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Successful treatment of a patient with multiple trauma including dislocated sacral fracture complicated with caudopathy

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Abstract

Introduction Combined injury, as a cause of death, occupies a central place in different age groups and is common for individuals ages 50 and younger. Most sacral fractures are traditionally repaired with screw or plate. However, the fixation can be unreliable in atypical anatomy of the upper sacral segment, U-shaped and H-shaped fractures, compression of nerve structures and failed fixation. **Material and methods** Reported is a case of a 29-year-old patient who suffered a severe concomitant injury including comminuted fracture-dislocation of the sacrum complicated by caudopathy. **Results** A good clinical and anatomical result was obtained. She developed a complete regression of neurological symptoms. The patient could ambulate without additional support. The function of the pelvic organs was restored. **Discussion** For a comparison, two methods were presented: lumbopelvic fixation using two rods and a transverse buckle and triangular fixation with a rod and an additional iliosacral screw. Lumbopelvic fixation is a surgical procedure for unstable pelvic ring injuries that allows immediate weight-bearing. Biomechanical tests showed greater primary stability with triangular lumbopelvic fixation than iliosacral fixation with no stress to the injured area. Bilateral lumbopelvic fixation with a transverse buckle allowed secure fixation of the lumbopelvic junction for fracture healing, protection of the sacroiliac joints preventing the development of transitional kyphosis and maintaining the spine balance with careful surgical handling of the soft tissues.

Keywords: case report, combined injury, sacral fracture, lumbopelvic fixation

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INTRODUCTION

Combined injury, as a cause of death, occupies a central place in different age groups and is common for individuals ages 50 and younger [1]. The prevalence of pelvic injury is 3 % of the total number of musculoskeletal injuries [2]. Longitudinal sacral fractures are a component of injury to the posterior structures of the pelvic ring in 45–90 % of cases and are combined with spinal injury in 20–47 % of cases [3]. Severe neurological disorders are more common for catatrauma than for road traffic accidents (ASIA grade A in 30.6 % and 6.0 % of cases, respectively, ASIA grade E in 36.8 % and 64.0 %) [4]. The severity of the condition of polytrauma patients is evidenced by the data of the disability analysis. The disability is reported to be 1.9 % with isolated musculoskeletal injuries, 10 % with multiple trauma and 32.7 % with combined injuries of the musculoskeletal system and internal organs [5]. In 1988, Denis et al. developed a classification system for sacral fractures based on parameters such as fracture direction, location and level. The sacrum was divided into 3 zones in his classification as shown in Figure 1.

Sacral fractures Denis zone 3 are often classified into 4 types based on the work of Roy-Camille and Strange-Vognsen. A type 1 fracture is a kyphotic deformity of the sacrum at the fracture level with minimal displacement. A type 2 fracture is a posterior displacement of the upper sacral fragment, flexion of the lower sacral fragment anteriorly. Type 3 fracture is an anterior displacement of the upper sacral segment, lordosis. Type 4 fracture occurs as a result of axial load and is characterized by the destruction of the body S1 without displacement of the inferior sacral fragment (Fig. 2) [6].

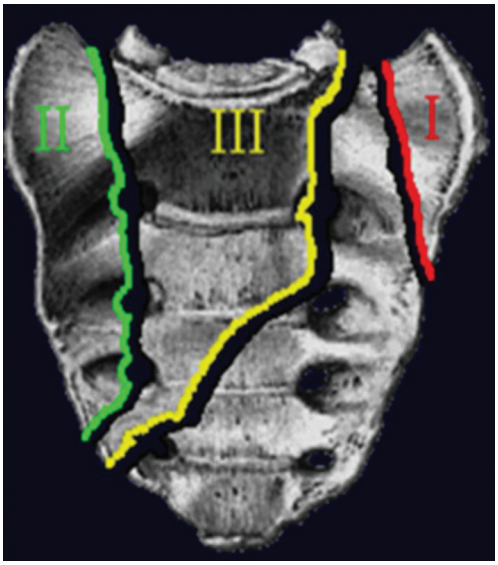

Fig. 1 Classification of sacral fractures developed by Denis included zone 1 at the level of the sacral wing, zone 2 as a transforaminal fracture and zone 3 at the level of the sacral canal

