spine Committee initiated this effort to formulate recommendations regarding the indications for surgery and nonsurgical treatment of thoracolumbar spine fractures through the published evidence and using elaborated methodology. Finally, these recommendations were formulated to improve patient care by defining the relevant literature and decision-making processes involved in the indications for surgical and nonsurgical treatment of thoracolumbar fractures. The surgical management of these patients often involves a multidisciplinary team. These recommendations were formulated as a guidance tool for surgeons through a series of indications for surgery and nonsurgical treatment of thoracolumbar spine fractures.

MATERIALS AND METHODS

The systematic review and meta-analysis was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The review followed the methods recommended by the Cochrane Handbook for Systematic Reviews of Interventions.

An international committee of spinal surgeons (members of the WFNS Spine Committee) organised a consensus meeting on the indications of surgical and nonsurgical management of thoracolumbar fractures. The meeting was conducted in Peshawar in December 2019 with WFNS Spine Committee members’ presence and participation. The meeting aimed to analyze a preformulated questionnaire through preliminary literature review statements based on the current evidence levels to generate recommendations through a comprehensive voting session.

We utilized the Delphi method to administer the questionnaire to preserve a high degree of validity. To generate a consensus, the levels of agreement or disagreement on each item were voted independently in a blind fashion through a Likert-type scale from 1 to 5 (1 = strongly disagree, 2 = disagree, 3 = somewhat agree, 4 = agree, 5 = strongly agree). Results were presented as a percentage of respondents who scored each item as 1 or 2 (disagreement) or as 3, 4, or 5 (agreement). The consensus was achieved when the sum for disagreement or agreement was ≥ 66%. Each consensus point was clearly defined with evidence strength, recommendation grade, and consensus level provided.

1. Eligibility Criteria

Articles were considered for review if they met the following inclusion criteria:

- Types of studies: randomized controlled trials, retrospective/prospective studies.
- Types of participants: patients who underwent conservative treatment for thoracolumbar spine fractures.
- Types of diagnosis: traumatic thoracolumbar spine fractures. Any osteoporotic thoracolumbar fractures were excluded.
- Types of treatments: nonoperative treatments.
- Outcomes: pain evaluation via visual analogue score (average VAS score), radiological features (mean kyphotic angle), loss in vertebral height (%), quality of life (36-item Short Form Health Survey [SF-36]), evaluated via physical compartment score, mental score, return to working life (days), length of hospital stay (days).

2. Search Strategy

The electronic databases of PubMed, MEDLINE, and the CENTRAL (Cochrane Central Register of Controlled Trials), were searched from 2010 till 2020. A highly sensitive search strategy based on the Cochrane Handbook recommendations for Systematic Reviews of Interventions, combined with medical subject headings and keywords to identify potential articles, was employed. The search strategy was compiled in consultation with members of WFNS Spine Committee. In addition to the electronic database search, coauthors manually checked the list of references eligible trials and previous reviews. The complete search strategy is available.

3. Study Selection

The coauthors initially screened titles and abstracts of all records after duplicates were removed. The full-text article for each potentially eligible article was screened.

4. Data Extraction

The coauthors independently used a standardized data ex-
traction form to collate study characteristics (publication year, country, diagnosis [fracture type + neurological deficit], number of patients), type of intervention (nonoperative). Studies published induplicate were only included once.

RESULTS

The panel was asked to vote on the indications for nonsurgical treatment of thoracolumbar fractures. A total of 6 statements were drafted and voted in Peshawar in December 2019.

Publication date from 2010 to 2020; English language; main word search in all-fields: “thoracolumbar” “fractures” and “treatment” We obtained 1,264 articles across all databases, and after removing duplicates, we were left with 504 articles. Four hundred fifty papers (nonrelated) after abstract review by an independent double-check up were excluded. Following a full-text review of the remaining 54 studies, the authors selected 9 studies that met the inclusion criteria to draw conclusions (Fig. 1). Out of 17 studies, 4 were randomized controlled trials, and rest were retrospective.

