



Bracing After Surgical Stabilization of Thoracolumbar Fractures: A Systematic Review of Evidence, Indications, and Practices

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■ **BACKGROUND:** The role of spinal orthotic braces after surgical stabilization is not clearly defined. We systematically reviewed the published literature to determine patterns of practice, indications, and current evidence for the use of orthotic braces after surgical thoracolumbar fracture stabilization.

■ **METHODS:** A search was performed for publications including descriptions of postoperative management and outcomes after surgical stabilization of thoracolumbar injuries. Differences between wearing versus not wearing a postoperative brace were examined with regard to loss of deformity correction, pain, return to previous work activity, functional improvement, instrumentation failure rate, pseudoarthrosis, and the percentage of reported complications.

■ **RESULTS:** This search yielded 76 pertinent studies. Postoperative bracing (POB) was adopted in 62 studies for a median wear time of 13.3 weeks. No significant differences in terms of pain, return to work, Frankel score improvement, or instrumentation failure were found between the POB and non-POB groups. Loss of surgical kyphotic reduction was slightly greater in the POB group (4.79° vs. 3.77°; $P < 0.001$). The overall complication rate was also higher in the POB group (16.3% vs. 11.9%; $P < 0.01$). The pseudoarthrosis rate was lower in the braced group (2.4% vs. 6.0%; $P < 0.001$).

■ **CONCLUSIONS:** Most surgeons use braces for 3 months after surgical thoracolumbar fracture stabilization. Given the lack of clinical or biomechanical evidence for this, and the additional costs and potential discomfort to patients, further investigation is warranted to determine when and if

POB for surgically stabilized thoracolumbar fractures is indicated. Controlled studies should include a careful analysis of pseudoarthrosis and complication rates.

INTRODUCTION

Treatment of thoracolumbar fractures includes a variety of surgical stabilization strategies as well as nonsurgical options that typically use an external brace. The role of postoperative bracing (POB) after surgical stabilization is controversial but the rationale for its use includes improving arthrodesis, reducing the load on the implanted hardware, and an analgesic effect for the patient. The orthosis reduces range of motion and should decrease the load on disks and lumbar muscles by distributing load throughout the brace and increasing the abdominal pressure.¹ Although several investigators suggest bracing after surgery for thoracolumbar fractures, there are no established indications for this in the literature.²⁻⁵ Most of these recommendations appear to be based on clinical experience and training.

Intervertebral motion does not appear to be significantly changed by bracing, and arguments in favor of POB often focus on limiting dangerous gross truncal movements or on the fact that the POB adds a degree of pain control.^{6,7} Considering the widespread use of POB, the associated cost, and possible collateral effects of bracing such as muscular hypotrophy, skin breakdown, delayed recovery, and pain, we sought to systematically review the existing literature to gain a better understanding of current practice, indications, and evidence for bracing after surgical thoracolumbar stabilization.⁸ We specifically compared loss of

Key words

- Brace
- Fracture
- Orthosis
- Orthotic
- Spine
- Trauma

Abbreviations and Acronyms

POB: Postoperative bracing

TLSO: Thoracolumbosacral orthosis

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surgically obtained deformity correction, pain scores, changes in employment status, screw breakage rate, and complication rates between studies that described use of POB and studies in which POB was not used.

METHODS

Search Strategy

An electronic literature search of the National Library of Medicine for publications from 1990 to 2014 was performed using combinations of the following keywords: thoracolumbar burst fracture, surgery, surgical treatment, brace, bracing. The search was limited to the English language and yielded more than 600 articles.

Study Selection and Data Extraction

The articles titles were reviewed using the following criteria for inclusion: surgical treatment of thoracolumbar burst fractures, excluding articles focusing on augmentation techniques (eg, vertebroplasty, kyphoplasty). The 200 resulting articles were reviewed to find those describing postoperative management with or without brace. Moreover, bibliographies of publications were screened for additional pertinent citations. Articles had to provide quantitative results for at least 1 of our study criteria (pain, changes in kyphotic correction, employment, screw breakage rate, or postoperative complication rate). Articles that investigated a variable other than bracing were still included and the mean outcome values were aggregated across whatever variable was investigated relative to the presence or absence of a brace for comparison in this study.