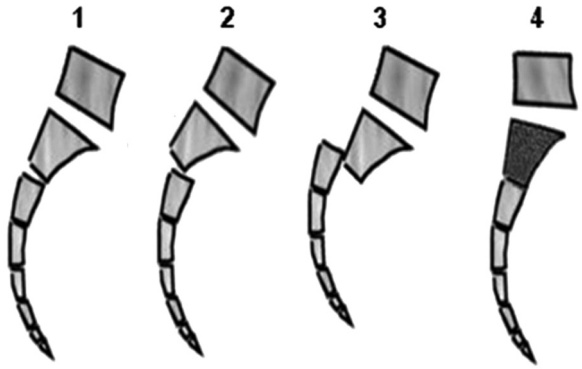

Fig. 2 The Roy-Camille classification of sacral fractures

Most pelvic fractures, those of the sacrum, in particular, can be effectively stabilized using iliosacral screws alone. Lumbopelvic fixation is required for unstable fractures with vertical displacement, for U-type sacral fractures with vertebral-pelvic instability. The surgical technique includes neurological decompression, multiplanar reduction of the pelvic ring and sacrum and a stable fixation. Repair of the severe injuries requiring lumbopelvic fixation is challenging and requires collaboration between trauma and spinal surgeons. Lumbo-pelvic fixation is an important method for stabilizing complex pelvic fractures [7, 8]. The choice of osteosynthesis for unstable injuries of the posterior pelvic half ring is very difficult even with a variety of modalities despite a large selection of metal constructs and methods of surgical correction. According to the literature, errors in choosing the method of treatment for fractures of the posterior half-ring of the pelvis largely affect the nature and rate of complications [9, 10]. The purpose was to demonstrate a clinical case of successful treatment of a patient with a concomitant injury including H-shaped fracture-dislocation of the sacrum using bilateral lumbopelvic fixation.

MATERIAL AND METHODS

Patient Ch. was transported to the emergency department of GAUZ City Clinical Hospital No. 1 35 minutes after falling from a height of the 4th floor with a suicidal intent. The patient's condition was extremely severe, hemodynamically unstable. BP 128/86; Ps, 102 beats/min; BR, 20 per minute; SpO_2, 96 %. She was examined by a traumatologist, surgeon, neurosurgeon, neurologist, resuscitator. She was diagnosed with closed comminuted fracture of the sacrum at the level of S1, S2, comminuted fracture-dislocation of the sacrum at the level of S3 complicated by caudopathy on the right; closed unstable complicated fracture of the L1 vertebral body with compression of the spinal cord at the level in the form of coarse lower paraparesis, sensory disturbances, dysfunction of the pelvic organs. She presented with closed comminuted fracture of both heels with displacement, closed fracture of the distal epimetaphysis of the left radius with displacement, bruised wound of the upper third of the right leg, macrohematuria, traumatic shock II, coprostasis, neurogenic bladder (Fig. 3). The sacral fracture was classified as H-shaped, bilateral, Denis 2-3, Roy Camille 2.

Hb, 166 g/L; Ht, 48.2 %; Er, 5.23×10^{12}; Ley, 14.4×10^{9}. UA: colorless, s.p. weight < 1.005, Pro 50 mg/dL, Ph 5.5, BLD 3+. Ultrasound of the abdomen and pleural cavities showed no free fluid. With diagnostic and anti-shock measures provided, she was transferred to the intensive care unit No. 1, where she stayed for two days to have her hemodynamic parameters stabilized. CBC 3 hours after admission: Hb, 126 g/L; Er 3.94×10^{12}; Ht, 37.5 %; Ley, 14.8×10^{9}. CBC 18 hours after admission: Hb, 103 g/L; Er 3.20×10^{12}; Ht, 30.4 %, Ley, 8.5×10^{9}. CBC after 2 days: Hb, 93 g/L; Er 2.88×10^{12}; Ht, 27.2 %; Ley, 6.4×10^{9}. CBC after 3 days: Hb, 89 g/L; Er 2.76×10^{12}; Ht, 26.2 %, Ley, 6.1×10^{9}. Surgical intervention performed after 4 days of injury included bilateral lumboiliac fixation, reduction of dislocated S3, decompression of the cauda equina roots and transpedicular Th12-L2 fusion (Fig. 4).

