Trauma Case Reports 32 (2021) 100428

Contents lists available at ScienceDirect

Trauma Case Reports

journal homepage: www.elsevier.com/locate/tcr

Mini-open lateral approach for anterior lumbar corpectomy combined with posterior screw-rod system augmentation for correction of kyphosis

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ARTICLE INFO

Keywords:
Burst fracture
Anterior instrumentation
Corpectomy
Posterior instrumentation
Kyphosis
Mini-open incision

ABSTRACT

Introduction: Traumatic burst fractures most commonly occur in thoracolumbar junction. Maintenance of spinal stability and decompression of spinal canal are the main goals of management in these cases. Either anterior, posterior or combined approaches may be selected. For anterior corpectomy, mini-open lateral incision may be used.

Case: 29 years old male patient, in whom posterior segmental instrumentation had been performed previously, readmitted 4 months later with a complaint of low back pain and urinary and gait incontinence. Radiological scans revealed iatrogenic kyphosis and loosening of uppermost transpedicular screws. Patient was managed via revision of posterior instrumentation and L1 corpectomy with cage and rod insertion.

Result: In patients with thoracolumbar burst fracture, loosening of screws and consequent iatrogenic kyphosis may be seen as a late complication. Combined anterior and posterior approach may regenerate spinal stability in these patients. Moreover; mini-open lateral incision with muscle sparing thoracotomy for anterior approach may cause less postoperative complications.

Introduction

Fractures of spine are mostly located in thoracolumbar junction. Burst fractures consist of 15% of these fractures and may be complicated with neurological deficit which usually require surgical intervention [1]. Maintenance of stability and fusion, together with spinal cord decompression is essential for anterior vertebral column fractures and may be achieved either via posterior decompression, indirect reduction or instrumentation [2]. In these cases, if fusion does not occur, development of kyphosis is inevitable [3].

Many theories have been postulated on the etiology of post-operative non-fusion and kyphosis such as life style, ineffective usage of posterior brace postoperatively and loss in height of the disc space adjacent to the burst fracture due to degeneration [3,4]. For correction of post-operative iatrogenic kyphosis; anterior, posterior or combined anterior and posterior instrumentation may be performed [3].

In this report, we are representing successful treatment of a case with iatrogenic kyphosis that developed after posterior segmental

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https://doi.org/10.1016/j.tcr.2021.100428
Accepted 12 February 2021
Available online 18 February 2021
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Fig. 1. Thoracolumbar CT scan at early postoperative period of posterior stabilization. 1A. Sagittal view shows the decompression of spinal cord at L1 segment. 1B and 1C. Axial view of T11 and T12 levels with screws, respectively.