Excluded studies included studies published in any language other than English, any case reports, animal studies, experimental studies, studies on osteoporotic thoracolumbar spine fractures, studies solely investigating surgical treatments.

Below is the review summary from those studies comparing nonoperative and operative treatment in AO type A fractures.

1. Pain (VAS Score)

Five studies reported pain outcomes through average VAS scores. Although average VAS score for nonoperative cohort (2.25) was 0.37 lower than surgery cohort (2.62), there was no significant difference in the average VAS scores between the 2 cohorts (p = 0.33).

2. Kyphotic Angle (Degrees)

Three studies reported posttreatment kyphotic angle. No statistically significant results were found between nonoperative (19.45°) and surgery (17.30°) (p = 0.8).

3. Loss of Vertebral Body Height

Four studies have reported average posttreatment loss of vertebral height. No statistically significant differences (p = 0.17) were observed between the average loss of vertebral body height for nonoperative cohort (37.72%) and the surgery cohort (20.19%).

4. Quality of Life (Physical Compartment, Mental Compartment Scores)

Five studies analyzed quality of life using the SF-36 test. No statistically significant differences were observed between nonoperative and surgery cohorts for physical compartment (56.29 vs. 63.37, p = 0.48) and mental compartment scores (59.30 vs. 63.74, p = 0.65).

5. Length of Hospital Stay

No statistically significant differences were observed between nonoperative (6.25 days) and surgery cohorts (6.09 days) for length of hospital stay (p = 0.97).

6. Return to Work

Two studies reported the time needed to return to work after treatment. No statistically significant differences (p = 0.84) were observed between nonoperative (76.6) and surgery (63.90) cohorts (Tables 1, 2).

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Fig. 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram of the review process.

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| Study            | Study design                | Country | No. | Fracture type + neurological deficit | Type of treatment | Mean pain score (VAS) | Mean kyphotic angle (°) | Mean vertebral height loss (%) | Mean physical compartment score (SF-36) | Mean mental compartment score (SF-36) | Mean hospital stay (day) | Mean return to work (day) |
|------------------|-----------------------------|---------|-----|-------------------------------------|-------------------|-----------------------|------------------------|--------------------------|----------------------------------|----------------------------------|------------------------|------------------------|
| Karaali et al.   | Retrospective               | Turkey  | 74  | Compression + burst fractures No neurological deficit | Nonoperative vs. surgery | Nonoperative, 2.64; surgery, 1.91 | Nonoperative, 35.5; surgery, 25.12 | Nonoperative, 62.9; surgery, 21.2 | Nonoperative, 56.67; surgery, 7.87 | Nonoperative, 56.74 | Nonoperative, 1.50; surgery, 3.18 | Nonoperative, 142.2; surgery, 104.79 |
| Pehlivanoglu et al. | Retrospective               | Turkey  | 45  | A3, A4 burst fractures No neurological deficit | Nonoperative vs. surgery | Nonoperative, 2.3; surgery, 1.9 | Nonoperative, 11.65; surgery, 4.09 | Nonoperative, 12.78; surgery, 7.87 | Nonoperative, 55.5; surgery, 55.47 | Nonoperative, 55.47 | Nonoperative, 11.0; surgery, 9.0 | N/A                  |
| Nataraj et al.   | Retrospective               | Canada  | 230 | Burst fractures + no neurological deficit | Nonoperative vs. surgery | Nonoperative, 2.9; surgery, 3.3 | N/A | N/A | N/A | N/A | N/A | N/A | Nonoperative, 11.0; surgery, 23.0 |
| Urquhart et al.  | Randomized controlled trial | Canada  | 96  | A3 fractures (burst) + no neurological deficit | TLSO (Brace) vs. no bracing | N/A | N/A | TLSO, 46.5%; no bracing, 45.5% | TLSO, 55.8%; no bracing, 55.2% | N/A | N/A | |
| Hitchon et al.   | Retrospective               | USA     | 68  | Burst No deficit | Nonoperative vs. surgery | Nonoperative, 1.9; surgery, 3.0 | N/A | N/A | N/A | N/A | N/A | N/A | |
| Shen et al.      | Retrospective               | China   | 129 | Burst + no (new) neurological deficit | Nonoperative vs. surgery | N/A | Nonoperative, 11.3; surgery, 22.7 | Nonoperative, 29.4; surgery, 31.5 | N/A | N/A | N/A | N/A | |
| Wood et al.      | Prospective randomised      | USA     | 47  | Stable burst fracture No neurological deficit | Nonoperative vs. surgery | Nonoperative, 1.5; surgery, 3.0 | N/A | Nonoperative, 89.5; surgery, 70.0 | Nonoperative, 89.0; surgery, 72.0 | N/A | N/A | N/A | |
| Shamji et al.    | Randomized controlled trial | Canada  | 23  | Burst No neurological deficit | Bracing (TLSO) vs. no bracing | N/A | TLSO, 47.6%; no bracing, 44% | TLSO, 51.6%; no bracing, 51.2% | TLSO, 43.3%; no bracing, 46.6% | N/A | N/A | |
| Bailey et al.    | Randomized equivalence trial | Canada  | 47  | Burst No neurological deficit | Orthoses vs. no orthoses | N/A | TLSO, 39.1%; no bracing, 36.6% | TLSO, 52.2%; no bracing, 50.8% | N/A | N/A | N/A | |