Fig. 3 The sacral fracture classified as H-shaped, bilateral, Denis 2-3, Roy Camille 2

Fig. 4 Bilateral lumboiliac fixation, reduction of S3 dislocation, decompression of the cauda equina roots. Transpedicular fusion of Th12-L2

Antibacterial therapy continued with ceftriaxone 1.0 IM 2 times a day. CBC after surgery: Hb, 82 g/L; Er, 2.57 × 10^{12}, Ht, 24.5 %, Ley, 9.6 × 10^{9}; Tr, 200 × 10^{9}. Hemotransfusion of erythrocyte suspension with the removed LTS in a volume of 556 ml was performed due to bleeding through the drains and from the postoperative wound. The transfusion was uneventful. On the 5th. Complete blood count after 5 days of hospitalization: Hb, 81 g/l; Er 2.58 × 10^{12}; Ht, 24.4 %; Ley, 9.3 × 10^{9}, Tr, 188 × 10^{9}.

The patient was allowed to kneel, active rehabilitation and exercise therapy initiated after 6 days. Anti-erythrocyte antibodies were not detected in the blood 3 days after the transfusion (day 7 of hospitalization). She developed hyperemia around the wound on the posterior half-ring of the pelvis, serous-mucous discharge from the wound of the sacral region, increased body temperature up to 40 ºC after 11 postoperative days (15th day of admission). Complete blood count: Hb, 107 g /l; Er 3.35 × 10^{12}; Ht, 30.7 %, Ley, 11.7 × 10^{9}, Tr, 638 × 10^{9}. Sutures were partially removed, debridement and curettage of the wound performed. At the suspicion of involved dural sac and of the cauda equina roots, blood immunoserology was performed with the complement level for 50 % hemolysis of erythrocytes measuring 27.24 CH 50/ml, T-lymphocytes (CD3+) (relative number), 80.094 %; T-helpers (CD3 / 4+) (rel. number), 50.759 %; NK cells (CD16 / 56+) (rel. number), 5.331 %. The antibiotic therapy was changed to tigacil 100 mg once, then 50 mg 2 times a day intravenously. Daily dressings, sanitation of the wound of the sacral region was recommended.

The patient could ambulate on her knees unassisted holding on to improvised objects after 18 days of hospitalization. Revision of the wound was performed due to maintaining serous-mucous discharge from the wound at the sacral site after 21 days of hospitalization: the posterior surface of the sacrum was the bottom of the wound and there were areas of necrosis at the wound edges, at the posterior surface of the sacrum with metal fixators being intact. Re-debridement of the wound was performed, necrotic tissues removed and a vacuum aspiration device applied. Positive dynamics was noted after 12 days with the wound cleared and granulations appeared. The vacuum apparatus was changed 3 times over 12 days.

The vacuum apparatus was removed, the wound sutured tightly after 34 days of hospitalization. The right calcaneus was plated with angular stability, wires were used to fix the left calcaneus and a volar bone plate and screws were applied for the right radius fixation.

A repeated divergence of the edges of the lower angle of the wound at the sacral site was detected at 36 days with a cavity of 2.0 × 2.0 cm. CBC showed Ley of Hb, 110 g/l; Er, 3.57 × 10^{12}; Ht – 32,0 %; Ley, 6.7 × 10^{9}; Tr, 684 × 10^{9}. The stitches were partially open. Dressings were performed with careful curettage and debridement of the wound for 16 days. Positive dynamics was noted at dressings with the entire area of the wound filled with granulations.

Surgical debridement with wound closure was repeated at 51 days. The sutures were removed after wound closure at 14 days (63rd day of hospitalization). The patient was discharged for outpatient treatment at the place of residence.

RESULTS

The total period of inpatient treatment was 63 days with a day in the intensive care unit for the condition stabilization, two postoperative days being on the pelvis and spine and one postoperative day being on the limbs to improve hemodynamics and respiratory support. The patient was allowed to kneel with rehabilitation and exercise therapy initiated at 2 days. She was encouraged to ambulate with full weight-bearing and sit down at 3 months of the operation. There was a lack of independent urination and decreased sensitivity in the perineal area throughout the inpatient treatment.