Seventy-six studies were identified that met full criteria.^{2-5,9-80} Of these, 29 described separate patient groupings. To appreciate any correlation with the use of POB, the groups were independently considered. The resulting 105 groups were screened for surgical approach criteria (anterior, posterior, or circumferential), open or minimally invasive, the performance of fusion or not, and in cases of posterior stabilization, the length of the construct (instrumentation was considered short when it involved the level above and below the fractured vertebra and long if more extended).

The articles were also screened across POB and non-POB groups in terms of kyphotic deformity, residual pain, return to work, instrumentation failure, pseudoarthrosis, and other complications at the last available follow-up (median, 32.2 months) documented in each study. Only articles reporting specific data for these criteria were analyzed. A Fisher exact test or a χ^2 test was used for categorical and ordinal data depending on category size, and an unpaired Student *t* test for continuous data to determine if any relationship with these outcomes and POB exists (SPSS v22; SPSS, Inc, Chicago, IL). Analysis of variance was used for multifactorial ranked data such as pain score, Frankel improvement score, and occupational outcomes. All analyses were weighted by the number of patients who contributed to their respective datasets. An α level of 0.05 was used to judge significance.

To determine if significant findings were applicable to a smaller, but more homogenous group, we also performed a post hoc subgroup analysis after limiting the inclusion criteria to open, short-segment, posterior fusions only.

RESULTS

POB was adopted in 62 of 76 studies (81.6% for a median bracing time of 13.3 weeks) (Figure 1). Of the 105 identified groups described in these studies, bracing was adopted in 84 groups (2230 patients), bracing was not used in 21 (544 patients); in 75 groups (2018 patients), surgery was performed by posterior approach; in 18 groups (523 patients), anterior; and in 12 groups (233 patients), by circumferential access.

Posterior Surgery

Within this category, POB was adopted in 62 groups (82.7%). In 38 groups, the brace was worn for an average of 12 weeks; in 7 groups, less (mean, 9.0 weeks); and in 10 groups, more (mean, 16.0 weeks); in 5 groups, the POB time was not reported and in 2 groups, the investigators maintained bracing until fusion was achieved.

Decortication and fusion was performed in 57 of the posterior groups, and instrumentation without clearly intended fusion was practiced in 18 groups. POB was adopted in 47 groups in which fusion was performed (82.4%) and in 15 groups in which fusion was not performed (83.3%).

Of 69 groups that reported construct length in posterior approaches, 23.2% used long constructs. Twelve POB groups had long constructs (21.1%), as did 4 of the non-POB groups (33%).

Most of the groups were open posterior fusions. Four groups that used POB instrumented through a minimally invasive approach. There were no reports of minimally invasive stabilization that did not use POB.

Anterior Surgery

POB was adopted in 13 groups (72.2%). In 7 groups, bracing was used for 12 weeks; in 1 group, less (10 weeks); and in 4 groups, more (mean, 21.4 weeks); in 1 group, the POB time was not reported.

Circumferential Surgery

POB was adopted in 9 of 12 groups. In 4 groups, bracing was used for 12 weeks; in 1 group, less (10 weeks); and in 3 groups, more

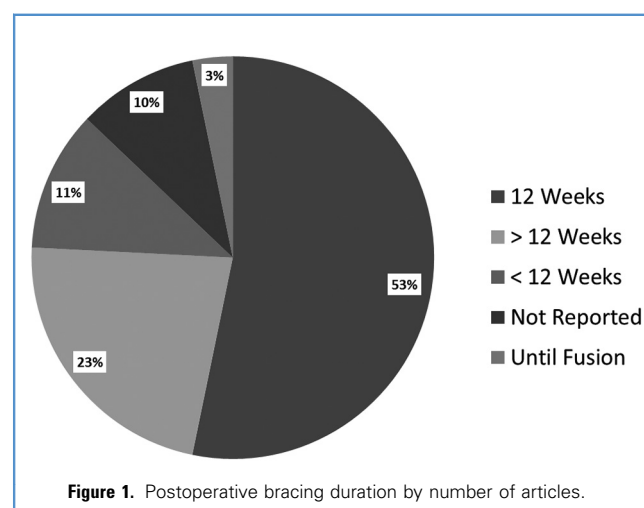


Figure 1. Postoperative bracing duration by number of articles.

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