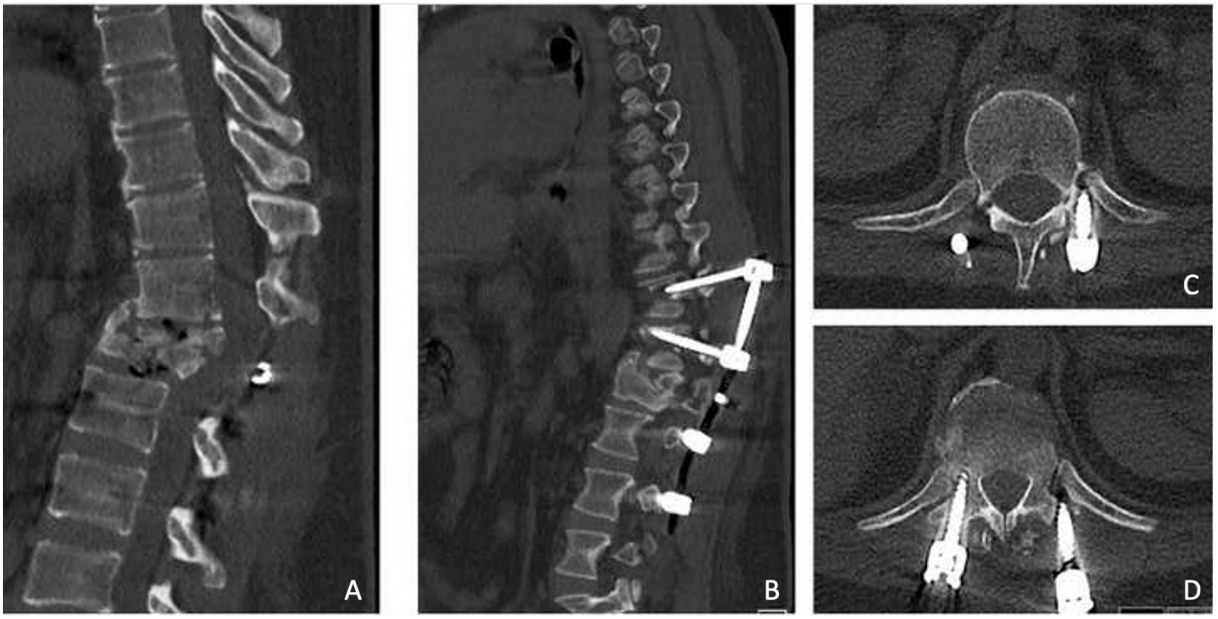

Fig. 2. Thoracolumbar CT scan of the patient 5 months after the initial surgery. 2A. Sagittal view showing kyphosis in thoracolumbar junction. 2B. Sagittal view with misalignment of screws in left T11 and T12 vertebrae. 2C and 2D. Axial views of T11 and T12 vertebra with pulled out screws in left side, respectively.

instrumentation. Corpectomy with cage and rod insertion via lateral approach and revision of posterior screw rod system was achieved in the same surgery. For corpectomy and anterior instrumentation, mini-open incision was used for extrapleural-retroperitoneal approach.

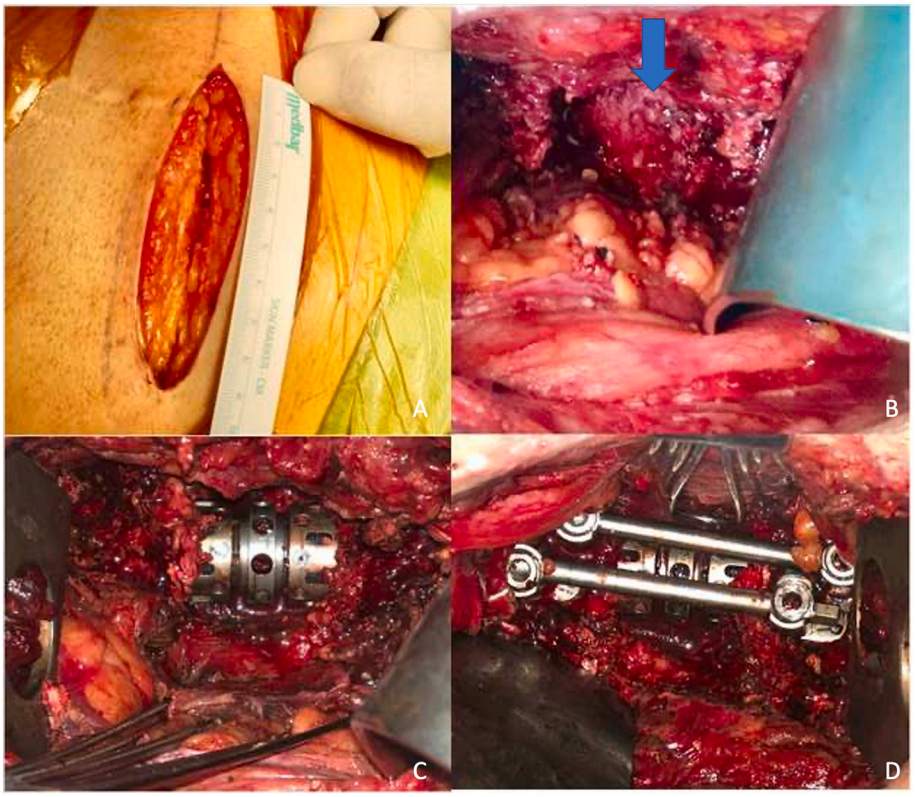

Fig. 3. Photographs of the anterior corpectomy and instrumentation peroperatively. 3A. Mini- open linear skin incision measured of 9 cm on 10th intercostal space. 3B. L1 corpectomy (arrow indicates the corpectomy level) is performed with high speed drill and Kerrison rongeurs. 3C. After insertion of dynamic expandable cage with autogreft implantation. 3D. After insertion of plaques on T12 and L2 vertebra and dual rod system.

