Clinical Article

Online ISSN : 2314-8969
Print ISSN: 2314-8950

Egy Spine J 27:6-15, 2018

www.esa.org.eg

THORACOSCOPICALLY ASSISTED VERTEBRAL RECONSTRUCTION SIMULTANEOUSLY WITH PERCUTANEOUS PEDICLE SCREWS FIXATION FOR MANAGEMENT OF THORACIC AND THORACOLUMBAR SPINAL FRACTURES.

Thoracoscopically Assisted Vertebral Reconstruction Simultaneously with Percutaneous Pedicle Screws Fixation for Management of Thoracic and Thoracolumbar Spinal Fractures.

Mohamed Shater MD, Ali Abou-Madawi MD, Hassan Alshatoury MD, Khaled Elsayed MD, Mootaz Shousha, MD*.

*Neurosurgery Department, Suez Canal University, Ismailia, Egypt, Department of Spinal Surgery, Zentralklinik Bad Berka, Bad Berka, Germany.**

Submitted: April 1st, 2018
Accepted: June 28th, 2018

Abstract

Background Data: Thoracic and thoracolumbar fractures are commonly provoked by axial compression which disrupts the anterior column. In this setting, posterior stabilization using pedicle screws alone may lead to delayed kyphosis and hardware failure due to inadequate anterior column support. Application of thoracoscopic anterior column reconstruction while patient in prone position for posterior percutaneous instrumentation is a minimally invasive combined technique.

Purpose: To evaluate the outcome of percutaneous pedicle screw instrumentation in combination with thoracoscopically assisted vertebral reconstruction using expandable titanium cage.

Study Design: Prospective clinical case study.

Patients and Methods: Eighteen patients with acute thoracolumbar fractures with different preoperative neurological status were recruited for this study. Patients were treated using a short segment percutaneous screw fixation construct combined with thoracoscopic corpectomy and insertion of expandable cage. Patients were followed for at least 6 months. Visual analogue scale (VAS), Oswestry disability index (ODI) and local kyphotic angle were recorded prospectively and compared to preoperative parameters. Intraoperative data including operative time, blood loss and perioperative complication was documented.

Results: Patients were operated within 7 days after trauma using combined anterior and posterior stabilization technique. Mean operative time was 213±42 min (Range, 170-300). The mean blood loss was 225±79 ml (Range, 100-350). The mean VAS score improved significantly after surgery. The mean of ODI preoperatively was 74±6.9 preoperatively and improved after 6 months to become 17.5±14.6. The mean regional kyphotic angle was 22.6±6.82^{o} preoperatively,

improved to 6.9±4.1° postoperatively and at final follow-up it became 8.67±4.8°. No patient had neurological deterioration or hardware failure during ≥6 months of follow up.

Conclusion: our data suggest that thoracoscopic anterior reconstruction and decompression augmented with posterior percutaneous in prone position yield good clinical and radiological results with minimal complications in thoracolumbar trauma. (2018ESJ158)

Keywords: Burst fractures; Thoracolumbar; Kyphosis; Expandable cage; Thoracoscopic spinal surgery; percutaneous spinal fixation

Introduction

Thoracolumbar fractures are common in clinical practice, with an estimated prevalence of 1% among young adults. The mechanism of trauma affects the type of fracture and the resultant instability. If axial compression is the main force implied, about 80-85% of this force is transmitted via the anterior vertebral column.[1] The consequence is isolated failure of the anterior column, loss of integrity of the vertebral endplates and vertebral body compression leaving the posterior column intact. Failure of anterior column is one of the indications to consider surgical reconstruction to avoid the spinal instability and its sequalae.[12]

Surgical treatment of thoracolumbar fractures aims at preservation of the physiologic balanced form of the spine through maintenance of the integrity of the spinal functional units, preservation of free motion segments as possible, and restoration of the vertebral alignment. This can provide initial stability, allows early mobilization and prevents future painful deformity or worsening of the neurologic functions.[17] Traditional pedicle screw instrumentation remains the most utilized surgical treatment for thoracolumbar. Although this method is safe and simple, many concerns exist over its efficacy if there is anterior column insufficiency.[3,24] In this setting, the stress concentrated at the pedicle screws leads to a high incidence of instrumentation failure (loosening, breakage), nonunion of the fracture, and progressive loss of the achieved kyphosis reduction.[18] Therefore, additional load-sharing through anterior column reconstruction should be added.[20]

It is accepted that the neural tissue should be decompressed at the side of compression if there is need to decompress the spinal cord or cauda equine in addition to spinal fusion.[35] The anterior approach allows clear visualization of the ventral part of thecal sac and remains the most practical approach for achieving a ventral decompression. Indications for anterior surgery currently include retro-pulsed fragments occupying more than two thirds of the spinal canal area, massive comminution of the vertebral body with a kyphotic deformity more than 30° and surgical intervention delay more than 4 days.[23] Symptomatic traumatic disc herniation causing compression of the spinal cord or nerve roots should be managed using ventral approach also.[34] The ventral approach and interbody fusion is indicated in patients of intervertebral disk injury with suspected progressive kyphosis due to disc degeneration.[16]

