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Conservative Treatment of Acetabular Both Column Fractures: Does the Concept of Secondary Congruence Work?

Konzervativní léčení zlomenin obou pilířů acetabula: funguje princip sekundární kongruence?

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ABSTRACT

Complete separation of all bony fragments around the acetabulum in both column fractures can lead to extra-anatomical orientation of these fragments around the femoral head with the potential of a "secondary congruence". No long-term data are known in the literature.

We could follow 35 patients were a both column fracture was treated non-operatively due to different reasons. Demographics, fracture type, additional fracture lesions (comminution, marginal impaction), the clinical and radiological result and joint failure (severe arthrosis, FHN, esc. THR) were analyzed.

The mean age was 38 years, 27 patients were male, eight female. All but four were multiply injured with a mean ISS of 22 points. 16 patients had additional pelvic ring injuries

The majority of patients showed a C1-fracture of the acetabulum (anterior column multifragmentary, posterior column simple).

31 patients healed in secondary congruence (88%). Primary displacement was half (11,4 mm, 3-27 mm) compared to patients without secondary congruence (20 mm, 17-22 mm). 80% of the patients had none or only slight pain and 77% had an excellent or good functional result (Merle d'Aubigné Score). The rate of joint failure due to non-union, femoral head necrosis, posttraumatic degenerative changes or pain was relatively low with 17% after a mean of 5 years following trauma.

In selected patients, conservative treatment of both column fractures can lead to acceptable long-term results with a high rate of secondary congruence.

INTRODUCTION

The aim of every treatment concept in acetabular fractures is an anatomical joint restoration which leads to best clinical and radiographical results (8, 11).

Both column fractures of the acetabulum are a relatively common fracture type that is observed in about one fifth of cases in large cohorts (7, 18). A both column fracture is defined as an acetabular fracture where no articular fragment is in connection with the axial skeleton (8).

In a special subgroup of both column fractures of the acetabulum the concept of "secondary congruence" was introduced by Letournel. Here, complete separation of all articular acetabular bony fragments can lead to an extra-anatomical orientation around the femoral head with the possibility of healing in secondary congruence.

The majority of both column fractures are treated operatively (8, 11, 15, 18). But approximately one fourth of these fractures "must" be treated conservatively (8, 11, 15, 18), due to polytrauma situation, additional comorbidities, additional soft-tissue injuries or expected stable fracture situation.

Letournel stated acceptable results after conservative treatment of this fracture type. Despite this, biomechanical data on secondary congruence indicate that non-operative treatment leads to an increase of peak pressu-

res in the supraacetabular region (roof) with the potential risk of developing posttraumatic degenerative changes (9).

Studies from Olsen et al. clearly showed that after fracture of the acetabulum, even with anatomical joint restoration, the physiological incongruency of the hip joint cannot be restored (16).

Therefore, it is of interest if this concept works as no clinical and radiological long-term data are known in the literature.

MATERIAL AND METHODS

In our pelvic database 35 patients with conservatively treated acetabular both column fractures with a long-term follow-up were identified. These patients were treated in the years 1974-2002.

Conservative treatment was performed due to polytrauma situation in 20 cases (57.1%), minor articular displacement in four cases (11.4%), older age > 65 years and comorbidities in three (8.6%), refusing an operative procedure in seven (20%) and abdominal infection in one (2.9%).

These patients were analyzed regarding demographical data (patient age, sex), type of accident, injury mechanism, type of admission, polytrauma rate (20) and ISS (1), concomitant pelvic ring injuries by AO/OTA classification (17), associated injuries and type of radiological diagnostics.

Traumatic brain injury (TBI) was graded according to the Glasgow Coma Scale (GCS) (19). Accompanying chest and abdominal injuries were classified according to the Organ Injury Scaling (OIS) (14). Additional pelvic ring injuries were analyzed alone and according to the complex pelvic trauma definition (2). A fracture-related nerve damage was divided into primary and secondary (iatrogenic) nerve damage.