VAS, visual analogue scale; SF-36, 36-item Short Form Health Survey; NA, not available.
DISCUSSION

This review discusses guidelines and highlights the lack of high-level evidence studies regarding the indications for nonsurgical versus surgical treatment of traumatic thoracolumbar spine fractures. Several spinal fracture studies contain a high level of heterogeneity in the studied populations, including the spinal levels (mixed cervical and thoracolumbar and lumbar), mechanism of trauma, anatomical classification of trauma, surgical approaches performed as well as follow-up periods.

1. Stability of the Thoracolumbar Spine Fracture

Fracture stability (comprised of mechanical and neurological stability) is a significant variable in formulating the therapeutic plan.

Denis\textsuperscript{23} in 1983 first classified instability into 3 subgroups, mechanical instability, neurological instability, and the combined instability. The mechanical stability of the thoracolumbar spine is analyzed based on the integrity of the bony structures and the integrity of the posterior ligament complex.\textsuperscript{24-26} On plain radiographs, reduction in the vertebral body height (50%), increased interspinous distance, and greater than 30°–35° of kyphotic deformity are indicators of injury to the posterior ligament complex.\textsuperscript{27-29} Computed tomography (CT) could be used for evaluating diathesis of facet joints.\textsuperscript{30,31} Magnetic resonance imaging is regarded as the most crucial examination in formulating the therapeutic plan for a patient with suspected PLC injury as it can analyze the PLC directly.\textsuperscript{32-34}

Neurological symptoms caused by a traumatic spinal injury can be classified with the Frankel scale or American Spinal Injury Association scale. Involvement of individual nerve root is categorized as Frankel grade E.\textsuperscript{35} Apart from grade E, the other grades of thoracolumbar spine fracture with a complete or incomplete deficit of neurological function due to the role of spinal canal compromise are considered unstable fractures, irrespective of the instability from fracture itself or injury to the posterior element. Despite the above, fractures accompanied with the neurological deficit are not necessarily an absolute indication for surgery.\textsuperscript{36-39} The surgical treatment is commonly conducted for cases with an incomplete neurological function deficit. It prevents further progression of neurological injury, aids in neurological recovery, and makes early mobilization possible by attaining fracture stability. However, if cases have Frankel A paralysis with complete neurological injury, the neurological exam should be conducted again after the period of spinal shock. If the neurological status is not changed on the second examination, there is a slim chance of neurological recovery expected due to decompression surgery.\textsuperscript{40} Hence, the treatment aims to restore spinal alignments and fracture stabilization, resulting in faster mobilization and improved rehabilitation options and results.\textsuperscript{35,41}