Case presentation

A 29 years old male patient was admitted to the emergency department of our institute with a suicide attempt of leap from a building. His neurological examination revealed paraplegia in both lower extremities and hypoesthesia below L1 dermatome. Cranial and spinal CT scans were performed and a burst fracture in L1 vertebra body with anterior compression of spinal cord was detected.

After any other possible pathologies due to trauma were eliminated, patient was transported to operation room and L1 spinal segmental stabilization was performed via bilateral transpedicular screws in T11, T12, L2 and L3 vertebrae that were connected with two rods and one connector. Spinal cord was decompressed via laminectomy at L1 vertebra and dural tear was repaired with primary closure (Fig. 1). Patient's early postoperative neurological examination revealed muscle strength of 3/5 and fine touch sensation in both lower extremities. Early postoperative period revealed no complications and the patient was discharged on day 8 postoperatively. He received physical rehabilitation afterwards.

4 months after the operation, the patient admitted again to our outpatient clinics with a complaint of new-onset insidious low back pain. Moreover, he had urinary and fecal incontinence. Thoracolumbar CT scan showed that left T11 and T12 screws were pulled out and there was kyphosis, especially in T11-L2 segments (Fig. 2). Combined anterior and posterior approach was choosen for revision surgery, where initial stage was extraction of the rods and screws in prone position. Peroperatively, the pull out of left T11 and T12 transpedicular screws were seen. After extraction of the system totally, a novel screw-rod system with transpedicular polyaxial screws of greater diameters were inserted and augmentation was performed up to 9th thoracal vertebra. At this stage of surgery, rods were not placed.

For second phase; the patient was positioned in left lateral decubitus position. Double-lumen tube was not inserted and the operation was held with a standard intubation. Also deflation of the lung was not applied. A 7 cm length incision was made along the 11th intercostal space. Approximately 9 cm of rib was cut via muscle sparing thoracotomy. For achieving an extrapleural retroperitoneal exposure, parietal pleura was retracted and the attachment of diaphragm to the thoracic wall was dissected. After fluoroscopic confirmation of the vertebral level, segmental arteries anterior to T12, L1 and L2 vertebral bodies were ligated and cut. L1 corpectomy was performed via punch forceps and high speed drill. A slim cortical layer of bone was preserved at the right lateral border and posterior border of the vertebral corpus. An expandable cage was inserted which was filled with bone graft prepared from the corpectomy material and locked after expansion. Then plaques were inserted on the left lateral wall of vertebral bodies of T12 and L2 segments. Two rods were attached on the plaques with four screws in total (Fig. 3).

