Preoperative manual on-table-traction for the reduction of thoracolumbar burst fractures: A technical note

ABSTRACT
Thoracolumbar burst fractures can frequently be treated either conservatively or surgically. Surgery is generally preferred when safe early mobilization with a reconstructed sagittal alignment is wanted without any external restraint. Various dedicated instruments are available on the market to perform reduction and distraction maneuvers on the spine intraoperatively to restore normal sagittal alignment after a fracture. The authors describe a simple but effective technique of proper patient positioning and preoperative on-table-traction that can effectively aid in the restoration of alignment and performance of surgery even with the most basic instrumentation.

Keywords: Canal encroachment, sagittal alignment, surgery, thoracolumbar fractures

INTRODUCTION
The optimal treatment for specific subtypes of thoracolumbar burst fractures still generates debate.[1,2]

Conservative versus operative treatment is frequently discussed in burst fractures with significant canal encroachment, and while restoration of an acceptable canal diameter and protection of the neural elements is an issue important in the short term, recreation of a normal spinal alignment is an objective mainly necessary for the long term.

The role of sagittal alignment and its correlation with a disability has been well demonstrated, and nowadays an increasing number of brands of spinal implants offer some form of instrumentation that allows for contemporaneous distraction and reduction of a kyphosed vertebral segment due to a fracture.[3,5]

When such instrumentation is not available some simple but essential steps and maneuvers can assist in reestablishing good sagittal alignment and canal decompression.

We report on a case of an L2 burst fracture where optimal preoperative positioning and simple manual on-table-traction permitted to revert segmental kyphosis and reestablish a good central canal diameter.

CASE REPORT AND TECHNICAL NOTE
A 32-year-old male construction worker fell off a ladder sustaining a type A4 fracture of the L2 vertebra. On admission, there were no neurological deficits except for painful paresthesias in both lower limbs, right over left. No signs or symptoms of cauda equina compromise.

After an initial X-ray investigation of the spine that showed the L2 fracture, computed tomography (CT) imaging, and magnetic resonance imaging of the lumbar spine were performed.

These investigations revealed a type A4 fracture with the involvement of both cranial and caudal endplates as well

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How to cite this article: Carlo P, Francesco C. Preoperative manual on-table-traction for the reduction of thoracolumbar burst fractures: A technical note. J Craniovert Jun Spine 2018;9:73-5.
as interruption of the posterior wall. The spinal canal was severely stenosed just below the level of the conus [Figures 1a and b-2a and b].

Considering the segmental kyphosis and the severe canal narrowing as well as the need for early mobilization for maintenance of muscle trophism and performance, we listed the patient for surgery by pedicle screw and rod fixation.

Under general anesthesia and muscle relaxation, the patient was positioned prone on two separate silicone-foam blocks, one of semi-cylindrical shape under the mid-upper chest and the other of wedge shape under the upper thighs and pelvis. In between these two supports, the abdomen is completely free which not only allows for better ventilation and reduced venous pressure but is also crucial in permitting the maximum amount of positional lordosis. Subsequently, and still, before sterile draping, a fluoroscopy C-arm was brought in to identify the fracture in the lateral projection. Two operators would now hold the patient at both ankles and under the armpits and apply simultaneous traction in the craniocaudal directions [Figure 3a]. Traction force is applied at maximum intensity for 3–5 s after which a lateral image is performed to check for any reduction. If no or only little reduction is visible on the fluoroscopy image, the procedure is repeated a couple of times with the attempt to hold the simultaneous traction some seconds more.

With this maneuver a good reduction of the segment was obtained, and realignment of the posterior wall of the fractured vertebra was already clearly visible on fluoroscopy [Figure 3b and c]. At this stage, the patient was prepared for surgery in a routine fashion, and a standard open pedicle screw instrumentation was performed including one vertebra above and one below the fracture level as well as the fractured vertebra itself.

A postoperative CT scan of the instrumented segment confirmed an important widening of the central canal and reversal of kyphosis [Figure 1c and d]. Rx rays of the lumbar spine after 3 months show good maintenance of the sagittal alignment [Figure 2c].

**DISCUSSION**

Vertebral fractures can be classified and treated in many ways and nature has blessed, or selected, all living creatures with an often incredible potential to recover from traumatic events. Thoracolumbar fractures are no exception to this rule, and this is also one of the main reasons why most of the fractures can still today spark a heated discussion between experts as to what the most suitable treatment should be.\[1,2\]
Our philosophy and ensuing treatment strategy is dictated essentially by two main factors: speed of recovery and return to normal activity for the short term and restoration and maintenance of an acceptable sagittal alignment mainly for the long term as the correlation between pain and sagittal alignment have been well established over the last two decades.

For these reasons, we favor surgery over conservative treatment and have the aim to reverse all segmental kyphosis caused by a fracture. With today’s third-generation spinal instrumentation and various technical integrations that offer the possibility to effect such reductions in the immediate posttraumatic phase, this is almost always possible through a single posterior approach. Besides the technical advances of the instruments that favor the surgeon, however, not too much emphasis can be placed on the value of proper patient positioning and the role and safety of traction. As this case shows, these two elements alone can generally help to restore both a good canal diameter and vertebral alignment even before any instrumentation is placed. This not only avoids the exertion of strains on the instrumented vertebrae for reduction maneuvers performed through the instruments but also often permits a simple in situ fusion which can be done also with simple pedicle screw instrumentation sets that do not offer any reduction integrations. Given that there is no anterior support as long as the fractured segments have not healed, we always attempt to place at least one pedicle screw also in the fractured vertebra as this has shown to increase the construct strength and reduces the risk for later loss of alignment. We try to place the screws in the fractured vertebra in an oblique direction to provide as much purchase within the pedicle as possible as this is the only stable part in the fractured vertebra [Figure 2c].

As far as canal diameter is concerned, it is well known that a good degree of canal remodeling occurs in the majority of cases in the long term, which is why a narrow canal due to a retropulsed fragment does not have to be a concern. We feel, however, that a realignment procedure that indirectly enlarges a severely stenosed canal in the early phase can only be useful both for the confidence and safety with which the patient can be mobilized and for the functionality of the mobilization itself.

CONCLUSION

We believe that the simple steps of proper positioning and preoperative on-table-traction are two very valid maneuvers that can safely and effectively help to achieve the best postoperative results in thoracolumbar burst fractures even with the most elementary setups and instrumentations.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship
Nil.

Conflicts of interest

There are no conflicts of interest.

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