2. Classification of Thoracolumbar Spine Fractures

Since the first sophisticated classifications introduced by Holdsworth in 1962 and by Denis in 1983, several classification systems have been formulated to aid in better communication among physicians, determine therapeutic strategies, and analyze the prognosis. Among such classification systems, McAfee classification, AO classification, and the thoracolumbar injury classification and severity score (TLICS) classification are most frequently utilized (Table 3).\textsuperscript{12,23,24,27,42-54}

The mainstay of the thoracolumbar spine trauma management is based on modern comprehensive and easily reproducible classification that is based on:

- Objective clinical and imaging assessment.
- Provide standardized grading of the trauma.
- Identify any type of injury.
- Facilitates the decision if the fracture is stable/unstable.

Table 2. A comparative analysis between nonoperative versus operative treatments for AO type A thoracolumbar fractures

| Characteristic                        | Nonoperative | Surgery  | p-value |
|---------------------------------------|--------------|----------|---------|
| Mean pain VAS score                   | 2.25         | 2.62     | 0.33    |
| Mean kyphotic angle (°)               | 19.45        | 17.30    | 0.81    |
| Mean vertebral height loss (%)        | 37.72        | 20.19    | 0.17    |
| Mean physical compartment score (SF-36)| 56.29       | 63.37    | 0.48    |
| Mean mental compartment score (SF-36) | 59.30        | 63.74    | 0.65    |
| Mean hospital stay (day)              | 6.25         | 6.09     | 0.97    |
| Mean return to work (day)             | 76.60        | 63.90    | 0.84    |

VAS, visual analogue scale; SF-36, 36-item Short Form Health Survey.

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| Classification system | Characteristics | Pros/cons |
|-----------------------|----------------|-----------|
| Denis                 | 1. A 3-column theory based on 2-column theory of Holdsworth<sup>24</sup>  
2. Suggests that fractures of the middle column were very unstable.  
3. According to morphology of the fracture and mechanism of injury, thoracolumbar fractures were classified as compression, burst, flexion-distraction, and fracture dislocation. | Pros: It is simple and introduces the idea of damage to the neurological system<sup>43</sup>  
Cons: it is quite challenging to identify thoracolumbar stable and unstable burst fractures<sup>44</sup> and interobserver reliability is low.  
Furthermore, it does not allow physicians to assess their therapeutic options for special fracture patterns on numerical evaluation of post-fracture stability<sup>45</sup> |
| McAfee                | 1. PLC is a significant structure for the stability of the fracture, owing to the CT results.  
2. Subcategorised the middle column trauma and suggested that the middle column fails by a trio of several forces such as axial compression, distraction, and translation.  
3. Taking the mechanism of trauma into account, the authors separated such fractures into various categories, wedge compression fractures, stable, unstable burst fractures, chance fractures, flexion-distraction injuries, and translational injury<sup>27</sup> | Pros: Clear picture on surgical intervention required for type of fractures – stable burst or unstable burst<sup>44</sup>  
Cons: lack of studies evaluating its reliability and validity<sup>44</sup> |
| McCormack            | 1. Forecasts the risk of failure of implant post posterior short-segment fixation for thoracolumbar spine fractures.  
2. Primarily introduction was in the aim of avoiding repeat kyphosis and failure of posterior short-segment fixation with pedicle screws through allowing the most suitable approach regarding approach (surgery).  
3. Categorises trauma into 3 groups, A (compression), B (distraction), and C (translation) injuries<sup>49</sup> taking into account mechanism of trauma, morphology of the fracture, and mechanical stability.  
2. Each category was further subcategorised from A1 to C3 (the higher the subgroup, the higher the severity of trauma and more unstable fractures | Pros: Load sharing score links well with the degree of spinal instability<sup>60</sup>  
Excellent inter- and intraobserver reliability was noted for junior surgeons<sup>49</sup>  
Cons: This classification intends only to identify fractures that would require additional anterior fixation following a posterior surgery<sup>49</sup>  
Cons: AO Classification attempted to advise the comprehensive classification including all varied type of fractures, it showcased solely moderate intraobserver and interobserver reliability owing to its complexity<sup>44,50,51</sup>  
Further drawbacks include its inability to formulate a definition of stability of the fracture as well as no mention of a injury to the neurological function<sup>43</sup> |
| AOSpine              | 1. Categorises trauma into 3 groups, A (compression), B (distraction), and C (translation) injuries<sup>49</sup> taking into account mechanism of trauma, morphology of the fracture, and mechanical stability.  
2. Each category was further subcategorised from A1 to C3 (the higher the subgroup, the higher the severity of trauma and more unstable fractures | Cons: AO Classification attempted to advise the comprehensive classification including all varied type of fractures, it showcased solely moderate intraobserver and interobserver reliability owing to its complexity<sup>44,50,51</sup>  
Further drawbacks include its inability to formulate a definition of stability of the fracture as well as no mention of a injury to the neurological function<sup>43</sup> |
| TLICS                | 1. The classification appears more comprehensive in comparison to the previous AO classification and includes information on neurological status and posterior ligamentous integrity<sup>12</sup>  
2. In terms of neurological functional status, grades vary from N0 (Neurologically intact), N1 (Transient deficit of neurological function), N2 (radicular symptoms), N3 (incomplete SCI or cauda equina injury), N4 (complete SCI), NX (unknown neurological status owing to sedation or trauma to the head)<sup>49</sup>  
3. Morphological analyzes hold a great deal of significance as it aids in therapeutic choices<sup>22</sup> and categories vary from MM1 (abnormal alignment of vertebral column), MM2 (communion of the vertebral body), MM3 (stenosis of the spinal canal), MM4 (intervertebral disc lesion).<sup>23</sup> The complete score was counted by tallying up the scores from each of the 3 categories, and used to decide which treatment is most appropriate.  
4. Conservative treatment is indicated for the total score of 3 points, 4 points to the grey area, where the decision on the therapy is taken by the physician, a score of 5 points indicates surgical treatment | Pros: The classification appears more comprehensive in comparison to the previous AO classification and includes significant information on neurological status and posterior ligamentous integrity<sup>22</sup>  
Evaluation of TLISS showcased fair to substantial intraobserver and interobserver reliability in various studies<sup>22-24</sup>  
Pros: The classification appears more comprehensive in comparison to the previous AO classification and includes information on neurological status and posterior ligamentous integrity<sup>12</sup> |