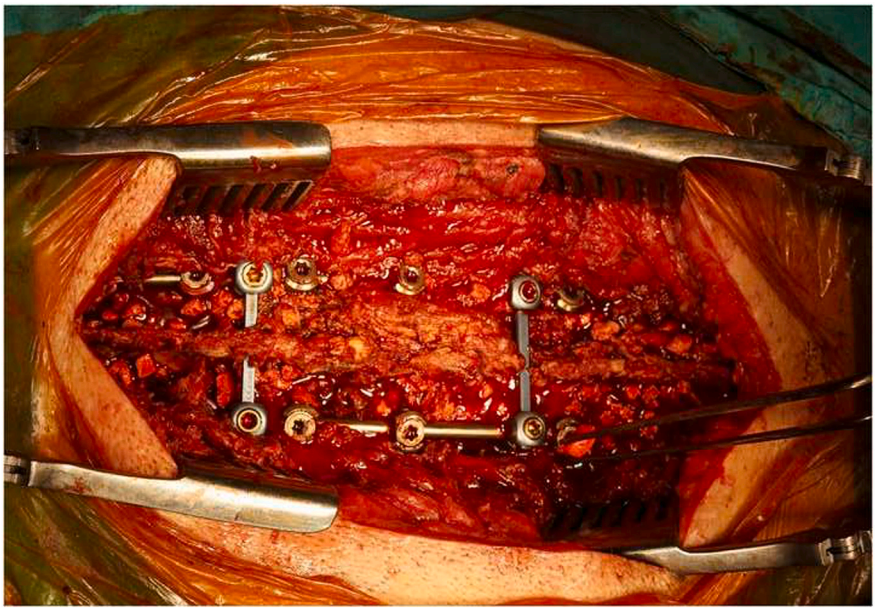

Fig. 4. Peroperative view of posterior segmental stabilization with screw rod system and two connectors.

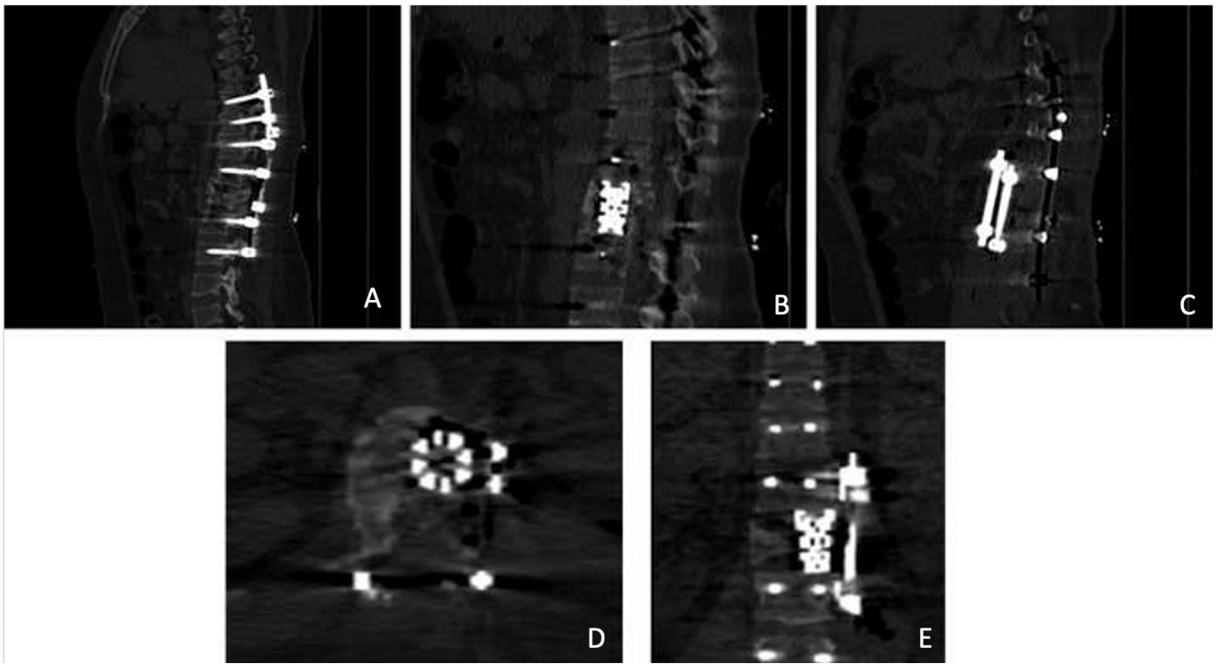

Fig. 5. Postoperative CT scan of both anterior and posterior instrumentation. 5A. Sagittal view of posterior instrumentation via 12 screws, 2 rods and 2 connectors between T9-L3 segments. 5B. Sagittal view with dynamic expandable cage filled with autogreft after corpectomy of L1 vertebra. 5C. Sagittal view of anterior dual-rod system inserted within plaques on T12 and L2 vertebral bodies. 5D. Axial view of anterior dynamic expandable cage and dual-rod system. 5E. Coronal view of anterior dynamic expandable cage and dual rod system.