Minimally invasive techniques are becoming more popular in the surgical subspecialties. Standard open surgical procedures are being modified to become less invasive, with the intention of reducing recovery time, and morbidity. Improvements in technology have allowed the surgeon to enter body cavities and create potential spaces such as the retroperitoneum by diaphragm splitting. Improved fiber optics, light sources, and use of 30° angled optic cameras have resulted in improved visualization of the structures surrounding the spine. Minimally invasive thoracoscopic technique provides the advantages of anterior decompression and anterior column reconstruction with minimal approach related morbidity.[22]

The traditional method for open dorsal instrumentation of the thoracolumbar spine requires extensive muscles dissection resulting in denervation of paravertebral muscles .In addition to muscle and soft tissue ischemia may be causes of reported patients of failed back syndrome after surgical fracture stabilization.[10,32] it was reported that muscle retraction during surgery results in time-dependent muscular histological damage due to increased intramuscular pressure.[13] Furthermore, conventional approach to the spine is related

with blood loss, higher risk of wound infection and prolonged hospitalization in comparison to minimally invasive techniques.[27] The combination of two minimal invasive surgical techniques provides the advantages of minimally invasive surgery and avoiding the morbidities associated with open approaches.[31]

The purpose of the present study was the clinical and radiological evaluation of acute thoracic and thoracolumbar fractures after stabilization utilizing short segment percutaneous pedicle screw construct reinforced with expandable titanium cage inserted through thoracoscopic anterior approach.

Patients and Methods

This prospective follow-up study was conducted in the period from January 2016 to January 2018. The study included 18 patients (11 males and 7 females), with an average age of 40.16±15.72 years (Range, 22-70). Patients with traumatic thoracic and thoracolumbar unstable (AO Classification ≥A3) fractures between T7-L1 were included regardless the morphological type of the fracture and the patient preoperative neurological status. Patients with lung adhesions and patients cannot tolerate general anesthesia or possible selective intubation (prior tracheostomy, tracheobronchial neoplasm or congenital stenosis) were excluded.

Patients were assessed for preoperative and post-operative pain using Visual Analogue Scale (VAS).[14] The preoperative and postoperative functional status were assessed according to Oswestry Disability Index (ODI)[11] after completing the questionnaire the disability was classified into minimal disability: ODI=0-20%, moderate disability: ODI=21%-40%, severe disability: ODI= 41%-60%, crippled: ODI=61%-80% and ODI=81%-100% means that these patients are either bed-bound or exaggerating their symptoms. Neurological status was classified according to Frankel grading system.[19] All these clinical parameters were documented preoperatively, before discharge, 3 months postoperatively and 6 months postoperatively.

Radiological evaluation including plain radiographs, CT and MRI and for post-operative follow up we used the postoperative radiographs to judge on correction of regional kyphotic angles, and any hardware failure. Intraoperative data were collected including the operative time, blood loss and intraoperative complications.

Differences in clinical and radiographic data preoperatively, post-operatively, and at final follow-up visit were tested using *t*-test for differences between means. The difference was significant if $P<0.05$.

Surgical Technique:

Patients were operated under general anesthesia in prone position over a spinal frame and a radiolucent operating table. Sterilization were done in a manner including the anterior axillary line and iliac crest in the sterile area on the side where the approach was done. Fluoroscopic views were taken in AP and lateral projections to define the pedicles and vertebral bodies clearly. We started with inserting the percutaneous screws fixation. Pedicle screws were inserted under the guidance of two image intensifiers taking anteroposterior and lateral views. A vertebroplasty needles were inserted bilaterally through the pedicles of the targeted vertebrae percutaneously using techniques in the same way we use during vertebroplasty and kyphoplasty procedures. The starting entry point is at 3 O`clock in left pedicle and 9 O`clock in case of Rt pedicle. Once the tip of the needle has been reached the anteromedial portion of the vertebral body, the stylet of the needle is removed and a guidewire was inserted instead. After completing needles insertion, the rest of the procedure is continued under control of fluoroscopy in the lateral view only. Once the guidewire was inserted, the needle is removed, and skin incision is done of 0.5 cm length. Following the guidewire, the pedicles were tapped using cannulated instruments. The cannulated polyaxial screw (Expedium-LISS ®) is then inserted. After insertion of all screws, the position of them is checked using the fluoroscopy in both anteroposterior and lateral views. The guidewire removed. Short screws were used in some patients for fractured vertebra.

Thoracoscopic Approach:

While the patient still on prone position. Left sided approach was selected in pathologies lower than T8 level while right approach was selected in higher levels. The thoracoscopic surgical technique

included two incisions: the first one is the working channel which is almost one-inch length in the mid-axillary line and the second is about 0.5 inch in the posterior axillary line for the thoracoscopy optic. The incision started bluntly till opening of the pleura underneath the intercostal space and localization of lung to minimize the lung injury. The prone position offered the use of ordinary (single lumen) endotracheal tube without need to use the single lung ventilation. The targeted level is localized using the fluoroscopy guidance. The pre-vertebral parietal pleura is incised vertically using scalpel then and pealed using blunt dissection. In some patients of thoracolumbar junction, we needed to disinsert the vertebral attachment of the diaphragm caudally using Cobb dissector.