PLC, posterior ligamentous complex; CT, computed tomography; SCI, spinal cord injury; TLICS, thoracolumbar injury classification and severity score; TLISS, thoracolumbar injury severity score.
• It gives the treatment direction – to fix or not to fix.
• Easily reproducible and easy to use in everyday practice.

Unfortunately, we are still searching for the ideal classification that will comply in 100% of the cases with the above criteria.

Oner et al.62 and Wood et al.63 indicated that the Denis classification system showed higher interobserver reliability than the AO classification system. Lenarz et al.65 reported the comparison of Denis, AO, TLICS systems in 97 thoracolumbar fractures and observed that changes in reliability were present in all 3 scenarios, with the highest reliability happening in the senior resident cohort and attending spine surgeon cohort.56 The lowest reliability was in the nonspine attending orthopedic and junior residents. In each cohort, the neurological function had the highest interobserver and intraobserver reliability. The researchers concluded that the TLICS is considered a widely deemed reliable tool compared to Denis and AO classification systems.57,59

3. Indications for Treatment of Thoracolumbar Spine Fractures

The goal of the management of thoracolumbar fractures involves reinstating the structural integrity and stability of the damaged spine, thus providing a biomechanically optimum environment for helping recovery. Historically, thoracolumbar fractures were managed primarily nonoperatively. However, recent technological improvements have shifted the transition from nonoperative to surgical treatment. However, the neurological deficit is seldom observed in cases managed nonoperatively. There is a lack of high-quality comparative research papers, with literature not confirming surgical treatment’s superiority over nonoperative treatment regarding pain management and restoration of neurological function.60-63