Last phase of the operation consisted of changing the position to prone again and insertion of two rods bilaterally between transpedicular screws. The rods were connected using two connectors after application of compression. For fusion; bony decortication with placing of bone autograft and allograft was performed (Fig. 4). Neuromonitorization with SSEP (somatosensory evoked potential), MEP (motor evoked potential) and EMG was achieved during all the phases of surgery. There were no signal alterations in values at the end of operation.

Patient was extubated in the intensive care unit on day 3, postoperatively. He was neurologically intact. Postoperative CT scan

revealed the correction of kyphosis in the thoracolumbar junction with successful placement of the instrumentation (Fig. 5). He did not have any postoperative complication. He was discharged on day 8 postoperatively without any back pain and incontinence.

Discussion

Correction of iatrogenic thoracolumbar kyphosis caused by pedicular screw loosening and non-fusion after posterior lumbar stabilization has been discussed in this paper. We are emphasizing that after a failed stabilization surgery and consequent loss of spinal instability, three column stabilization is essential.

In traumatic thoracolumbar burst fractures, either laminectomy with posterior instrumentation or anterior corpectomy with cage instrumentation is recommended. A prospective study held in 43 patients showed that even though patient outcomes are similar in both techniques, anterior approach presents less complications and require fewer additional surgeries [5]. Moreover, Been et al. stated that spinal canal decompression may be better accomplished via anterior approach [6]. However; in our case, laminectomy combined with posterior segmental instrumentation was selected in first admission. After this surgery, adequate decompression of the spinal cord and optimal stabilization of the spine was achieved (Fig. 1). Authors of this paper believe that in emergency circumstances where the patient has neurological deficit, posterior instrumentation maintains a quicker decompression of the canal and lessens the risk of bleeding more than anterior decompression.

Loosened pedicle screws in uppermost segment of instrumentation caused kyphosis and instability of the vertebral column, 4 months later. Multiple risk factors have been defined for screw loosening such as excessive loading, inadequate anterior support, deep implant related infection and osteopenia [7]. A revision surgery was inevitable for this patient. There were two alternatives; augmentation of the posterior system with only posterior midline approach or a combined anterior and posterior instrumentation. The reason for not choosing the former was to avoid further restriction of motility of the spine. Moreover, long term viability of this technique is questionable [8]. Therefore, a combined anterior instrumentation with corpectomy and posterior instrumentation revision with shorter augmentation was preferred.

Zhao et al. discussed 26 patients who underwent anterior corpectomy after compromised posterior stabilization that had been performed after traumatic fractures. In their case series; despite misalignment of the system, they did not enroll in further posterior intervention [9]. This might seem feasible since it may reduce the duration of operation and lessen the postoperative complications, however, in the patient that we are representing, revision of the posterior instrumentation was mandatory due to pull out and loosening of screws.

Additionally, we achieved anterior corpectomy for L1 vertebra with extrapleural retroperitoneal approach via mini-open incision. Wide incisions may predispose significant postoperative pain, especially intercostal neuralgia, excessive blood loss, damage to abdominal wall and pulmonary complications [8,10]. Mini-open incision is defined at a length range between 4 and 12 cm. This incision is commonly used together with Syntax retractor or in thoracoscopic and laparoscopic spinal interventions [10]. Moreover, for most of the spine surgeons, division of diaphragm is considered to be essential in order to reach the retroperitoneal space [11]. In the case that we have described, muscle sparing thoracotomy (MST) has been intervened through a 7-cm skin incision and diaphragm was only bluntly dissected from the thoracic wall. As MST is well known to reduce postoperative pain and complications with preservation of pulmonary function; our case may be illustrative on showing that lumbar corpectomy and instrumentation may be accomplished with a less invasive approach [12].

Conclusion

In thoracolumbar burst fractures, development of kyphosis due to loosening of pedicular screws is a possible complication. For management of these patients, a combined anterior and posterior approach is an option. Whilst revision and augmentation of the posterior screw-rod fixation system may seem feasible, it severely restricts range of motion. Mini-open anterior approach with muscle sparing thoracotomy and revision of posterior system may be an alternative treatment to achieve stability and fusion with less restricted mobility.

Acknowledgements

None. Nothing to declare.

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