Corpectomy:

The segmental vessels in the middle of the vertebral body were identified, ligated and then cut to avoid intraoperative bleeding. Discectomy for the disc above and below the fractured vertebra were done. Preparation of fusion surface was done by scrapping the endplates. The fractured vertebra was removed using osteotomes and bone rongeur. The posterior longitudinal ligament was opened and using 30° to be sure about the neural tissue and spinal canal decompression. Epidural bleeding, which usually happened as in open technique, follows the direction of gravity. In prone position, bleeding goes away from the area of cord decompression and needs minimal suction. Anterior column reconstruction was performed using titanium cage (mediExpand®) filled with bone fragments collected from corpectomy. At the end of procedure, the thoracic cavity was inspected, and an intercostal tube is inserted. The posterior instrumentation is then completed.

The procedure was carried out after arrangement with cardiothoracic surgeon to be in call for urgent thoracotomy in patient patient was indicated for urgent thoracotomy.

Results

The total number of patients recruited for this study was 18 patients with mean age of 40.16±15.72 years (Range, 22-70). There was male predominance where male patients represent 11 patients (61%) while females were 7 (39%). Most patients were smoker 14 (78%). Regarding the preoperative presentations we found that all patients suffered from low back pain, 4 patients (22%) suffered from radicular pain. Neurological status preoperatively; 12 (67%) were classified as grade E (neurologically intact), 3 patients (16.5%) were classified as grade C, and 3 patients (16.5%) were classified as grade A. (Table 1) 76 % of our patients were in the thoracolumbar area between T11 and L1 and the remaining patients were between T7 and T10. (Figure 1) We found that 10 patients belong to A3 according to AO Classifications, 7 patients were A4, and one patient was B1 (Figure 2). Surgical procedures; 83% of trauma patients were subjected to corpectomy while 17 % of patients were subjected to discectomy and interbody fusion based on surgeon judgment. Harvesting of iliac bone graft was done in 3 patients (17%) while the remaining majority used the bone collected from corpectomy. We operated through the Left side in 16 patients (89%), while in 2 patients (11%) we used the Right sided thoracoscopic approach.

Reported operative data showed that the mean operative time for thoracoscopic procedure was 131±18.2 min (Range, 100-150). In posterior instrumentation the reported mean time was 82±30.2 min (Range, 50-150) min total operative time was 213±42 min (Range, 170-300) min the mean blood loss was 225±79 ml (Range, 100-350). Assessment of neurological improvement after 6 months showed that the neurological status in 15 patients (83.5%) were classified as grade E, 1 patient was grade C (5.5%), 1 patient (5.5%) was grade B, and one patient (5.5%) persisted at grade A. (Table 1)

The mean of ODI preoperatively was 74±6.9 and improved before discharge to 47±18.4, at 3 months the average ODI became 28±16.9, while at 6 months the average ODI was 17.5±14.6 ($P<0.001$). There was statistically significant difference between the ODI preoperative, post-operative, after months and after 6 months. (Table 1) The mean of VAS preoperatively was 7.5±0.9. Before discharging it became 5±0.8 then at 3 months follow up the mean VAS became 2.38±0.78 and at 6 months follow up the VAS average became 1.83±1 ($P<0.001$). This showed statistically

significant differences between the preoperative VAS in comparison to post-operative VAS.

The mean regional kyphotic angle was 22.6±6.82° preoperatively, which improved in post-operative images to be 6.9±4.1° and at 6 months the mean Cobb angle was 8.67±4.8° (P< 0.01). Comparing the kyphotic angle preoperatively and Cobb angle postoperatively, and 6 months showed statistically significant difference in the kyphotic angle correction.

Reported complications in this study can be considered as minor complications. 14 patients have no complication while 4 patients suffered from transient complications which lasted less than 4 weeks. Reported complications were superficial wound infection (2 patients), and transient intercostal neuralgia (2 patients). There were minor pulmonary complications in form of pneumonia (2 patients) and lung contusions were reported in one patient diagnosed intraoperatively, no major organ injury, spinal cord injury or added neurological deficit. No patient had a redo surgery in follow up period of 6 months.

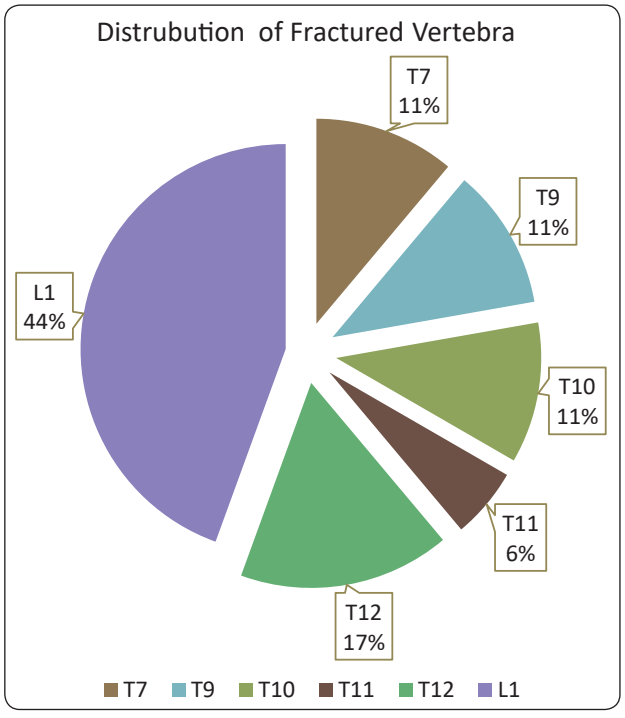

Figure 1. Distribution of the fractured vertebra level in patient operated for fracture in this study.

