Post-traumatic high thoracic angular kyphosis: posterior approach with correction and fusion in two steps

Marco Brayda-Bruno · Andrea Luca · Alessio Lovi ·
Marco Zambotti · Aldo Sinigaglia · Claudio Lamartina

Published online: 17 November 2012
© Springer-Verlag Berlin Heidelberg 2012

Keywords VCR · Angular kyphosis · Cervico-thoracic junction · Paraplegia · Wound infection · Correction of cervicothoracic kyphosis · Halo-gravity traction · Tracheostomy

Introduction

Neglected or inadequately managed fractures may lead to severe angular deformities. Where progressive over time, this may become symptomatic. Chronic pain and sometimes neurologic impairments are usually associated with kyphotic deformity of more than 30°.

Various techniques have been described to correct angular post-traumatic kyphotic deformities. Traditionally, the three-stage surgery, adopting a posterior-anterior-posterior approach, allows a good reduction of the kyphosis with a wide decompression of the cord. However, this approach reports a relatively high morbidity, due to the multistage procedure [1]. Moreover, the cervico-thoracic junction, as the anatomical site of the deformity, may present a further challenge to the anterior approach.

Of the posterior-only procedures [2], the Smith–Petersen Osteotomy (SPO) may not be suitable to correct severe kyphotic deformity, especially where there is an anterior fused mass.

The pedicle subtraction osteotomy (PSO) is generally performed in cases where there is a rigid anterior and posterior column, such as in inveterate fractures. Multiple PSO may be required to achieve an adequate correction of a severe deformity, which could dramatically increase the chance of morbidity following this procedure.

Posterior vertebral column resection (PVCR) has recently gained in popularity, as a method of treatment for post-traumatic kyphosis [3]. It is performed through a single or double posterior approach, including the complete resection of one or more vertebral segments. This technique allows both an excellent correction of the sagittal plane deformity, and an adequate canal decompression. However, consideration must be given to the high demands of this procedure, the possibility of extensive blood loss and higher risk of neurologic impairment.

Post-traumatic angular kyphosis represents a challenging pathology. The selection of the most suitable correction technique is of paramount importance to achieve a good final result. Potential risks and benefits of the procedure should be carefully evaluated.

Case description

In 2009, the patient, a 58 year-old female, had a car accident resulting in multiple rib fractures, lung contusion, and a myelic fracture of the third thoracic vertebra with complete paraplegia.

Electronic supplementary material The online version of this article (doi:10.1007/s00586-012-2567-6) contains supplementary material, which is available to authorized users.

M. Brayda-Bruno (✉) · A. Luca · A. Lovi · M. Zambotti ·
A. Sinigaglia · C. Lamartina
IRCCS Istituto Ortopedico Galeazzi, Milan, Italy
e-mail: marco.brayda@spinecaregroup.it

Watch surgery online

The vertebral fracture was treated in emergency with a posterior decompression, through a complete T3 and T4 laminectomy, and a hybrid fixation T2–T5 with hooks and screws. The neurological status of the patient remained unchanged after the procedure due to the severity of the primary trauma.

During her postoperative stay in the ICU, the patient developed a septic status with wound infection, not responsive to any antibiotic therapy. After 15 days, because of the severity of the infection, the spine surgeons decided to remove the implant and perform a debridement of the wound, which finally controlled the infection. The patient was transferred to a rehab unit with a complete paraplegia.

In 2012, the patient was first referred to us, with a severe angular cervicothoracic kyphosis of over 60°, unbearable neck and high thoracic pain. The patient was still paraplegic.

Halo-gravity traction was used for 1 month, with the patient reporting a clinical improvement. According to the surgical preoperative plan, and in consultation with the anaesthesiologist team, an elective tracheostomy was performed in order to obtain a safe airway management.

Surgical procedure

The positioning of the patient was carefully prepared and carried out, in order to obtain the best possible exposition of the cervicothoracic junction. A custom made mask was produced to allow for the halo ring.