Surgical treatment is seldom suggested for compression fractures. However, a vast proportion of flexion-distraction/fracture dislocations require surgery (stabilization). As surgical treatment is frequently recommended for thoracolumbar fractures with neurological deficits, the current review’s main focus is the surgical management of fractures with neurological systems intact. To date, there is no high-quality, randomized research study supporting the superiority of surgical treatment over conservative treatment when there is no deficit of neurological function. Siebenga et al.64 revealed that AO type A fractures (with an intact neurological system) treated by surgical treatment compared to nonoperative treatment revealed superior radiological results; however, clinical outcomes were similar.64

Literature suggests that conservative treatment is indicated even in burst fractures with canal encroachment in the absence of a neurologic function’s major deficit. The spinal canal’s spontaneous remodelling is one of the variables favouring nonoperative management.65

Many spinal surgeons do not necessarily prioritize minimal neurological deficits (monoradicular symptoms) unless it is severe with spinal canal compromise in surgical decision-making. Meanwhile, all of the spinal trauma classification systems consider evaluation of spinal cord damage.23,45,66,67

4. Nonoperative Management of Thoracolumbar Spine Fractures

In a spinal cord injury case, trauma to the neural structures happens both at the time of the trauma (primary – nonmodifiable) and in the subsequent period due to vascular dysfunction, edema, ischemia, electrolyte shifts, production of free radical, inflammation, and delayed apoptotic cell death (secondary – potentially modifiable) or iatrogenic reasons.68 During prehospital treatment and in the emergency department management, also follow-up care, all the necessary measures should be taken to immobilize spinal trauma patients safely, to avoid a focal neurological deficit.12

The statistics suggest that the majority of thoracolumbar fractures are stable, amenable to nonoperative management. The aim of nonoperative treatment is an appropriate regime of immobilization and, as early as possible, ambulation of the patient.69 At the start, a short duration of bed rest may be indicated. Successful nonoperative treatment is based on patient collaboration, physiotherapists, nurses, and senior physicians. A change in treatment plan may be considered in the event of significant deterioration of clinical or radiological presentation.42

Half of the thoracolumbar fractures are classified as compression type due to axial compression alone or flexion forces and present with wedge deformities of the vertebral body on radiological evaluation. Patients with compression-type fractures are seldom treated operatively as they are rarely associated with a current or potential deficit of neurological function.43

Various pharmacological therapies are thought to alleviate secondary trauma have been studied in depth. These include steroids (anti-inflammatory), gangliosides, naloxone (opiate receptor blocker), calcium channel blockers, free radical scavengers, and neurotropic agents. Steroids were used quite heavily in the clinical management of spinal cord injury since mid of the 1960s. In animal spinal cord injury models, neurological recovery improved following steroid use.70 After encouraging outcomes via an elevated dose of steroids in NASCIS (National Acute Spinal Cord Injury Study) 1 and 2 trials. However, in a third
study, methylprednisolone failed to demonstrate an effect in comparison to placebo. Additionally, due to increased risk of infections, its use is no longer recommended.  

American Association of Neurological Surgeons/Congress of Neurological Surgeons guidelines state that administration of methylprednisolone is no longer recommended as there is no class 1 or 2 study that has shown benefits. Hurlbert reported that the utility of high-dose methylprednisolone in the therapy of acute spinal cord injury is not proven as a standard of patient care. A survey (2006) indicated that most of the respondents continue to give methylprednisolone, but by fear of litigation. However, in the current times, a high dose of steroid treatment is not considered to be a mainstream treatment.

Bracing is no longer considered necessary for the treatment of fractures of the vertebral column. Independent randomized control trials revealed no advantages from wearing braces. In a systematic review, Giele et al. reported that there is no evidence for the efficacy of bracing in cases with traumatic thoracolumbar fractures.

1) Pain improvement (VAS score)

Literature regarding pain improvement from nonoperative and operative management of AO type A fractures is conflicted. A randomized prospective study evaluating stable burst fracture management revealed a statistically significant pain improvement from nonoperative treatment compared to surgical intervention. Similar results were revealed by a large-scale retrospective study (n = 230). However, the difference was not statistically significant. On the other hand, Karaali et al. evaluating compression, burst fractures (without neurological deficit) revealed that surgical management might yield a superior pain improvement in comparison to nonoperative management.