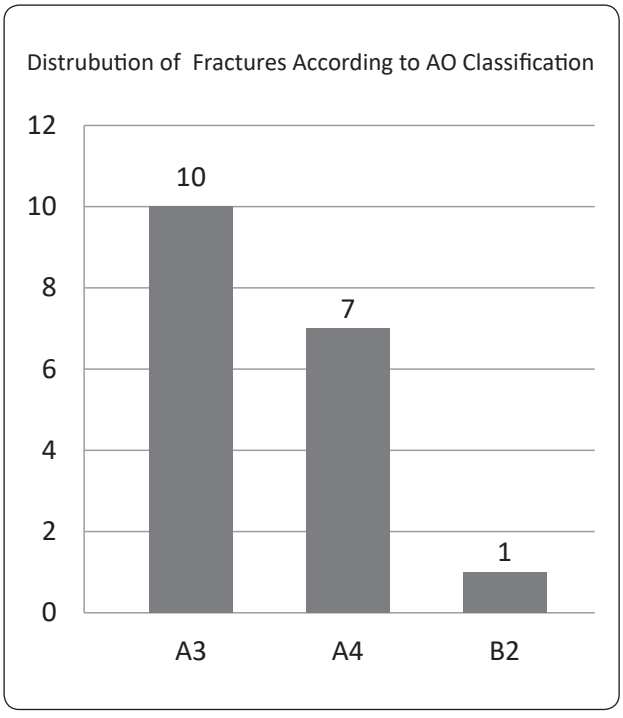

Figure 2. Morphological classification of the thoracolumbar fracture according to AO classification of thoracolumbar fractures.

Table 1. Preoperative and Postoperative Neurological Status

Frankel Grade	Preoperative	Immediate Postoperative	3 months Postoperative	6 months Postoperative
E	12 (67%)	12 (67%)	12(67%)	15 (83.5%)
D	0 (0%)	0 (0%)	3 (16.5%)	0 (0%)
C	3 (16.5%)	3 (16.5%)	0 (0%)	1 (5.5%)
B	0 (0%)	0 (0%)	2 (11%)	1 (5.5%)
A	3 (16.5%)	3 (16.5%)	1(5.5%)	1(5.5%)

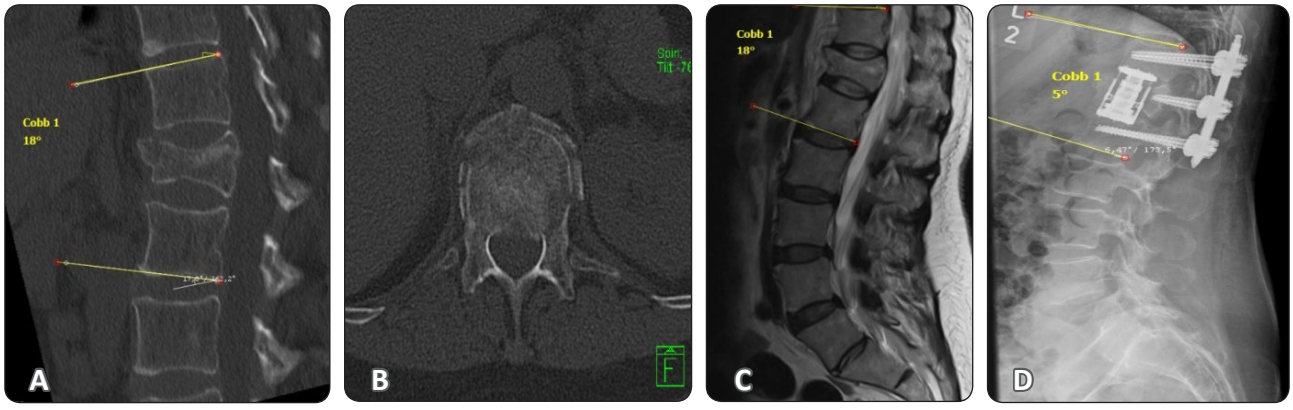

Figure 3. A 55 years old male patient not known to have any chronic illness presented with 12 thoracic compression fracture. (A,B,C) showing preoperative CT and pre-operative MRI. Patient was operated for thoracoscopic corpectomy T 12 and percutaneous short segment fixation using short pedicles screws for the fractured vertebra. Cobb angle corrected from 18 preoperatively to be 5 degrees postoperatively. Patient neurological status was intact preoperatively without any deterioration postoperatively. (D) Shows x-ray post operatively and kyphotic Cobb angle postoperatively.

