Minimal Invasive Transvertebral Reduction And Stabilisation Of Coronal Split Fractures

S Fürderer, C Schnurr, D König

Citation

Abstract
Introduction: The treatment of coronal split fractures Magerl type A2.2 and A2.3 is controversially discussed. Recommendations range from nonoperative treatment up to posterior-anterior fusion procedures. Method: We present two cases of A2.3 and A2.2 fractures successfully treated by using the Vertebral Body Stent System VBS (Synthes, Philadelphia, PA) with a bilateral transpedicular approach. In both cases it was possible to connect the fragments by the stents and to realigne the endplates. No intradiscal leakage appeared. Patients were mobilized the following day. After 3 months during follow up, no signs of non-union or refractures were seen. Conclusion: In carefully selected cases coronal split burst fractures of the thoracolumbar spine can be treated by minimal invasive transvertebral fixation.

INTRODUCTION
Common indications for vertebral augmentation techniques without additional instrumentation are „painful unstable compression fractures“ . Other indications are metastatic vertebral destruction, vertebral angioma, lymphoma and multiple myeloma. All of these conditions are considered as suitable for intravertebral stabilisation as long as sufficient stability can be assumed after intervention.

Therefore, limitations are posterior wall instability, severe anterior column instability and destruction of the vertebral body. For fractures classified as AO A2, there is no consensus regarding the optimal treatment so far. General recommendations suggest posterior internal fixation and/or anterior stabilization procedures. In literature there is a single report about treatment by kyphoplasty. We present the feasibility of a transvertebral reduction and stabilization procedure in such cases.

CASE PRESENTATIONS
CASE 1: CORONAL SPLIT BURST FRACTURE AO A2.3
The 82 year old lady fell down the stairs. She immediately complained about back pain during sitting and standing leading to immobilisation. X-rays taken at the day of admission already showed a fracture line through the inferior endplate of L2(Fig 1a). The MRI revealed a split burst fracture with destruction of the mid portion of the vertebral body so the fracture was to be classified as AO A2.3 according to the Magerl-classification and biconcave grade 2 in the Genant classification (Fig 1b and c).

Figure 1
Fig 1 a-c: Lateral X-ray and T1/T2 weighted MRI of patient1 with a coronal split burst fracture classified as Magerl / AO type A2.3 and Genant grade 2.

She underwent a Vertebral Body Stent procedure. During surgery special care was taken for drilling in order not to displace the anterior fragment. The stents were placed close to the anterior cortex. So it was possible to reduce the endplates and to lift the mid portion of the vertebral body (Fig 1e and f).

The patient experienced immediate pain relief and left hospital 2 days after intervention with a NRS pain scale of 2.
Figure 2
Figure 1d-g: X-rays and CT scans in coronal and sagittal reconstruction of patient 1: VBS of L1, prophylactic vertebroplasty of T12 and L2. Reduction of the endplate infraction and transvertebral stent implantation and filling. No intradiscal leakage was observed, however paravertebral leakage of T12 anterolateral.

CASE 2: CORONAL SPLIT FRACTURE AO A2.2
The 44 year old patient suffered from epileptic seizures after resection of a cerebral astrocytoma 4 years ago. Medication therefore was valproic acid. In a seizure he fell and suffered a L2 fracture with a crack irradiating into the posterior wall (Fig 2 a and b).

Figure 3
Figure 2a and b: transverse and sagittal CT scans of patient 2: Coronal split fracture with posterior wall compromise classified as AO A2.2/A3.1.1

Despite of his young age, due to his co-morbidity the patient was stabilized also by bilateral transpedicular VBS. Again the fragments were fixed by K wiring and canals were drilled up to the anterior cortex. The stents were placed in the center of the fracture line. Expanding the stent resulted in an endplate reconstruction without displacement of the anterior fragment. During filling a small leakage into the spinal canal was noted (Fig. 2d-f). The postoperative neurologic control did not show any radicular pain or neurologic dysfunction. Again no intradiscal leakage appeared. The patient left hospital with a NRS scale of 1.

Figure 4
Figure 2c-f: transverse and sagittal CT scans of patient 2 after intervention: fracture reduction and transvertebral stabilisation. Small cement leakage through the crack in the posterior wall without clinical relevance.

FOLLOW UP
Both patients were examined for follow up after 3 months. X-rays were taken in standing position.

Patient 1 complained about low back pain at the lumbosacral junction but not at L2. There was tenderness of the spinous process L5 as well as over the facet joints L4/5. Patient 2 did not complain about any pain, loss of function or other symptoms. In both patients X-ray showed a fracture consolidation without loss of reduction as well as severe facet arthritis of L4/5 and L5/S1.

Patient 1 returned 6 months after surgery due to a new fracture at L4 classified as AO A1.1. She was treated nonoperatively and 2 months later the fracture was considered as healed in the final X-ray. However she still
complains about low back pain and is treated by facet joint injections.

**DISCUSSION**

The treatment of complete split fractures is a matter of discussion. While A2.2 fractures without major destruction are considered to be suitable for conservative treatment as well as for kyphoplasty several authors indicate that A2.3 fractures should be treated by open reduction and internal fixation with or without additional transpedicular bone grafting or vertebroplasty (1,2,3). There are so far singled-out case reports in literature about the minimal invasive treatment with A2.2 fractures without detailed description of major central destruction or posterior wall fragment nor that of A2.3 fractures (4). The principle of transvertebral stabilization however appears reasonable as it allows to preserve one or two motion segments compared to internal fixation procedures. So far, it has been a problem to connect the anterior and the posterior fragment in a safe way. Transpedicular bone grafting only works as osteoconductive procedure whereas in additional vertebroplasty there is a significant risk of intradiscal leakage. On the other hand Sanasi et al. (5) report a case of delayed split fracture after a kyphoplasty procedure.

The present study demonstrates that a minimal invasive treatment of coronal split burst fractures is feasible. The reduction of the endplate might close the gaps into the disc space and prevent intradiscal leakage of the PMMA-cement.

**CONCLUSION**

Minimal invasive transvertebral stabilization seems to be an issue for the treatment of unstable coronal split fractures of the thoracolumbar spine. Further investigations have to be performed in order to confirm the first results of this case studies.

**References**

Author Information

Sebastian Fürderer, MD
Orthopaedicum Trier, Dept for Orthopaedic Surgery, Klinikum Mutterhaus der Borromäerinnen

Christoph Schnurr, MD
LVR Klinik für Orthopädie

Dietmar-Pierre König
Prof, LVR Klinik für Orthopädie