Eur Spine J
DOI 10.1007/s00586-012-2568-5

OPEN OPERATING THEATRE (OOT)

Sagittal alignment correction and reconstruction of lumbar post-traumatic kyphosis via MIS lateral approach

Pedro Berjano · Marco Damilano · Claudio Lamartina

Keywords Post-traumatic kyphosis · Lumbar fracture · Imbalance · Minimally invasive surgery · Lateral access · Neuromonitoring · Blood saving

Learning targets

- To learn details on the minimally invasive surgical lateral approach to the upper lumbar spine,
- To identify a surgical strategy for anterior correction of rigid posttraumatic kyphosis,
- To describe a method for anterior column reconstruction with reduced bleeding,
- To identify a strategy to reduce the risk of bone subsidence.

Introduction

Symptomatic post-traumatic thoracolumbar kyphosis is a significant clinical problem that may require complex surgical procedures for reconstruction. Correction of the deformity requires either anterior lengthening or posterior shortening of the spine. Due to the extensive anterior approach classically required for anterior reconstruction, many surgeons tend to treat this pathology with posterior procedures. Pedicle subtraction osteotomies can be necessary to posteriorly achieve more than 20 degrees of correction. This procedure typically needs four-level fusion and causes significant blood loss (frequently more than 1000 ml). Minimally invasive anterior reconstruction with short-segment posterior percutaneous instrumentation can be an alternative that combines complete correction and primary stability while sparing motion segments.

Case description

This 64 year-old woman sustained a fall from stairs resulting in a compression fracture of her L2 vertebra. Upon hospital admittance, it was indicated surgical treatment, and the treating team planned a canal decompression and instrumented fusion. At the end of the posterior decompression, a severe blood loss was accumulated (intraoperative 5,2 g/dl of haemoglobin in blood), and considering the patient rejecting to receive any blood transfusion, the surgeon decided not to proceed with instrumentation and fusion. She was subsequently managed conservatively with an orthosis.

Watch surgery online

Electronic supplementary material The online version of this article (doi:10.1007/s00586-012-2568-5) contains supplementary material, which is available to authorized users.

P. Berjano (✉) · C. Lamartina
IRCCS Istituto Ortopedico Galeazzi, Milan, Italy
e-mail: pberjano@gmail.com

M. Damilano
Istituti Clinici Zucchi, Monza, Italy

Published online: 16 November 2012

Two years later, the patient presented to us with persistent disabling back pain rated 9/10 in a numeric rating scale, limited walking ability and difficulty for daily living activities. Plain X-rays showed a L2 compression fracture with preservation of the posterior wall height, a laminectomy at the fracture site, an angular kyphosis of 31° at L2 and 13° of scoliosis between L1 and L3 and an anterior callus bridging L1/L2 was. On long standing lateral films, the pelvic incidence was 38° and the pelvic tilt 17° (increased compared to the expected value of 7° calculated, based on the pelvic incidence value [1]).

Surgical procedure

A surgical correction was planned with an anterior partial L2 corpectomy through a mini-open direct lateral approach, anterior release, correction of kyphosis and reconstruction with an expandable titanium cage (X-Core, Nuvasive Inc, San Diego, CA, USA). This cage was selected for its design, with large endplates allowing application of load in the stronger ring apophysis of the vertebral body from lateral cortex to lateral cortex and spreading the load on a large contact area, thus reducing the risk for subsidence [2] and same day posterior percutaneous fixation from L1 to L3.

The anterior procedure was performed through a left approach with partial resection of the Xth rib, retropleural-retroperitoneal exposure of the L2 vertebra. L1-L2 and L2-L3 discs were exposed with transpsoas muscle splitting. To reduce bleeding, meticulous bipolar haemostasis was performed through the procedure; preparation of the endplates for fusion was done before corpectomy; expeditious en bloc partial corpectomy was obtained with large osteotomes.

Complete osteotomy of the anterior bone bridge and contralateral anulotomy was performed under direct visualization to allow for correction of the kyphotic deformity. Special care was observed to avoid subsidence of the endplates; a three point reduction manoeuvre, with force manually applied by an assistant on the back of the patient at the level of fracture was preferred during implantation of the expandable cage. Final adjustment of the height of the anterior column was obtained by expansion of the cage while unloading endplates with posterior force applied on the back of the patient. Morcelised bone graft (from the resected vertebral body and rib) was applied in the intervertebral gap. No thoracic drain was necessary. After the anterior reconstruction, pedicle screws were placed percutaneously at L1 and L3 and compression was applied through the vertebral fixator. Total surgical time was 210 min. Estimated blood loss was 200 ml.

Postoperative information

The patient was allowed to stand up the next day with a Jewett orthosis, which was worn for 2 months. The patient referred significant relief of pain after surgery. She left the hospital after 5 days. No blood transfusion was necessary during or after surgery.

Postoperative radiographs demonstrate a correction of the segmental kyphosis from 31° to 3°. Flexion–extension, lateral bending and torsion movements were avoided for 3 months. At this time of follow-up, the patient rates her back pain as 1/10. She stated that she would definitively recommend the procedure to other patients.

Discussion and conclusion

Posttraumatic kyphosis after thoracolumbar junction fractures can be a significant source of persisting pain and disability. In this case, surgical resection of posterior elements of stability without a fusion can have had a role in increasing the anterior collapse leading to final severe deformity. Pain in this condition can be a combination of discogenic pain at the fracture site (when spontaneous anterior fusion does not occur) and increased muscle effort to compensate for sagittal imbalance. Anterior release, vertebral body reconstruction, correction of kyphosis and fusion allows for excellent realignment and resistance to compression. Thus, posterior short segment instrumentation can be enough to grant permanent stability and correction. The stability of the construct depends strongly on the resistance to compression in the vertebral bodies. Surgical technique with careful preservation of the harder bone of the end plates and ring apophysis, indirect reduction to avoid overload of the endplates and choice of an implant with specific design to avoid subsidence (as the "side to side" plate design of the implant used in this procedure) can help obtaining complete and durable correction of kyphosis. Elimination of injured discs and complete sagittal realignment are felt to be important to get excellent clinical results. Minimally invasive approach (mini-incisional anterior reconstruction plus percutaneous posterior instrumentation) help reducing bleeding, perioperative pain and muscle denervation, and make in the authors' experience the procedure applicable also in the elderly.

Conflict of interest None.

References

1. Vialle R, Levassor N, Rillardon L et al (2005) Radiographic analysis of the sagittal alignment and balance of the spine in asymptomatic subjects. J Bone Joint Surg Am 87:260–267
2. Smith WD, Dakwar E, Le TV, Christian G, Serrano S, Uribe JS (2010) Minimally invasive surgery for traumatic spinal pathologies a mini-open, lateral approach in the thoracic and lumbar spine. Spine 35:S338–S346