A midline skin incision was performed, with the excision of the scar tissue. A total exposure of the posterior vertebral arches was achieved from T12 to C6. This step was meticulously carried out at the level of the previous surgery. Since a complete laminectomy had already been done, the procedure was performed without any dural lesions. Because of the scar tissue, the anatomic layers were barely detectable, resulting in constant blood loss.

Once the anatomical landmarks were properly defined, pedicle screws were positioned according to the preoperative plan, using a combination of an O-arm for the upper part, and free hand technique for the lower thoracic segment. Because of the severe kyphosis, the positioning of the screws was particularly challenging at T1 and T2. An intraoperative CT scan was then performed in order to confirm the correct positioning of the pedicle screws. After 4 h of surgery and based on the considerable blood loss and clinical condition of the patient, the surgeons decided, after the request of the anaesthesiologist, to continue the column resection in a second session. The bone, harvested during the procedure, was then packed and stored in the paravertebral space and covered by the dorsal muscles. An accurate closure of the anatomical layers was performed after positioning a sub-fascial drainage.

After 1 week in ICU, the patient was ready for the second stage of the surgery, the vertebral column resection (VCR). The patient was positioned, once again, in a prone position in Halo traction. The exposure of the bone was quick and easy. The bone harvested during the first procedure was found to be in good condition. An accurate irrigation of the tissue was consistently performed. According to the preoperative plan, two clamps in C7 and two in L1 were added to the pre-existing implant.

The next step was the bilateral costectomy at T3 and T4. The scar tissue was entirely removed, isolating the pleural sheet. The left T3 nerve root was then well recognizable and isolated the right one appeared as a fibrotic string. The T3 and T4 osteotomy was performed, achieving a good mobilization of the kyphotic spine, after which a 10 mm tantalum cage was inserted anteriorly. The correction was achieved by placing two pre-bent CoCr rods and extending the head of the patient during the manoeuvre. A compression on the posterior elements, screws and hooks, facilitated the improved correction. According to the intraoperative fluoroscopic measurements, a correction of 45° was obtained. Two cross-links were then placed. An accurate decortication of the posterior elements was then performed, inserting the bone grafts in the fusion area of cervicothoracic spine. Before the wound closure, two drainages were positioned to reduce the postoperative haematoma.

Postoperative information

The patient spent 5 days in ICU, and 2 days later she was transferred to a rehabilitation centre. At discharge, the wound closure was satisfactory, except for its proximal third, due to the position of the patient in bed. After 10 days in the rehab centre, the patient's wound was not recovering properly, thus she was readmitted to hospital. A wound revision with plastic surgeons was then performed with good clinical results.

Discussion and conclusion

PVCR represents one, and perhaps the most effective technique, to correct severe post-traumatic deformity. It is a demanding procedure with high risk of potential complications. In this case, the patient was already paraplegic due to the original cord injury, but the risk of a cranial extension of the cord injury was taken into account.

The decision to split the procedure into two steps is an important issue for discussion. The risks of infection and the overall morbidity are considered to be higher when surgery is performed in two steps. For this reason, the

procedure should be carried out in one-step whenever possible.

In this case, there were two major factors that led us to the two-stage procedure. First, a pre-operative tracheotomy was performed to meet the anaesthesiologist's needs. This procedure took about 1 ^{1/2} h, because of the kyphotic deformity of the cervico-thoracic junction. Secondly, during the procedure, massive bleeding ensued from the scar tissue.

In order to secure to the patient's safety, and in agreement with the anaesthesia care team, the surgery was divided into two steps.

Conflict of interest None.

References

1. El-Sharkawi M, Koptan WM, El-Miligui YH, Said GZ (2011) Comparison between pedicle subtraction osteotomy and anterior corpectomy and plating for correcting post-traumatic kyphosis: a multicenter study. *Eur Spine J* 20:1434–1440
2. Roussouly P, Nnadi C (2010) Sagittal plane deformity: an overview of interpretation and management. *Eur Spine J* 19: 1824–1836
3. Wang Y, Lenke LG (2011) Vertebral column decancellation for the management of sharp angular spinal deformity. *Eur Spine J* 20:1703–1710