Thoracolumbar burst fracture treatment

- Kyphoplasty as a Treatment Option for Traumatic Burst Fractures: A Case Series Evaluating Patient Outcomes and Functional Benefits
- Efficacy and safety of posterior short-segment versus long-segment pedicle screws fixation for thoracolumbar burst fractures: A systematic review and meta-analysis
- Effect of the sequence of intermediate instrumentation and distraction-reduction of the injured vertebra on the treatment of thoracolumbar burst fractures with high rate of spinal canal encroachment
- Evaluating the Role of Intermediate Screws in the Early Healing of Traumatic Thoracolumbar Fractures Managed by Short-Segment Fixation
- Fusion Versus Non-fusion for Thoracolumbar Burst Fractures Treated With Short-Segment Posterior Instrumentation Including the Fracture Level
- Percutaneous Treatment of Traumatic A3 Burst Fractures of the Thoracolumbar Junction Without Neurological Impairment: The Role of Timing and Characteristics of Fragment Blocks on Ligamentotaxis Efficiency
- Delayed hemorrhagic shock due to reverse chance thoracic vertebrae fracture complicated with hypoxemia caused by diaphragmatic eventration
- Single-Stage Posterior Unilateral Transpedicular Corpectomy With Circumferential Reconstructive Stabilization for the Treatment of Severe Thoracic and Lumbar Complete Burst Fractures

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The management of patients with thoracolumbar burst fractures remains a topic of debate, with conservative treatment being successful in most cases but not all.

see Thoracolumbar burst fracture conservative treatment

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see Thoracolumbar injury classification and severity score.

Evidences have revealed that functional outcomes in the long term may be equivalent between operative and nonoperative management for neurologically intact thoracolumbar burst fractures.

Patients with comminuted burst fractures deserve special attention, even if initially classified as non-operative according to the TLICS algorithm. In such cases, if a decision of conservative management is taken, a close follow-up is recommended due to the high likelihood of long-term kyphotic deformity [1].

Bracing

In 2009 there was no evidence for the effectiveness of bracing in patients with traumatic thoracolumbar fractures. The lack of high-quality studies prevents relevant conclusions from being drawn [2].

In a systematic review in 2014 the evidence suggested that orthosis could not be necessary when TL burst fractures without neurologic deficit are treated conservatively. However, due to limitations

related with number and size of the included studies, more RCTs with high quality are desirable for making recommendations with more certainty [3].

In 2017 Bracing following operative stabilization of thoracolumbar fracture does not significantly improve stability, nor does it increase wound complications. Moreover, data suggests that post-operative bracing may not be a cost-effective measure [4].

Surgery

Many authors recommend surgery to remove retropulsed bone fragments from the canal in burst fractures to 'decompress' the spinal canal. Limb et al. believe, however, that neurological damage occurs at the moment of injury when the anatomy is most distorted, and is not due to impingement in the resting positions observed afterwards. They studied 20 consecutive patients admitted to there spinal injuries unit over a two-year period with a T12 or L1 burst fracture. There was no correlation between bony or canal disruption and the degree of neurological compromise sustained but there was a significant correlation between the energy of the injury (as gauged by the Injury Severity Score) and the neurological status ($p < 0.001$). This suggests that neurological injury occurs at the time of trauma rather than being a result of pressure from fragments in the canal afterwards and questions the need to operate simply to remove these fragments [5].

Approach

The posterior approach may be more effective than the anterior approach. However, more high-quality, randomized controlled trials are required to compare these approaches and guide clinical decision-making. Level of Evidence Level II, therapeutic study [6].

Fusion

The results of a meta-analysis suggested that fusion was not necessary when thoracolumbar burst fracture was treated by posterior pedicle screw fixation. More randomized controlled trials with high quality are still needed in the future [7].

Evidence is insufficient to inform the selection of different methods of pedicle screw fixation or the combined use of fusion. However, in the absence of robust evidence to support fusion, it is important to factor the risk of long-term donor site pain related to bone harvesting into the decision of whether to use this intervention. Further research involving high-quality randomised trials is needed [8].

Percutaneous techniques

Limited data suggest that percutaneous techniques are associated with less postoperative pain, less blood loss, a shorter hospital stay, and a slightly better functional outcome. However, concerns remain on the effectiveness of percutaneous techniques in correcting spinal deformity and achieving bony fusion. Further studies are needed to verify these preliminary findings [9].

From a biomechanical point of view long-segment posterior fixation (LSPF) still represent a biomechanically superior option for treating thoracolumbar burst fractures (BF) [10].