The primary fracture displacement, additional hip dislocation, acetabular roof arc measurement (10), time of surgical stabilization, surgical approach, and surgery time with blood loss as well as damage to the femoral head (contusion, impaction), the acetabulum (contusion, impaction, comminution zones) and the presence of an associated fracture of the posterior wall or intra-articular fragments were recorded.

The postoperative radiological result was graded according to Matta (12).

The follow-up was recorded using a standardized documentation form (18) including pain analysis and neurological impairments (4). The long-term functional outcome was classified according to the Merle d'Aubigné-score (13). Assessment of the radiological result included follow-up x-ray examination for post-traumatic osteoarthritis changes according to Helfet (18), the presence of femoral head necrosis according to Ficat and Arlet (5) and the presence of heterotopic ossification according to Brooker (3). In addition, the implantation of a secondary total hip prosthesis was documented. A radiological joint failure was defined as the presence of post-traumatic osteoarthritis grade 4 and/or the presence of post-traumatic femoral head necrosis grade 3 or 4 and/or the presence of heterotopic ossification of grade 4 and/or secondary implantation of a total hip prosthesis.

RESULTS

Demographic data

There were 26 male and 9 female patients. The average age was 38.7± 15.5 years (18-68 years). The cause of the accident was a high energy trauma in road traffic accidents in all patients. Most patients (62.9%) were transferred to our hospital. 11.4% of the patients had an isolated pelvic trauma, 31.4% had multiple injuries and 57.1% were polytraumatized. The mean ISS was 22.4 ± 9.7 points (9-43 points).

Concomitant injuries

A total of 31 patients (88.6%) had associated injuries. An additional TBI was present in 57.1% of patients, a chest trauma in 51.4% and a blunt abdominal trauma in 34.3%. 34.3% sustained fractures of the upper and 31.4% fractures of the lower extremities. An additional pelvic ring injury was present in 16 patients (45.7%). In 17.1% a contralateral type A2-injury and in additional 17.1% patients a type B-injury was present. In four patients (11.4%) a pelvic ring type C-injury was present.

Radiological diagnostics

Radiological diagnostics included a standard anterior-posterior pelvic radiograph in all cases. Additional oblique views (ala and obturator oblique views) were performed in 17 patients (48.6%). A CT-scan of the pelvis was performed in 18 patients (51.4%).

Fracture characteristics

The typical type of a both column acetabular fracture is the C1.2 fracture according to the AO/OTA classification (60%). This fracture starts typically high at the iliac crest and shows a multifragmentary fracture of the anterior column with a simple fracture of the posterior column. Other types of fractures included two C1.1 fractures, three C1.3 fractures, one C2.1 fracture, two C2.2 fractures, two C2.3 fractures and four fractures involving the SI joint (C3).

The mean articular fracture displacement was 12.8 mm ± 6.4 mm (2-22 mm). The femoral was not dislocated in 57.1%. Of the remaining 15 patients, all had a centrally displaced femoral head. An associated fracture of the posterior wall was found in one patient, whereas Pipkin fractures were not seen.

Reduction of the femoral head was performed immediately in 7/15 patients after 5.8 hours (1-8 hours) by closed reduction or traction treatment. In all other eight patients no reduction was performed.

The mean anterior-posterior roof arc was 18.7°, on the iliac oblique view of 18.4° and 14.5° on the obturator-oblique view. A comminution zone of the acetabular roof was seen in 17.1% of the patients.

Nerve injury

Only two of these patients had an acetabular fracture related sciatic nerve injury (5.7%).

