Editorial

Burst fractures

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Burst fractures caused by severe axial loading were first described by Holdsworth in 1970.⁵ This fracture type is radiographically characterized by disruption of the posterior vertebral body cortex with possible retropulsion of bone fragments into the spinal canal. Burst fractures are common and encountered in approximately 45% of all major thoracolumbar traumas, with approximately half of these patients being neurologically intact.⁷ Despite their high incidence and a large body of literature on treatment strategies for thoracolumbar burst fractures, there is no consensus on the optimal treatment regimen. A previous randomized, prospective study by Wood et al.¹³ demonstrated minimal if any advantage of operative treatment compared with bracing for patients without neurological deficits. These findings were recently corroborated by a systematic review of the literature, which came to the conclusion that nonoperative and operative treatment strategies lead to similar outcomes with regard to quality of life, pain, and disability.¹¹

Despite the paucity of scientific evidence supporting surgical treatment of traumatic burst fractures in neurologically intact patients, the popularity of internal fixation has been increasing. Modern spinal instrumentation with rigid 3D fixation allows for immediate patient mobilization and rehabilitation of patients and potentially reduces the likelihood of delayed kyphotic deformities.¹⁰ While a number of studies report no correlation between final kyphotic deformity and functional outcome in routine cases,^{1,3,8–10} the later correction of a delayed fixed kyphosis requires a substantially more morbid intervention to achieve proper alignment as compared with fixating the fracture while it is still mobile.⁶ Given the growing evidence that sagittal balance problems exert a negative impact on quality of life, the maintenance of normal spinal alignment in younger patients may have significant implications as these patients age.^{2,4} More recently, the advent of minimally invasive surgical techniques for spinal fixation has reenergized the debate on how to best manage these injuries.

In their current publication, Vanek and colleagues¹²

studied 37 consecutive neurologically intact patients with traumatic burst fractures of the thoracolumbar spine (AO subtypes 3.1–3.3). Of note, these burst fracture subtypes are believed to be at risk for instability or later kyphotic progression, so surgery is frequently used in these disruption patterns. Given the substantial morbidity of conventional stabilization procedures, the authors explored the possibility of less invasive surgery with percutaneous pedicle screw fixation as a treatment option. It should be noted that historically, percutaneous pedicle screws had their origin in Europe where the “fixator interne” systems were used for burst fractures to maintain alignment. The hardware used 20 years ago is also different from the one used today, in that the connecting rods were placed above the fascia, and they always required later removal. Contemporary percutaneous pedicle screw-rod systems employ subfascial rods, so their later removal becomes more optional.

The investigators treated half of the patients with short-segment percutaneous screw fixation and the other half with an open short-segment construct and concomitant posterolateral fusion. All patients underwent fixation at 1 level above and 1 level below the injury site, and fixation at the fracture level was used. Patients were assigned to their treatment based on their order of presentation, with every other patient receiving the minimally invasive surgery. As expected, the authors found reduced surgical time, less blood loss, and lower pain levels during the first 7 postoperative days in patients who underwent percutaneous fixation compared to the conventional technique. Moreover, the percutaneous technique allowed for equivalent restoration of the vertebral body height compared with conventional techniques after a 2-year follow-up. The loss of sagittal correction in both groups was less than 5°, which is an excellent result, considering that only 3-point fixation methods were used. Furthermore, it was surprising that segmental sagittal alignment was not affected by later removal of the instrumentation.

Overall, clinical outcomes and patient satisfaction were similar in both groups. However, the authors found a trend toward increased return-to-work rates in patients undergoing the percutaneous procedure. Seventeen of 18 patients with minimally invasive surgery returned to work, compared with 12 of 17 patients who underwent the open procedure. Although this study was not adequately powered to allow definitive conclusions, the concept of whether a less invasive method of spinal fixation is responsible for these long-term findings deserves more

study. Other factors may have been responsible for these findings, including the effects of nonequivalent treatments (fusion vs nonfusion), the timing of hardware removal, and patient selection. For example, despite the authors' efforts to allocate similar patients into their 2 treatment groups, patients in the percutaneous treatment group were on average 5 years younger (39.4 ± 16.9 years vs 45.6 ± 15.3 years), and the percutaneous group also had a higher rate of sports-related injuries. The functional outcome measures would also have benefitted substantially from more standardized and comprehensive measures such as the Oswestry Disability Index (ODI), 36-Item Short Form Health Survey (SF-36), or EuroQol Group-5 Dimension (EQ-5D). These measures would have allowed for a determination of the intervention's impact on quality of life metrics.

The work of Vanek et al. further demonstrates that percutaneous screws constitute a valid treatment strategy for neurologically intact patients with burst fractures. However, before the case can be made that percutaneous fixation results in better outcomes, more in-depth investigation is needed. One must consider this information in the context that historical evidence suggested bracing may be better than surgery (in these select cases), and a nonoperative comparator group may ultimately be needed in future studies.

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Disclosure

Dr. Wang serves as a consultant to DePuy Spine and Aesculap Spine, and is a patent holder for DePuy Spine.

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Response

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The primary aim of our study was to show the non-inferiority of percutaneous surgery, especially regarding proper placement and stability of instrumentation and the treated segment depicted on follow-up radiography or CT, which was undoubtedly proven. As an important bonus to this finding, we found a significantly lower pain profile after percutaneous procedures in comparison with standard fixation, similarly to the obvious trend of the better working capability of patients undergoing percutaneous fixation. The question of active versus conservative treatment was not raised in this study due to institutional preference of active treatment. Although we are aware of studies comparing active and conservative treatment in neurologically intact patients and their results, in our opinion, active treatment has the major advantages of early mobilization after surgery and better patient comfort. Furthermore, the vast majority of our patients prefer active treatment rather than bracing for 2–3 months. We are aware of small differences in our 2 groups; however, the difference in age was not statistically significant. In the future we are prepared to study patient satisfaction in those who undergo minimally invasive treatment using standardized questionnaires, and compare these results to those from patients operated on using open surgery, to obtain results comparable with other studies.

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