Injury, Int. J. Care Injured 43 (2012) 446–451

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Stabilization of fatigue fractures of the dorsal pelvis with a trans-sacral bar. Operative technique and outcome

Isabella Mehling [*], Martin Henry Hessmann [a], Pol Maria Rommens [a]

Centre for Musculoskeletal Surgery, Department of Trauma Surgery, University Medical Centre Johannes Gutenberg-University, Mainz, Germany

ARTICLE INFO

Article history:
Accepted 10 August 2011

Keywords:
Fatigue fractures
Pelvic ring
Sacrum
Osteoporosis
Trans-sacral bar

ABSTRACT

Introduction: Due to ageing of our population the number of fatigue fractures of the pelvic ring is steadily growing. These fractures are often treated with bed rest but may result in a disabling immobility with severe pain. An operative treatment is an option in these cases. The aim of operative treatment is bony healing obtained by stable fixation giving back to the patient's previous mobility. Optimal surgical treatment is currently under debate. Sacroiliac screw fixation and sacroplasty are used for stabilization of the dorsal pelvis. Due to the technique and the low density of spongious sacral bone, no or only low compression in the fracture site is obtained, which may inhibit bony healing. The trans-sacral bar compression osteosynthesis is presented as an alternative procedure. We present the outcome of 11 patients, who were treated with this method.

Methods: The patient is placed in prone position on the operation table. Under image intensifier control, a 5 mm threaded sacral bar is inserted through the body of S1 from the left to the right dorsal ilium. Nuts are placed over the bar achieving fracture compression. When anterior pelvic instability is present, an anterior osteosynthesis is also performed. Clinical and radiological outcome were evaluated one year after index surgery with different scoring systems.

Results: Eleven patients (9 F and 2 M) were treated between 2005 and 2010. The mean age of the patients was 73 years at time of operation. There were no mechanical complications. Postoperatively there was a temporary nerve palsy of L5 in one case. The mean follow-up was 14 months. In all patients, a bony healing of the dorsal pelvic ring was achieved. Seven patients showed a major clinical improvement, in four patients a moderate.

Conclusions: Trans-sacral bar osteosynthesis is a promising method for stabilization of fatigue fractures of the pelvic ring. Only with this method, a high interfragmentary compression is achieved, independent of the quality of the spongious bone of the sacral body.

Introduction

With an ageing population, we register a steady and rapid increase of the prevalence of osteoporotic fractures of the humeral head, the distal radius and the vertebral column. Also the number of intra- and extra-capsular hip fractures is steadily growing. To deal with these fractures, new operation techniques and adapted implants have been developed. Angular stable plates are available for proximal humerus and distal radius fractures. Cut out force of existing implants for the proximal femur is enhanced by the application of intra-bone cements in the femoral head. Kyphoplasty and vertebroplasty are frequently used for stabilization of compression fractures of the vertebral column due to osteoporosis. In the older patient group, fatigue fractures of the pelvic ring are also coming to the fore.[1,2] Most of these fractures are situated in the ventral pelvic ring. They are the result of a low energy trauma such as a simple fall at home. These fractures are usually treated by bed rest, administration of pain killers followed by mobilization with walking aids (Fig. 1).[3,4]

The number of fatigue fractures at the dorsal pelvic ring remains widely unknown. As the pelvis is a circular structure every fracture of the anterior pelvic ring must be combined with a lesion of the posterior pelvic ring. These lesions are often invisible at the primary pelvic overview.[5] If a CT scan is performed, a small crush area or an interruption of the ventral cortex at the lateral mass of

* Corresponding author at: Department of Trauma and Orthopaedic Surgery, University Medical Center of the Johannes Gutenberg-University of Mainz, Langenbeckstrasse 1, 55101 Mainz, Germany. Tel.: +49 6131 172845; fax: +49 6131 176633.
E-mail addresses: isabella.mehling@unimedizin-mainz.de, isabellamehling@web.de (I. Mehling), martin.hessmann@klinikum-fulda.de (M.H. Hessmann), pol.rommens@unimedizin-mainz.de (P.M. Rommens).
[a] Department of Trauma and Orthopaedic Surgery, University Medical Center of the Johannes Gutenberg-University of Mainz, Langenbeckstrasse 1, 55101 Mainz, Germany. Tel.: +49 6131 177292; fax: +49 6131 176633.

0020–1383/$ – see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.injury.2011.08.005

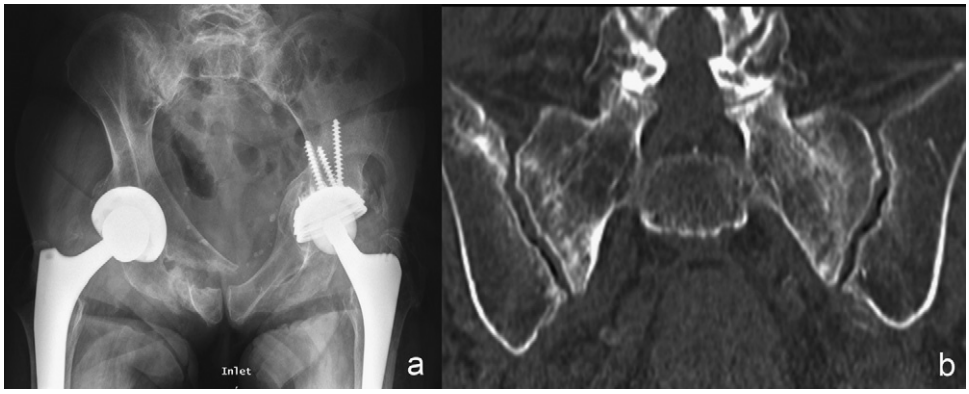

Fig. 1. 80 year old woman with fatigue fractures of the anterior and posterior pelvic ring due to recurrent falls. The fractures were treated conservatively with bed rest and pain killers. The inlet view shows the pseudarthrosis of the anterior pelvic ring (a), and the CT scan of the sacrum the conservatively treated fracture nearly healed (b).