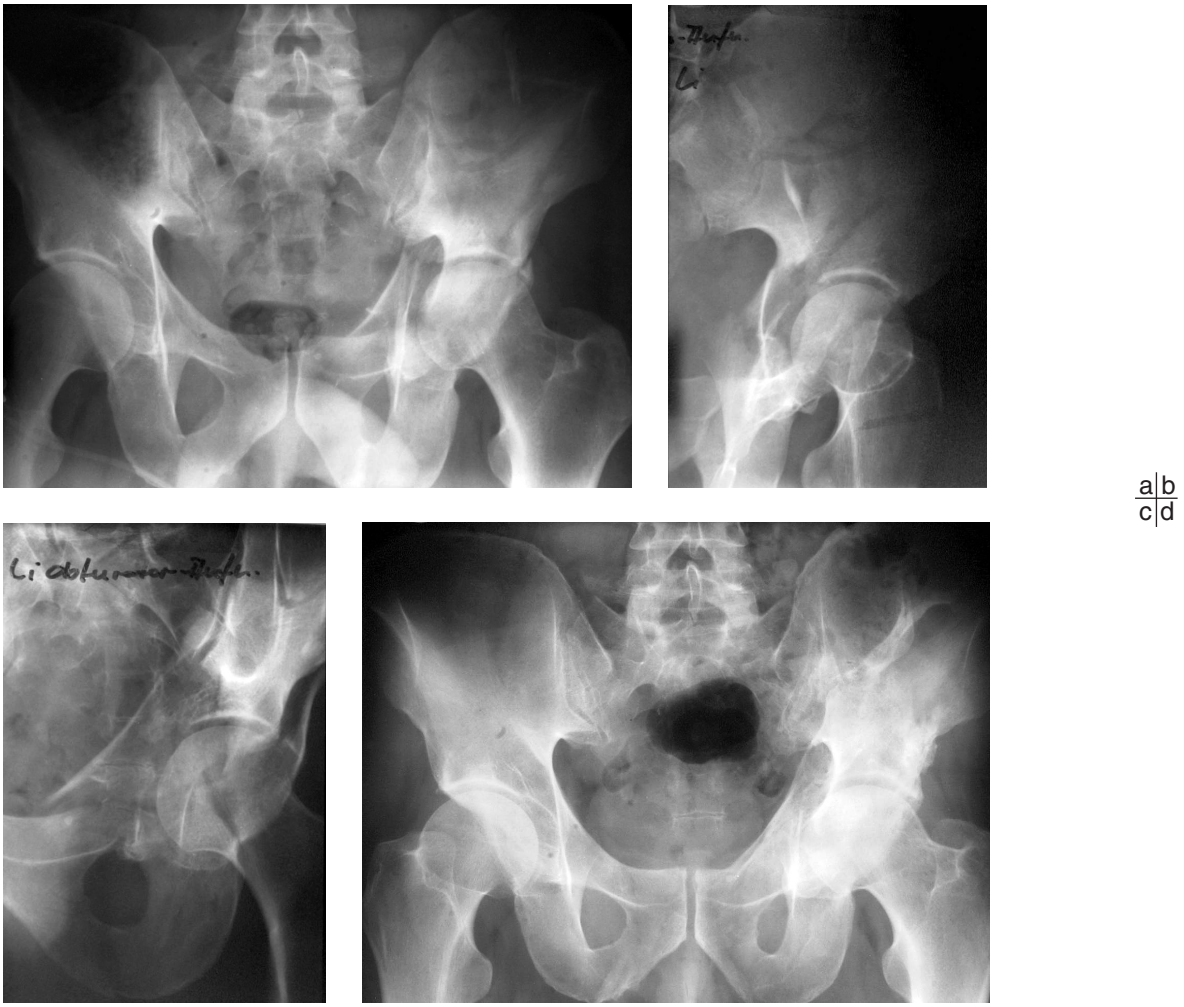
Long-term results

These 35 patients could be followed after a mean of 65 ± 64 months (12-232 months). The average subjective Visual Analog Scale pain score at follow-up was 18.5 ± 23.6 (0–87 points). The patients were rated by the examiner as having no pain in 45.7%, mild pain in 31.4%, moderate pain in 14.3% and severe pain in 5.7%.