The patient could ambulate unassisted at 1-year follow-up and there was a complete regression of neurological symptoms. The metal fixators were removed 2 years after the operation. The wounds healed with primary intention. Radiographs at 2 years of surgery, before hardware removal and after removal of the fixators showed consolidated fracture of the sacrum, the frontal and sagittal balance of the spine being maintained with no radiographic signs of sacroiliac arthrosis and signs of proximal and distal transitional kyphosis (Fig. 5).

Fig. 5 Consolidated sacral fracture seen in the radiograph after fixator removal

DISCUSSION

There is a paucity of publications reporting the choice of the fixation method and the sequence of surgical interventions for polytrauma patients suffering unstable pelvic injury. The choice of surgical strategy for unstable injuries of the pelvic ring is very difficult even with available modalities, despite the large selection of metal constructs and methods of surgical correction. Early accurate assessment of the clinical status of severely injured patients is crucial for guiding the surgical treatment strategy since surgical trauma can not only worsen the patient's condition, but also cause death [9]. Screw or plate fixation are common options for most sacral fractures. However, these techniques are unreliable in atypical anatomy of the upper sacral segment, U-shaped and H-shaped fractures, compression of nerve structures with the bone and previous fixation failure. Lumbo-pelvic fixation can potentially stabilize these injuries providing secure fixation and restoration of function.

Lumbopelvic fixation for traumatic injuries of the pelvic ring was introduced in 1994 and improved by Schildhauer et al. [11]. The two methods employed were lumbopelvic fixation using two bars with a transverse bar and triangular fixation with a bar and an additional ileosacral screw. Lumbo-pelvic fixation is a surgical procedure for unstable pelvic ring injuries that allows for immediate weight-bearing. Biomechanical tests indicated greater primary stability of triangular lumbopelvic fixation as compared to ileosacral fixation as long as there is no stress on the injured area at the compression site. The use of unilateral lumbopelvic fixation is unacceptable due to a loss of the frontal and sagittal balance of the spine with resultant overloading of the opposite facet joints, the unilateral sacroiliac joint and chronic lower back pain. There is a need for posterolateral arthrodesis of the unilateral sacroiliac joint and the L5/S1 joint [12].

Infection (8 %) and failed fixation (6 %) are common indications for reoperations. Adverse events can be caused by severe injury to the pelvic ring and internal organs of smaller pelvis and the abdominal cavity. The authors reported the complications as unavoidable in many cases despite appropriate treatment strategies [10, 13]. The use of active surgical strategy, early rehabilitation of the patient can improve the results and terms of treatment reducing mortality and morbidity [14]. Patients with unstable injuries of the posterior complex and predominant injury to the ligamentous complex experience higher complication rate [15].

Biomechanically appropriate methods of internal fixation are practical for decompression of injured neural structures in the treatment of vertically unstable pelvic injuries. Lumbopelvic fixation with the possibility of simultaneous access for decompression of neural structures is the most optimal way to treat such complex injuries [16, 17]. There are various methods for placing pedicle screws into the posterior iliac spine directly or through the S2 vertebral body, lateral masses of the sacrum or S1/S2 vertebral bodies and various combinations of the methods. The screws may fail to provide rotational stability and sacroiliac screws (triangular fixation) can be added [18]. Many authors report a high percentage of infectious complications in patients with vertically and rotationally unstable injuries. Postoperative infectious complications can reach 19 % with the overall incidence of postoperative complications amounting to 40 % [8, 19].

CONCLUSION

Lumboiliac fixation of unstable sacral injuries with vertebral-pelvic dissociation is used to stabilize the damaged segment avoiding weight to be borne by the sacrum. The method allows for secure fixation of the lumbopelvic junction to achieve fracture healing, preserve the sacroiliac joints and avoid the development of transient kyphotic deformity maintaining the spinal balance with careful handling of soft tissues during the intervention. A good anatomical and functional result was obtained despite the problems with wound healing associated with the duration of surgery due to the lack of surgical experience of the team.

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