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Correction of posttraumatic kyphosis of the thoracolumbar spine with modified pedicle subtraction osteotomy

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Klaus J. Schnake and Frank Kandziora

Keywords
Posttraumatic kyphosis · Pedicle subtraction osteotomy · Vertebral fracture · Posterior stabilization

Introduction

Posttraumatic kyphosis can cause sagittal imbalance, visible on lateral whole spine radiographs. If compensatory mechanisms fail, patients may suffer from pain and disability. Depending on the degree and location of the kyphotic segment, different surgical options are available. For treatment of thoracolumbar kyphosis, pedicle subtraction osteotomy (PSO) has shown good clinical and radiological results [1–4]. The film demonstrates a modified PSO technique for a case of posttraumatic kyphosis after L1 burst fracture [5].

Case description

The 58-year-old male patient suffered from severe back pain due to an incomplete burst fracture after a fall from stairs 9 months ago. Radiological examination revealed posttraumatic kyphosis and possible non-union at L1. The bisegmental local kyphosis was 20 degrees. Whole spine images showed an anterior imbalance (13 cm anterior to C7 plumb line). Kyphosis of the whole thoracic spine was 51 degrees. Lumbar lordosis was reduced to 28 degrees. CT scan showed on one hand bridging osteophytes and on the other hand intradiscal gas phenomena. Thus, residual non-union was suspected. Patient had no signs of neurological deficits. Preoperative planning revealed a required correction of approximately 30 degrees.

Surgical procedure

Patient is placed in prone position on an adjustable, hinged table. The surgical procedure is performed with intraoperative neuromonitoring (MEPs). After posterior midline incision the following operative steps are performed: Preparation of the spine from T11 – L3 and placing of pedicle screws (minimum 5.5 mm diameter) in T11, T12, L2 and L3. Complete laminectomy of T12 and L1 with exposure of the nerve roots. Resection of T12/L1 facet joints. Preparation of the transverse processes of L1, which are cut through. Dissection of the periosteum of the lateral vertebral body. Resection of the pedicles of L1. Wedge-shaped chiselling of the upper lateral parts of the vertebral body under protection of the neural structures. Starting from the bottom of the pedicle, the chisel is elevated towards the upper anterior endplate. Advancing the chisel up to 5 mm to the anterior cortex. Discectomy and partial corpectomy of the upper L1 body with rongeurs. Curettage of the lower endplate of T12. Finally, resection of the posterior upper wall of the L1 vertebral body. After that step, only a remaining small anterior bridge stabilizes T12 and L1. By performing posterior compression this bridge bends or breaks and correction of the kyphosis can be achieved. Compression can be performed manually by approximating the upper and lower screws, or by using the hinged operating table. After compression, bony contact between T12 endplate and L1 vertebral body should exist.

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Bended rods are fixed to the pedicle screws in order to stabilize the spine. The dural sac typically bulges after correction, but should not kink. Sufficient space should be palpable by using a nerve hook around the dural sac and the visible pairs of nerve roots. The remaining bone chips can be placed in the osteotomy gap and/or posterolateral to enhance fusion. The construct is reinforced by a cross-link. The wound is closed as usual, however, a subfascial redon drain should be placed.

Postoperative information

Patient recovered quickly and could be mobilized on first postoperative day without bracing. Physiological sagittal alignment could nearly be restored (5 cm anterior to C7 plumb line). Local kyphosis was reduced to 12 degrees of lordosis. Therefore, 32 degrees of correction had been achieved. Due to preoperative shortening of the hip flexor muscles, extensive physiotherapy was necessary to regain full hip movement and normalizing gait and standing, respectively. Radiographic controls are necessary after mobilization and after 3 and 12 months postoperatively.

Discussion and conclusion

In general, PSO is a safe and effective technique [3, 4]. However, the original technique did not include the resection of the upper disc [1, 2]. In the presented case, like in many posttraumatic cases, the upper disc was severely degenerated and showed signs of instability. Therefore, correction and solid fusion could only be achieved by modifying the PSO technique including resection of the disc [5].

Wide decompression of neural structures and intraoperative use of an image intensifier helps to avoid major complications like neural or vascular lesions. Blood loss can be extensive. In the presented case, patient was on anticoagulation medication preoperatively. Depending on the bone quality, a minimum of 4 screws on each side of the osteotomy is mandatory. In osteoporotic bone, more screws or PMMA-augmented screws should be used. The described technique is suitable for pathologies between T12 and L4. Patient should get informed, that postoperative rehabilitation is crucial to achieve a satisfying clinical outcome.

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