The mean Merle d'Aubigné score was 15.8 ± 3.8 points (8–18 points) with 48.6% of patients with a perfect functional result, 28.6% with a good, 5.7% with a moderate and 11.4% a poor functional outcome. A persistent fracture-related nerve deficit was observed in one patient. One patient had a complete recovery and one a partial recovery of his primary sciatic nerve injury.

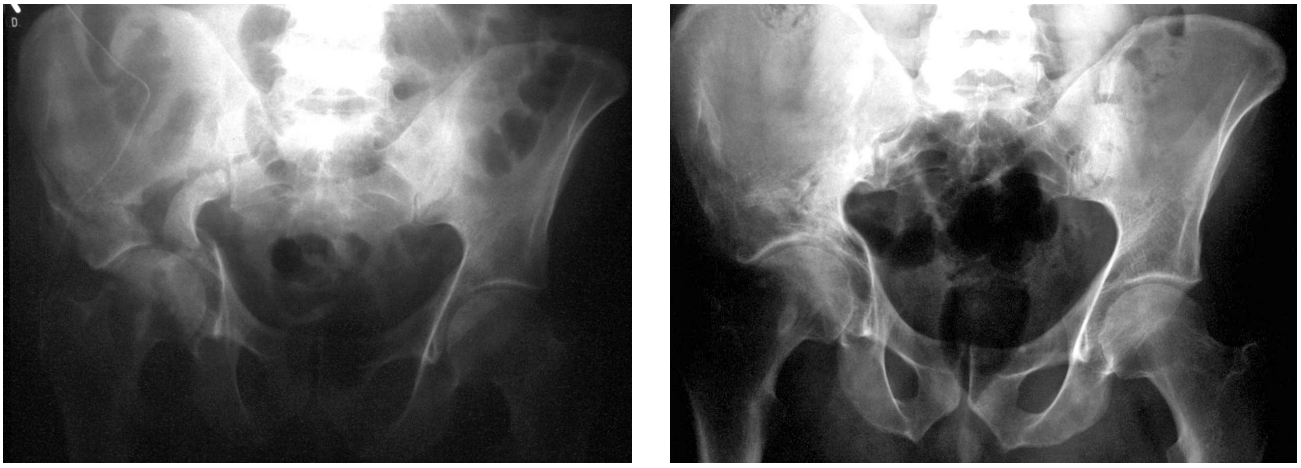
At follow-up 31 patients healed in secondary congruence (88%). Primary displacement was half (11,4 mm, 3-27 mm) compared to patients without secondary congruence (20 mm, 17–22 mm).

26 patients (74.3%) had no post-traumatic osteoarthritic changes of their hip joint (Fig. 1, 2). Seven patients had mild changes (20%) and two patients (5.7%) had moderate arthritis. One patient developed femoral head necrosis grade IV requiring a total hip prosthesis 20 months post-injury. An acetabular non-union was observed in one patient. Overall, four patients had a secondary total hip replacement after, 9, 12, 20 or 117 months, respectively. Overall, a joint failure was diagnosed in 17.1% of the patients. There was a non-significant cor-



a|b
c|d

Fig. 1. 40-year-old male patient after MVA in 1985 with a left both column fracture, left multiple rib fractures and an abdominal injury with splenic lazeration and a left diaphragmatic rupture.
The a.p. x-ray shows a typical multifragmentary anterior column fracture and a more simple posterior column fracture with a small and minor displaced posterior wall fragment (a). Ala oblique (b) and obturator oblique views (c) confirm these findings and all three views show a good congruence between the femoral head and the acetabular roof. Therefore, conservative treatment was initiated due this congruence and the general injury severity (ISS 29).
Follow-up analysis 45 months after injury revealed only slight pain in the groin area (visual analog scale 12%), a Merle d'Aubigné Score of 17, good hip joint movement with extension/flexion 0/0/100°, internal/external rotation 20/0/40° and abduction/adduction 40/0/30°. Follow-up x-ray (d) shows a bony healed acetabular fracture with some displacement of an anterior wall fragment but good congruence.