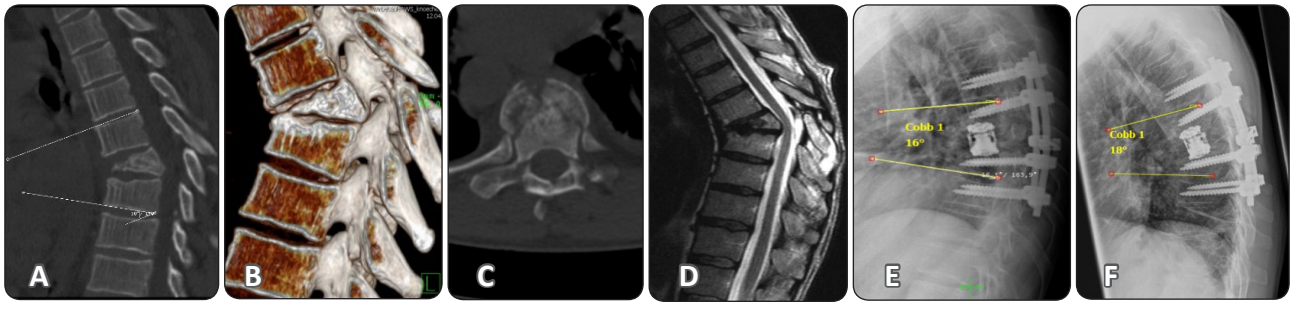

Figure 4. Female 65 years old patient known to have diabetes mellitus presented with T8 burst osteoporotic fracture after fall. She presented with incomplete spinal cord injury on Frankel Grade she was Grade C. She was suffering of severe Back pain. (A,B,C) showing preoperative CT images. (D) Showing the T2 Weighted images sagittal view with cord compression. Preoperative kyphotic angle was 33 degrees. The patient was operated for corpectomy using thoracoscopy technique. (E) Patient after surgery Cobb angle was corrected to be 16 degree on XR. No intraoperative complications reported. After 6 months the patient regained her normal neurological state and on Frankel grade she became grade E. (F) Cobb angle became 18 degree and accepted fusion was reported. Visual analogue score on last follow up was 2 and ODI improved from 65 to be 20 at final follow up.

Discussion

Thoracolumbar region is the most common site of spinal fractures and then the lumbar region.[28] Thoracolumbar fracture can lead to spine instability and potential neurologic deficits. Furthermore, the collapse of the vertebral body can result, at long follow-up, in a major kyphotic deformity.[16] This kyphotic deformity can therefore be responsible for development of posttraumatic chronic back pain syndrome. According to these risks, a surgical treatment of these fractures can be advocated in order to restore vertebral body height, correct the kyphotic deformity, and if necessary decompress the neurologic elements.[15]

The first use of thoracoscopy for the treatment of spinal disease was reported simultaneously in 1993 by Mack et al,[22] in Germany and Rosenthal et al,[29] in the United States. Thoracoscopic spine surgery initially applied to treat vertebral body disease to obtain a tumor biopsy sample. Later, more complex procedures were performed. In 1993 Mack et al,[22] reported on 10 patients in whom VATS was used for various therapeutic procedures anterior release for scoliosis, discectomy, vertebral body biopsy

sampling, drainage of a disc space abscess, and anterior interbody fusion.

Thoracoscopy differs from other approaches like thoracotomy and costotransversectomy. It has several advantages like less muscular injury, minimal rib retraction, and minimal rib resection). Complex spine procedures like spinal cord decompression, reconstruction, and instrumentation can be achieved using thoracoscopy. Unlike posterior approaches, thoracoscopy provides a direct and complete view of the entire ventral surface of the thecal sac and dura.[7] Successful thoracoscopic spinal surgery needs a lot of new skills, and perceptions of the endoscopic anatomy that differs from open surgery. Long instruments use through narrow ports at the chest wall is a challenging procedure which requires long and steep learning curve. The anterolateral thoracoscopic spinal fusion of the thoracolumbar spine can be considered as a relatively new treatment strategy for unstable fractures of the thoracolumbar spine.[4,9,26]

In the early era of thoracoscopic spinal surgery, the lateral decubitus position has been preferred for doing video-assisted thoracoscopic approaches. but there is a lot of advantages that appeared in doing the thoracoscopic spinal surgery in the prone position which attracted a group of spine surgeons to do the thoracoscopic approach in the prone position.[19,21,31] The prone position facilitates correction of associated kyphosis simply due to body weight and avoid any coronal imbalance due which may result in lateral decubitus. The prone position provides easier surgical approach as it allows the great vessels to fall forward with gravity, providing a corridor in the areolar tissue between the great vessels and the anterior longitudinal ligament. It is supposed that the risk of vascular injuries might be minimized. In the prone position, the blood and debris fall anteriorly following the gravity away from the surgical field, this saves the time required for repeated suction and clearing the operative field near the cord. Theoretically, the lateral decubitus provide time saving in patient of vascular injury as open thoracotomy can be started immediately to control bleeding without the need to re-position and re-sterilize the patient. In prone position the surgeon can do the surgery while he is sitting.