In general, surgical treatment of traumatic spine fractures is safe and effective. Surgical techniques can only be compared using randomized controlled trials [11].

Kyphosis

Operative management of thoracolumbar burst fractures without neurologic deficit may improve residual kyphosis, but does not appear to improve pain or function at an average of 4 years after injury and is associated with higher complication rates and costs [12].

The expandable cage group showed better results in loss of kyphosis correction, operation time, and amount of intraoperative blood loss [13].

Timing

There is strong evidence within the literature that early surgical stabilization consistently leads to shorter hospital stays, shorter intensive care unit stays, less days on mechanical ventilation, and lower pulmonary complications. This effect is more evident in patients who have more severe injuries as measured by Injury Severity Score. This benefit is seen in both, spinal cord injured and noncord-injured patients. There is also some evidence that early stabilization does not increase the complication rates compared to late surgery [14].

However, the definite conclusion cannot be made due to the heterogeneity of the included studies and low level of evidence. Further prospective studies are required to confirm whether there are benefits to early stabilization compared with late stabilization [15].

Thoracolumbar burst fracture treatment for those with neurological deficits

Consensus has not been met regarding the optimal treatment strategy for those with neurological deficits.

Surgical treatment for burst fracture in the belief that neurological improvement can be achieved is not justified, although surgery may still occasionally be indicated for structural reasons. This information should not be withheld from the patients [16].

A review article in 2017 summarizes the contemporary evidences to discuss the role of nonoperative management in the presence of neurological deficits and the optimal timing of decompression surgery for neurological recovery. In summary, although operative management is generally recommended for thoracolumbar fracture with significant neurological deficits, the evidence is weak, and nonoperative management can also be an option for those with solitary radicular symptoms. With regards to timing of operative management, high-quality studies comparing early and delayed

intervention are lacking. Extrapolating from the evidence in cervical spine injury leads to an assumption that early intervention would also be beneficial for neurological recovery, but further studies are warranted to answer these questions [17)].

Thoracolumbar burst fracture A3 and A4 treatment for those without neurological deficits

Rometsch et al. did not find differences in disability or pain outcomes between operative and nonoperative treatment of A3 and A4 TL fractures in neurologically intact patients. Notwithstanding, the available scores have been developed and validated for degenerative diseases; thus, their suitability in trauma may be questionable. Specific and uniform outcome parameters need to be defined and enforced for the evaluation of TL trauma [18)].

Systematic reviews

Searches were performed in PubMed and the Web of Science. Clinical and radiological outcome data were collected. For studies comparing operative with nonoperative treatment, the standardized mean differences (SMD) for disability and pain were calculated and methodological quality and risk of bias were assessed.

From 1929 initial matches, 12 were eligible. Four of these compared surgical with conservative treatment. A comparative analysis of radiological results was not possible due to a lack of uniform reporting. Differences in clinical outcomes at follow-up were small, both between studies and between treatment groups. The SMD was 0.00 (95% CI -0.072, 0.72) for disability and -0.05 (95% CI -0.91, 0.81) for pain. Methodological quality was high in most studies and no evidence of publication bias was revealed.

We did not find differences in disability or pain outcomes between operative and nonoperative treatment of A3 and A4 TL fractures in neurologically intact patients. Notwithstanding, the available scores have been developed and validated for degenerative diseases; thus, their suitability in trauma may be questionable. Specific and uniform outcome parameters need to be defined and enforced for the evaluation of TL trauma [19)].

The traditional surgical approach, when indicated, involves spinal fixation and spinal arthrodesis. Newer studies have brought the need for fusion associated with internal fixation into question. Not performing arthrodesis could reduce surgical time and intraoperative bleeding without affecting clinical and radiological outcomes.

Diniz Jet al. aimed to assess the effect of fusion, adjuvant to internal fixation, on surgically treated thoracolumbar burst fractures.

A search of the Medline and Cochrane Central Register of Controlled Trials databases was performed to identify randomized trials that compared the use and nonuse of arthrodesis in association with internal fixation for the treatment of thoracolumbar burst fractures. The search encompassed all data in these databases up to February 28, 2016.

Five randomized/quasi-randomized trials, which involved a total of 220 patients and an average follow-up time of 69.1 months, were included in this review. No significant difference between groups in the final scores of the visual analog pain scale or Low Back Outcome Scale was detected. Surgical time and blood loss were significantly lower in the group of patients who did not undergo fusion ($p < 0.05$). Among the evaluated radiological outcomes, greater mobility in the affected segment was found in the group of those who did not undergo fusion. No significant difference between groups in the degree of kyphosis correction, loss of kyphosis correction, or final angle of kyphosis was observed.