a b

Fig. 2. 40-year-old male patient after bicycle injury in 1991 with a right both column fracture involving the SI-joint and a small bowel injury. The latter was treated by laparotomy with following complication of abdominal infection.
The a.p. x-ray shows an acetabular roof involvement with two major fragments, one of these involving the SI-joint (a). Conservative treatment was initiated due to the abdominal infection.
Follow-up analysis 29 months after injury revealed only slight pain in the groin area (visual analog scale 26%), a Merle d'Aubigné Score of 17, good hip joint movement with extension/flexion 10/0/120°, internal/external rotation 30/0/40° and abduction/adduction 40/0/30°. Follow-up x-ray (b) shows a bony healed acetabular fracture with a good congruence and no significant signs of posttraumatic arthritis.

relation of joint failure dependent on primary fracture displacement (17 vs. 11 mm).

DISCUSSION

Optimal long-term results can be expected with anatomic joint reconstructions in acetabular fractures (8, 11). Both column fractures have an incidence of approximately 22% (7). These fractures are often displaced and the majority show a multifragmentary anterior column fracture accompanied with a single posterior column fragment, whereas more uncommon multifragmentary posterior column injury or involvement of the sacro-iliac joint is observed (6).

The majority of both column fractures are treated operatively (8, 11, 15, 18). But approximately one fourth of these fractures "must" be treated conservatively (8, 11, 15, 18), due to polytrauma situation, additional comorbidities, additional soft-tissue injuries or expected stable fracture situation. The indications for operative stabilization of both column fractures are well defined. Classical indication for an operative procedure are an unstable hip, loss of joint congruence, displaced fractures (> 2 mm), incongruence or diastasis of the articular surface, interposition of soft tissue, hip dislocation or impairment of additional nerve injury (8, 10-12).

In contrast, general indications for a non-operative treatment can be general contraindications (restriction in general health or significant comorbidities e.g. heart failure, diabetes, etc.), local soft-tissue lesions (Morel-Lavallé-lesions), open fractures, local or systemic infections or multiply injured patients who cannot be operated in the early phase after sustaining a polytrauma.

Letournel introduced the concept of "secondary congruence" in both column fractures of the acetabulum (8). In this special subgroup the complete separation of all articular acetabular bony fragments can lead to an extra-anatomical orientation around the femoral head with the possibility of healing in secondary congruence. He concluded, that acceptable results can develop.

In contrast, Levine et al. performed a biomechanical analysis on secondary congruence. They found an increase of the mean pressure and peak pressure in the acetabular roof area, whereas the contact area and mean pressure between femoral head and acetabular surface was decreased significantly in the anterior articular region and on a lesser degree in the posterior region (9). Therefore, a risk of developing posttraumatic degenerative changes exists in this fracture type after conservative treatment.

No studies exist in the literature on clinical long-term results after conservative treatment of both column fractures.

Our study of a selected patient group after conservative treatment of these injuries showed surprisingly good long-term results. 80% of the patients had none or only slight pain and 77% had an excellent or good functional result (Merle d'Aubigné Score). The rate of joint failure due to non-union, femoral head necrosis, posttraumatic degenerative changes or pain was relatively low with 17% after a mean of 5 years following trauma.

The main disadvantage of this analysis was that no group of consecutive patients could be analyzed and that this patient group is heterogeneous regarding type of both column fracture, indication for conservative treatment and additional injuries.

Therefore, no recommendations can be made, which results clearly can be expected with such a treatment concept.

CONCLUSION

Overall, in a selected group of patients, conservative treatment of both column fractures can lead to acceptable good long-term results with a high rate of secondary congruence. The amount of primary displacement seems to have some influence on the long-term result.

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