In this study we reported significant improvement of both ODI and regional kyphotic angle. The functional outcome is a very important parameter in evaluating the efficacy of spinal surgical procedure. The target of the spinal surgery is to eliminate pain and restore the normal daily life activities for the patients. The correlation between the functional out come and the radiological correction was assessed in previous studies. There is a controversy regarding the correlation between functional outcome and sagittal balance malalignment. Some authors[8] reported significant correlation, others[36] did not find significant correlation.

In our combined simultaneous technique, we found significant reduction of the regional kyphotic deformity the correction average was about 14 degree and loss of correction after 6 months about 2 degrees. These accepted radiological results were similar to other studies evaluated the role of thoracoscopy in management of thoracolumbar fracture. Shawky and his colleagues,[31] in their prospective study they investigated 26 trauma patients operated by combined approach using percutaneous screws fixation and thoracoscopic reconstruction in the same session while patient in prone position. They found the kyphotic angle 25.5810.98° preoperatively, post operatively 9.1910.63° and after 2 years 14.8810.43°.

Reinhold et al,[28] in a prospective multicenter study found that surgical intervention for management of thoracolumbar burst fracture provide early return to work in comparison to patient managed conservatively. They also found that average gain of correction, which persisted for 15 months, was significantly higher in the operatively treated group. They also found that the correction loss is related to the methods used to replace the corpectomy, they found a higher loss of correction in patients managed by iliac bone crest insertion for fusion instead of cage insertion. There was radiological improvement by implanting cages instead. In addition to this, the surgical approach to the iliac crest is associated with postoperative complications as persisting long-term graft donor site pain.

There is a controversy about the efficacy of combined anterior and posterior reconstruction surgery when was compared with standalone

approach in treating the kyphotic deformity. The clinical outcome and its relation to the nature of procedure done whether anterior alone approach or combined approaches still unclear. Although some authors[5,28,30] reported higher reduction of the posttraumatic kyphotic deformity could be achieved by using combined dorso-ventral strategy, others[6] reported no statistically significant differences in kyphotic angle correction after single strategy in comparison to combined dorso-ventral stabilization.

Uchida et al,[33] found in their study in 2006 that transpedicular posterior instrumentation can achieve a good reduction of the deformity. However, it has been concluded that in patient of important bone defect, long-term spinal stability is not guaranteed and a loss of correction up to 10° can occur using posterior instrumentation alone. It has also been demonstrated that satisfactory kyphotic deformity reduction can be obtained using percutaneous approach.[31]

Pesenti et al,[25] discussed the regional kyphotic correction in their retrospective study for evaluation of combined minimally invasive two staged surgery using ventrodorsal approach in management of thoracolumbar fractures in 34 patients. The average gain of correction of kyphosis was 9° after the posterior instrumentation. Further correction of the kyphotic deformity after the anterior approach was also significant for the regional kyphosis (average gain of 3°). At one-year follow-up there was no significant loss of reduction compared to the immediate postoperative evaluation average loss of correction 1° for regional kyphosis. According to the results of Pesenti et al,[25] regional and vertebral kyphosis was still significantly improved after the anterior approach even if the amplitude of correction was smaller than that after the posterior fixation. This difference can be explained by the distraction effect of the telescopic vertebral body prosthesis. However, they concluded that the clinical impact of this further reduction of the deformity is rather small when compared to the posterior correction. Nevertheless, at one-year follow up, no significant loss of reduction was visible on CT-scan measurements. These results confirm the interest of anterior approach not to improve the deformity reduction obtained by the posterior instrumentation, but in order to obtain a solid and stable time construct.

Conclusion

The results of present study showed that using the thoracoscopic spinal surgery can help in doing anterior vertebral segment reconstruction and spinal canal decompression simultaneously with posterior percutaneous spinal fixation while patient in prone position for management of thoracic and thoracolumbar yield a good clinical and radiological results with minimal complications.

References

1. Alpantaki K, Bano A, Pasku D, Mavrogenis A, Papagelopoulos P, Sapkas G, et al: Thoracolumbar burst fractures: a systematic review of management. Orthopedics 33:422-429, 2010
2. American Spinal Injury Association: International Standards for Neurological Classifications of Spinal Cord Injury. revised ed., Chicago, Ill:1-23, 2000
3. Azam MQ, Sadat-Ali M: The concept of evolution of thoracolumbar fracture classifications helps in surgical decisions. Asian Spine J 9:984-994, 2015
4. Beisse R, Potulski M, Beger J, Buhren V: Development and clinical application of a thoracoscopy implantable plate frame for treatment of thoracolumbar fractures and instabilities. Der Orthopade 31(4):413–422, 2002
5. Bence T, Schreiber U, Grupp T, Steinhauser E, Mittelmeieret W: Two column lesions in the thoracolumbar junction: anterior, posterior or combined approach? A comparative biomechanical in vitro investigation. Eur Spine J 16(6):813–820, 2007
6. Danisa O, Shaffrey C, Jane J, Whitehill R, Wang G, Szabo T, et al: Surgical approaches for the correction of unstable thoracolumbar burst fractures: a retrospective analysis of treatment outcomes. J Neurosurg 83(6):977–983, 1995
7. Dickmann C, Rosenthal D, Perin N: Thoracoscopic spine surgery, general principles of thoracoscopy. Thieme, New York 7–18, 1999