the sacrum may be detected. The MRI scan, performed in patients with chronic pain, can show several areas of bone bruise at the sacro-iliac joint. In a smaller part of these patients, complete transforaminal or lateral fractures of the sacrum occur but remain undetected. Candidates for fatigue fractures of the dorsal pelvis are patients with chronic cortisone intake, patients who received a radiation therapy after tumour resection in the small pelvis, or patients with long-standing paraplegia. Risk factors for insufficiency fractures are severe osteoporosis, rheumatoid arthritis, for which a long-time corticosteroid therapy is given.[6]

An operative treatment is indicated in fractures with instability and persistent immobilizing pain. The aim of the operative treatment is to obtain bony healing by stable fixation giving back to the patient his previous level of activity. Optimal surgical treatment for complete transforaminal or lateral fractures of the sacrum is still under debate. As in younger patients with acute sacral fractures, sacroiliac screw fixation is used.[7] Only low compression in the fracture site is obtained due to low density of spongious bone in which the screws are inserted. The consequence may be early loosening of the screws with loss of stability of the bone-implant construct. To prevent such complication, cement augmented screw osteosynthesis has been proposed as an alternative to sacroplasty, which is the application of bone cement in the fracture gap only.[8] Sacroplasty seems to bring immediate pain relief and avoid longer immobilization, but only small case series are published until now.[9–11] We describe a case series of eleven patients with fatigue fractures of the sacrum, which have been stabilized with a transsacral bar compression osteosynthesis. We compare our results with those of Vanderschot et al. who also performed the transiliac-sacral-iliac bar procedure.[12]

Patients and methods

Operative technique

The patient is placed in prone position on the operation table. Before draping and surgery, it is made sure that anterior-posterior pelvic overview, pelvic inlet and pelvic outlet views and a lateral view of the sacrum are available as image intensification pictures of good quality. The pictures are evaluated to identify indispensable landmarks such as the sacro-iliac joints, the prominence of the sacral promontory and both neuroforamina of S1. If possible, the patient has been prepared the day before surgery with rectal washout.

The correct level for implant insertion is marked on the skin during lateral image intensifier control of the sacral body S1. Through a lateral skin incision, a 2.8 mm drill bit with soft tissue protector is inserted and pushed through the gluteal muscles towards the lateral cortex of the dorsal ilium. With a slight hammer blow, the tip of the drill is driven into the lateral cortex. The position of the drill bit is controlled under image intensification in the three views. The drill bit must be directed towards the centre of the S1 body with the largest possible distance to the promontorium, neuro-foramina, sacral canal and anterior cortex. Corrections are made until the ideal position and direction of the drill bit is achieved. Drilling is started until the tip of the bit perforates the sacro-iliac joint. The surgeon feels the perforation of the lateral wall of the sacro-iliac joint and the resistance of the medial wall. Again, position and orientation of the drill bit are controlled. Drilling is continued carefully. As the substance of spongiosa in the sacral body is not very dense and strong, no significant resistance is felt during drilling. This is dangerous as perforation is not registered as in drilling of cortical bone. For this reason, the position of the drill bit is controlled in the three views regularly. Next, the drill bit reaches the medial cortex of the second sacro-iliac joint and perforates it. The drill bit is driven through the sacro-iliac joint and the lateral cortex of the ilium. Drilling is proceeded until the tip of the drill bit is felt subcutaneously. A similar contra lateral incision is made over the drill bit and the tip is fixed with a clamp. Now, the drill bit is used as a guide. With a 4.5 mm cannulated drill, the trajectory is enlarged. Three pictures are taken in the threes views and archived. The drill bit is removed and a 5 mm bar (Synthes, Oberdorf, Switzerland) of convenient length is inserted in the power tool. The tip of the bar is locked in the cortical defect created by the previous drilling manoeuvres. Again, position and orientation of the sacral bar are controlled and compared with position and direction of the drill bit on the three images. The sacral bar is forwarded by rotational movements originated from the power tool until its tip perforates the opposite dorsal ilium and is located in the gluteal muscles. The correct final position is assumed in the pelvic overviews with the image intensifier. On each side, a washer is inserted over the sacral bar and pushed against the ilium. Nuts and counter nuts are rotated over the sacral bar until they reach the washers. Slight compression is created by tightening of the nuts. Finally, the superfluous parts of the sacral bar are cut by a side cutter on both sides. The incision are cleaned and closed layer by layer over drains (Fig. 2).

In case a ventral instability of the pelvic ring exists, the patient is turned on the operation table and a reduction and internal fixation of the ventral pelvis is done. Depending on the type of instability, the fixation may be a plate osteosynthesis or a unilateral or bilateral retrograde cannulated pubic ramus screw osteosynthesis.

After operation, the patients were allowed to mobilize with crutches, as soon as they felt able to do so.