The data reviewed in this study suggest that the use of arthrodesis did not improve clinical outcomes, but it was associated with increased surgical time and higher intraoperative bleeding and did not promote significant improvement in radiological parameters [20].

Prospective randomized studies

From 1994 to 1998, forty-seven consecutive patients (thirty-two men and fifteen women) with a stable thoracolumbar burst fracture and no neurological deficit were randomized to one of two treatment groups: operative (posterior or anterior arthrodesis and instrumentation) or nonoperative treatment (application of a body cast or orthosis). Radiographs and computed tomography scans were analyzed for sagittal alignment and canal compromise. All patients completed a questionnaire to assess any disability they may have had before the injury, and they indicated the degree of pain at the time of presentation with use of a visual analog scale. The average duration of follow-up was forty-four months (minimum, twenty-four months). After treatment, patients indicated the degree of pain with use of the visual analog scale and they completed the Roland and Morris disability questionnaire, the Oswestry back-pain questionnaire, and the Short Form-36 (SF-36) health survey. RESULTS: In the operative group (twenty-four patients), the average fracture kyphosis was 10.1 degrees at the time of admission and 13 degrees at the final follow-up evaluation. The average canal compromise was 39% on admission, and it improved to 22% at the final follow-up examination. In the nonoperative group (twenty-three patients), the average kyphosis was 11.3 degrees at the time of admission and 13.8 degrees at the final follow-up examination after treatment. The average canal compromise was 34% at the time of admission and improved to 19% at the final follow-up examination. On the basis of the numbers available, no significant difference was found between the two groups with respect to return to work. The average pain scores at the time of the latest follow-up were similar for both groups. The preinjury scores were similar for both groups; however, at the time of the final follow-up, those who were treated nonoperatively reported less disability. Final scores on the SF-36 and Oswestry questionnaires were similar for the two groups, although certain trends favored those treated without surgery. Complications were more frequent in the operative group. CONCLUSION: We found that operative treatment of patients with a stable thoracolumbar burst fracture and normal findings on the neurological examination provided no major long-term advantage compared with nonoperative treatment [21].

Case series

2001

study involved 80 patients. Inclusion criteria required the following: neurologically intact patient, single-level closed burst fracture involving T11-L2, no fracture dislocations or pedicle fractures, age of 18 to 65 years (nonpathologic adult), and no other major organ system or musculoskeletal injuries. Patients in the nonoperative group (n = 47) were allowed activity to the point of pain tolerance

beginning on the day of injury using a hyperextension brace. Patients in the operative group (n = 33) underwent three-level, (one above, one at fracture level, and one below) fixation using VSP or TSRH instrumentation. The follow-up period was 2 years. RESULTS: The surgical group had less pain up to 3 months and a better Greenough Low Back Outcome Score up to 6 months, but the outcome was similar afterward. No neurologic deficit in any patient. In the nonoperative group, the kyphosis angle worsened by 4 degrees, and the retropulsion decreased from 34% to 15%. In the operative group, there was one case of superficial infection and two cases of broken screws. The kyphosis angle was improved initially by 17 degrees, but this was gradually lost. Hospital charges were four times higher in the operative group. CONCLUSIONS: Short-segment posterior fixation provides partial kyphosis correction and earlier pain relief, but the functional outcome at 2 years is similar. Early activity to the point of pain tolerance can be safely allowed [22)].

1998

Sixty-eight patients with thoracolumbar burst fractures were treated operatively in 36 cases, and nonoperatively in 32 with recumbency for 1-6 weeks. Treatment was based on clinical and radiological criteria. Eighty-one percent of the recumbency patients, but only 14% of the surgical patients were intact on admission. Patients were followed for a mean+/-SD of 9+/-10 months in the recumbency group, and 21+/-21 months in the surgical group. RESULTS: Neurological improvement and progressive angular deformity occurred in both groups. The cost of recumbency in our patients was nearly half that of those who required surgery, though the length of hospitalization between the two groups was similar at 1 month +/-2 weeks. CONCLUSION: The above study emphasizes that the selection of operative versus nonoperative treatment in burst fractures should not be random but based on clinical as well as radiological criteria. Recumbency is favored in patients who are intact, with angular deformity less than 20 degrees , a residual spinal canal greater than 50% of normal, and an anterior body height exceeding 50% of the posterior height. Surgical intervention is generally indicated in patients with partial neurological deficit, and those with severe instability [23)].

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