8. Domenicucci M, Preite R, Ramieri A, Ciappetta P, Delfini R, Romanini L: Thoracolumbar fractures without neurosurgical involvement: surgical or conservative treatment? J Neurosurg Sci 40(1):1–10, 1996
9. Elkosha H, Elsaghir H, Ezz Edeen A, Nabil M, Ebrahim M: Thoracoscopic anterior reconstruction cmbined with posterior pedicle screw-based fixation in management of thoracolumbar junction fractures. Egyptian Spine Journal 1:20-28, 2012
10. Elmeshtawy M, Hassan Kh: Safety and efficacy of percutaneous non-cannulated transpedicular screws fixation (TPSF) in the management of thoracolumbar fractures. Egyptian Spine Journal 7:5-12, 2013
11. Fairbank J, Pynsent P: The Oswestry Disability lndex. Spine 15:2940-2952, 2000
12. Fields AJ, Lee GL, Keaveny TM: Mechanisms of initial endplate failure in the human vertebral body. J Biomech 43(16):3126-3131, 2010
13. Gejo R, Matsui H, Kawaguchi Y, Ishihara H, Tsuji H: Serial changes in trunk muscle performance after posterior lumbar surgery. Spine 24(10):1023–1028, 1999
14. Gillian A, Samra M, Tetyana K, Melissa F: Measures of Adult Pain. Arthritis Care & Research 63:S240-S252, 2011
15. Hempfing A, Zenner J, Ferraris L: Restoration of sagittal balance in treatment of thoracic and lumbar vertebral fractures. Orthopade 40(8):690–702, 2011
16. Heyde C, Tschoeke S, Hellmuth M, Hostmann A, Ertel W, Oberholzer A: Trauma induces apoptosis in human thoracolumbar intervertebral discs. BMC Clinical Pathology 6(5):1-9, 2006
17. Jacobs R, Casey M: Surgical management of thoracolumbar spinal injuries: general principles and controversial considerations. Clin Orthop 189:22-35, 1984
18. Jeon C, Lee Y, Youn S, Lee H, Chung N: Factors affecting postural reduction in posterior surgery for thoracolumbar burst fracture. J Spinal Disord Tech 28:225-230, 2015
19. King A, Mills T, Loe W, Chutkan N, Revels T: Video-assisted thoracoscopic surgery in the prone position. Spine 18:2403–2406, 2000
20. Ko S, Lee S: Result of posterior instrumentation without fusion in the management of thoracolumbar and lumbar unstable burst fracture. J Spinal Disord Tech 27:189-195, 2014
21. Lieberman I, Salo P, Orr D, Kraetschmer B: Prone position endoscopic trans-thoracic release simultaneous with posterior instrumentation for spinal deformity. Spine 25:2251-2257, 2000
22. Mack M, Regan J, McAfee P, Picetti G, Ben-Yishay A, Acuff T: Video-assisted thoracic surgery for the anterior approach to the thoracic spine. Ann Thorac Surg 59:1100-1106, 1995
23. McCullen G, Vaccaro A, Garfin S: Thoracic and lumbar trauma: rationale for selecting the appropriate fusion technique. Orthop Clin North Am 29:813–828, 1998
24. McLain R, Sparling E, Benson D: Early failure of short-segment pedicle instrumentation for thoracolumbar fractures: A preliminary report. J Bone Joint Surg Am 75:162-167, 1993
25. Pesenti S, Graillon T, Mansouri N, Rakotozanani P, Blondel B, Fuentes S: Minimal Invasive Circumferential Management of Thoracolumbar Spine Fractures. BioMed Research International Volume. Article ID 639542:1-6 ,2015
26. Potulski M, Beisse R, Buhren V: Thoracoscopy-guided management of the “anterior column”. methods and results. Der Orthopade 28(8):723–730, 1999
27. Rechtine G, Bono P, Cahill D, Bolesta M, Chrin A:Postoperative wound infection after instrumentation of thoracic and lumbar fractures J Orthop Trauma 15:566–569 ,2001
28. Reinhold M, Knop C, Beisse R, Audigé L, Kandziora F, Pizanis A, et al: Operative treatment of traumatic fractures of the thoracic and lumbar spinal column: part III: follow up data. Der Unfallchirurg 112(3):294–316, 2009
29. Rosenthal D, Rosenthal R, Simone A: Removal of a protruded thoracic disc using microsurgical endoscopy. A new technique. Spine (Phila Pa 1976) 19(9):1087-1091, 1994
30. Sasso R, Best N, Reilly T, McGuire R: Anterioronly stabilization of three-column thoracolumbar injuries. J Spinal Disor’Gd Tech 18: S7–S14, 2005
31. Shawky A, El-Meshtawy M, Al-Sabrout A, Hassan K, Boehm H: Thoracoscopically assisted corpectomy and percutaneous transpedicular

instrumentation in management of burst thoracic and thoracolumbar fractures. European Spine Journal 22:11–18, 2013