2) Kyphotic angle and loss of vertebral body height

During conservative care, it is common to oversee a certain degree of increasing fracture kyphosis in most patients, frequently closer to the pretreatment sagittal alignment. However, kyphosis has not been showcased to link with increased pain levels in various studies, even up to 30°. Nonoperative management is less efficacious in decreasing kyphotic angle in comparison to surgical management. Karaali et al. revealed that the nonoperative cohort’s kyphotic angle (at the final follow-up, 24 months) of 17.61° to be higher than the surgical cohort (p < 0.001). Similar results were observed from a range of retrospective studies (Pehlivanoglu et al. and Shen et al.).

Furthermore, nonoperative management seemed less successful in halting the loss of vertebral height than surgical management. Karaali et al. revealed that at all follow-ups (3 months, 6 months, and 24 months), the nonoperative cohort had a significantly higher (p < 0.001) loss of vertebral height versus the surgical cohort. Similar results were reported by the other retrospective designed studies; however, the 2 cohorts’ differences were not statistically significant.

Shamji et al. evaluated bracing and nonbracing cohorts, and results revealed bracing to not be significantly superior to nonbracing cohorts in limiting vertebral height loss.

3) Quality of life (SF-36)

Literature on which management leads to a higher quality of life is conflicted. Pehlivanoglu et al. revealed that the surgical cohort had a higher mental and physical compartment score than nonoperative cohorts. In contrast, Wood et al. demonstrated that nonoperative cohorts had a significantly higher mental and physical score versus the surgical cohort.

Studies evaluating bracing and nonbracing cohorts did not reveal any statistically significant results regarding improving quality of life.

4) Length of hospitalisation and return to work

Literature on length of hospital stay for compression/burst fractures (without neurological deficit) managed nonoperatively and surgically is conflicted and lacking. While Karaali et al. revealed a shorter hospital stay for patients managed nonoperatively, Pehlivanoglu et al. showed otherwise. All studies revealed that surgical management leads to a faster return to work versus nonoperative management regarding returning to work.

5. Future Research

Each section within these recommendations suggests areas of need for future high-quality studies. However, as an overall requirement, future research should try to analyze patients with thoracolumbar trauma separate from patients with cervical trauma to better clarify the most effective diagnostic and treatment ways for these patients in particular.

CONCLUSION

Ensuring the best indications for nonsurgical or surgical treatment for the patients sustaining thoracolumbar fractures remains crucial. However, the available literature is still not unanimous,
and further research is necessary. Compression-type fractures and stable burst fractures are mostly managed conservatively. If there is significant vertebral body structural damage, kyphotic angulation, neurological deficit, spinal canal compromise, surgical treatment may be considered. AO types B, C fractures are to be treated primarily surgically. The majority of the AO type A fractures may be treated conservatively.

WFNS RECOMMENDATION ON INDICATIONS FOR SURGICAL TREATMENT OF THORACOLUMBAR FRACTURES

- AO types B and C fractures preferably should not be treated conservatively (strongly agree 16.7%, agree 66.7%, disagree 16.7%).
- AO types A2, A3, and A4 can be treated conservatively if there is no significant vertebral body collapse, significant kyphotic angulation, or canal compromise with neurological impairment (agree 100%).
- There is no clinical evidence that bracing for conservative treatment of thoracolumbar fractures will improve the outcome (agree 100%).
- Fracture dislocations and cases with significant instability (score ≥ 5 of TLISS classification) should preferably be operated (strongly agree 16.7%, agree 83.3%).
- For burst fractures with neurological deficits, surgical decompression and stabilization may be considered, although there is not enough scientific evidence to support that (strongly agree 16.7%, agree 66.7%, disagree 16.7%).
- Burst fractures without neurological deficits can be treated either with conservative or surgical techniques (strongly agree 16.7%, agree 83.3%).

CONFLICT OF INTEREST

The authors have nothing to disclose.

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