32. Sihvonen T, Herno A, Paljdrvi L, Airaksinen O, Partanen J, Tapaninaho A: Local denervation atrophy of paraspinal muscles in postoperative failed back syndrome. Spine 18(5):575–581, 1993
33. Uchida K, Kobayashi S, Matsuzaki M, Nakajima H, Shimada S, Yayama T: Anterior versus posterior surgery for osteoporotic vertebral collapse with neurological deficit in the thoracolumbar spine. European Spine Journal 15(12):1759–1767, 2006
34. Whang P, Vaccaro A: Thoracolumbar fractures; anterior decompression and interbody fusion. J Am Acad Orthop Surg 16:424–431, 2008
35. White A, Panjabi M: Clinical Biomechanics of the Spine. Philadelphia: Lippincott 2nd ed, 1–125, 1990
36. Wood K, Buttermann G, Mehbod A, Garvey T, Jhanjee R, Sechriest V: Operative compared with nonoperative treatment of a thoracolumbar burst fracture without neurological deficit. A prospective, randomized study. J Bone Joint Surg Br 85-A (5):773–781, 2003

Address reprint request to:

Mohamed Shater, MD.
Neurosurgery Department, Faculty of Medicine, Suez Canal University, Ismailia, Egypt. - Email: mshaterneuro@gmail.com
The authors report no conflict of interest

الملخص العربي

إعادة تكوين جسم الفقرة المكسورة بواسطة المنظار الجراحي الصدري بالتزامن مع تثبيت الفقرات من الخلف بالتدخل المحدود عن طريق ثقب الجلد لعلاج كسور الفقرات الصدرية والقطنية

البيانات الخلفيه: عادة ما تحدث الكسور بالفقرات الصدرية والفقرات القطنية وقد يحتاج الى إعادة تكوين لجسم الفقرة المكسورة مع تركيب دعامة من التيتانيوم او العظام عوضا عن جسم الفقرة المكسورة وذلك لمنع زيادة زاوية الحداب ما بعد الجراحة. يعتبر استخدام المنظار الجراحي الصدري احد وسائل التدخل الجراحي المحدود لعمل إعادة تكوين جسم الفقرة وكذلك رفع أي ضغط عن النسيج العصبي.

الغرض: تقييم نتائج استخدام اجراء جراحي مركب عبارة عن تثبيت للفقرات من الخلف باستخدام التدخل المحدود عن طريق ثقب الجلد بالتزامن مع إعادة تكوين جسم الفقرة عن طريق تركيب قفص التيتانيوم قابلة للتوسيع بواسطة منظار الصدر.

تصميم الدراسة: دراسة حالة سريرية مستقبلية

المرضي و الطرق: شملت 18 مريض يعانون من كسر بإحدى الفقرات الصدرية او القطنية ام علاجهم بواسطة اجراء جراحي مركب عبارة عن تثبيت للفقرات من الخلف باستخدام التدخل المحدود عن طريق ثقب الجلد بالتزامن مع إعادة تكوين جسم الفقرة عن طريق تركيب قفص التيتانيوم قابلة للتوسيع بواسطة منظار الصدر. وتم متابعة المرضى لفترة لا تقل عن 6 أشهر مع تدوين البيانات داخل الجراحة وتشمل الوقت الجراحي وكمية الدم المفقود وملاحظة شدة الالام والأداء الوظيفي للمرضى على مقاس اوسويستري وكذلك قياس زاوية الحداب لمنطقة الفقرة المكسورة ومقارنة النتائج قبل وبعد الجراحة. كما تم تسجيل حدوث اي مضاعفات في مرحلة أثناء او ما بعد الجراحة.

النتائج: تم اجراء التدخل الجراحي المرضى في غضون 7 أيام بعد الاصابة باستخدام تقنية التثبيت الأمامي والخلفي المشترك. متوسط وقت الجراحة كان 213 ± 42 دقيقة (المدى= 170-300). كان متوسط فقدان الدم 225 ± 79 مل (المدى= 100-350). تحسن متوسط معدل مقياس شدة الالم بشكل ملحوظ بعد الجراحة. كان متوسط الاداء الوظيفي للمرضى على مقياس اوسويستري قبل الجراحة 74±6.9 قبل الجراحة وتم تحسينه بعد 6 أشهر ليصبح 17.5 ± 14.6. كانت زاوية التحدب 22,6±6.82 º قبل الجراحة ، وتحسنت إلى 6.9 ± 4.1 º بعد العمل الجراحي ، وفي المتابعة النهائية أصبحت 8.67±4.8 º. لم يكن أي مريض يعاني من تدهور عصبي حركي أو حسي ما بعد الجراحة . كما لم تسجل اي مضاعفات استدعت تدخل جراحي ثاني اثناء فترة المتابعة.

الاستنتاج: تشير نتائج الدراسة الى ان استخدام المنظار الصدري بالتزامن مع التدخل المحدود وتركيب مسامير من الخلف عن طريق ثقب الجلد هو اجراء جراحي امن وفعال في علاج كسور الفقرات الصدرية والقطنية.