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Surgical Treatment of Displaced Acetabular Fractures

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SUMMARY

Introduction Acetabular fractures are severe injuries, generally caused by high-energy trauma, most frequently from traffic accidents or falls from heights. Fractures of the extremities, head injuries, chest, abdomen and pelvic ring injuries are most commonly associated injuries.

Objective The purpose of this study was to evaluate the results of open reduction and internal fixation of acetabular fractures. The open anatomical reduction of the articular surface combined with a rigid internal fixation and early mobilisation have become the standard treatment of these injuries.

Methods We conducted a retrospective analysis of 22 patients of average age 43.13 years. The patients were treated by open reduction and internal fixation at the Orthopaedic Clinic of Niš from 2005–2009. The follow-up was 12 to 60 months, with the average of 21.18 months after surgery.

Results All injured patients were operated on between 4 and 11 days (5.7 days on the average). According to the classification by Judet and Letournel, 15 (68.18%) patients had an elementary acetabular fracture, whereas 7 (31.82%) patients had associated fracture. A satisfactory postoperative reduction implying less than 2 mm of displacement was achieved in 19 (86.36%) patients. The radiological status of the hip joint, determined according to Matta score, was excellent in 15 (68.18%) patients, good in 4 (18.18%) patients and moderate in 3 (13.63%) patients. According to Merle d'Aubigné Scale, the final functional results of the treatment of all operated patients were excellent in 12 (54.54%) patients, good in 7 (31.81%) patients and moderate in 3 (13.63%) patients.

Conclusion Surgical treatment of dislocated acetabular fractures requires an open reduction and a stable internal fixation. Excellent and good results can be expected only if anatomical reduction and stable internal fixation are achieved.

Keywords: fractures; acetabulum; surgical treatment

INTRODUCTION

Acetabular fractures are severe injuries, most frequently caused by a high-energy trauma. Fractures of the extremities, head injuries, chest, abdomen and pelvic ring injuries are the most commonly associated injuries [1-5]. Judet and Letournel were pioneers in the surgical treatment of displaced acetabular fractures [6, 7]. Open anatomical reduction of the articular surface in displaced acetabular fractures, rigid internal fixation and early mobilisation has become a standard treatment for these injuries [8, 9]. A successful anatomical reduction of the articular surface of the acetabulum allows an adequate contact between the acetabulum and the femoral head, as well as a normal pressure distribution on the hip joint. Anatomical reduction prevents post-traumatic osteoarthritis, and a stable internal fixation enables normal functioning of the hip joint. In dislocated acetabular fractures, where anatomical repositioning is not achieved, hip incongruence occurs, which finally leads to a fast failing of the femoral head (avascular necrosis) and to post-traumatic osteoarthritis [10, 11]. The final functional results are directly dependent on the success of the anatomical reduction and fracture fixation [12, 13].

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OBJECTIVE

The purpose of this study was to evaluate the results of open reduction and internal fixation of acetabular fractures. The open anatomical reduction of the articular surface combined with rigid internal fixation and early mobilisation have become the standard treatment for these injuries.

METHODS

The paper presents the results of the surgical treatment of displaced acetabular fractures in 22 patients treated at the Clinic of Orthopaedic Surgery and Traumatology in Niš. The fractures were classified according to Judet and Letournel, and the final functional results were determined according to the scale of Merle d'Aubigné [6, 14]. The final radiological results were determined according to Matta score [13]. The standard procedure of the preoperative preparation included radiographic diagnostics and multislice computed tomography (MSCT). The surgical approach depended on the type of the fracture. Three approaches were adopted; the Kocher-Langenbeck approach, the ilio-inguinal Letorunel approach, or the

combined approach [15, 16]. All fractures were fixed with reconstructive plates for the pelvis and the acetabulum using 3.5 mm screws of various lengths. The follow-up of the operated patients was 12 to 60 months (21.18 months on the average) after the operation.

RESULTS

The retrospective study analysed 22 patients with displaced acetabular fractures. They were operated on at the Orthopaedic and Traumatology Clinic of Niš from 2005 to 2009. This treatment included patients with isolated acetabular fractures, whereas three patients had an accompanying pelvis fracture. The average age of the operated patients was 43.13 (from 19 to 68) years of age. As regards the gender of the patients, there were 19 (86.36%) male and three female patients (13.64%). In 16 (72.72%) patients the fracture was the consequence of a traffic accident trauma, whereas in six (27.28%) patients the cause of the fracture was a fall from a height. All patients were operated on between 4 and 11 days after injury (5.7 days on the average). Seven (31.8%) patients had a fracture of the posterior acetabular wall. The classification of fractures by Judet and Letournel is presented in Figure 1. According to this classification, 15 (68.18%) patients had an elementary acetabular fracture, while seven (31.82%) patients had associated acetabular fracture.

Figures 2, 3, 4 and 5a,b,c show a preoperative X-rays, MSCT and postoperative X-rays of the patients with transversal (transtectal) acetabular fractures and the iliac bone fracture. The Kocher-Langenbeck approach was used in the surgical treatment of 14 (63.63%) patients, ilio-lingual approach was used in four (18.18%) patients, and iliofemoral approach was adopted in two (9.09%) patients. In two (9.09%) patients, the combined approach (the anterior and the posterior approach) was used. A satisfactory fracture reduction was achieved in 19 (86.361%) patients. During follow-up a deep vein thrombosis occurred in one patient (4.54%). No infections occurred. Postoperative peroneus nerve palsy occurred in one (4.54%) patient. As regards later complications, two (9.09%) patients had heterotopic ossifications, two (9.09%) had post-traumatic osteoarthritis and one (4.54%) had avascular necrosis of the femoral head. These patients underwent hip arthroplasty. The average follow-up of the patients was 21.18 months (from 12 to 60 months). The radiological status of the hip joint, according to Matta score, was excellent in 15 (68.18%), good in four (18.18%) and moderate in three (13.63%) patients. According to Merle d'Aubigné Scale, the final functional results were excellent in 12 (54.54%) operated patients, good in seven

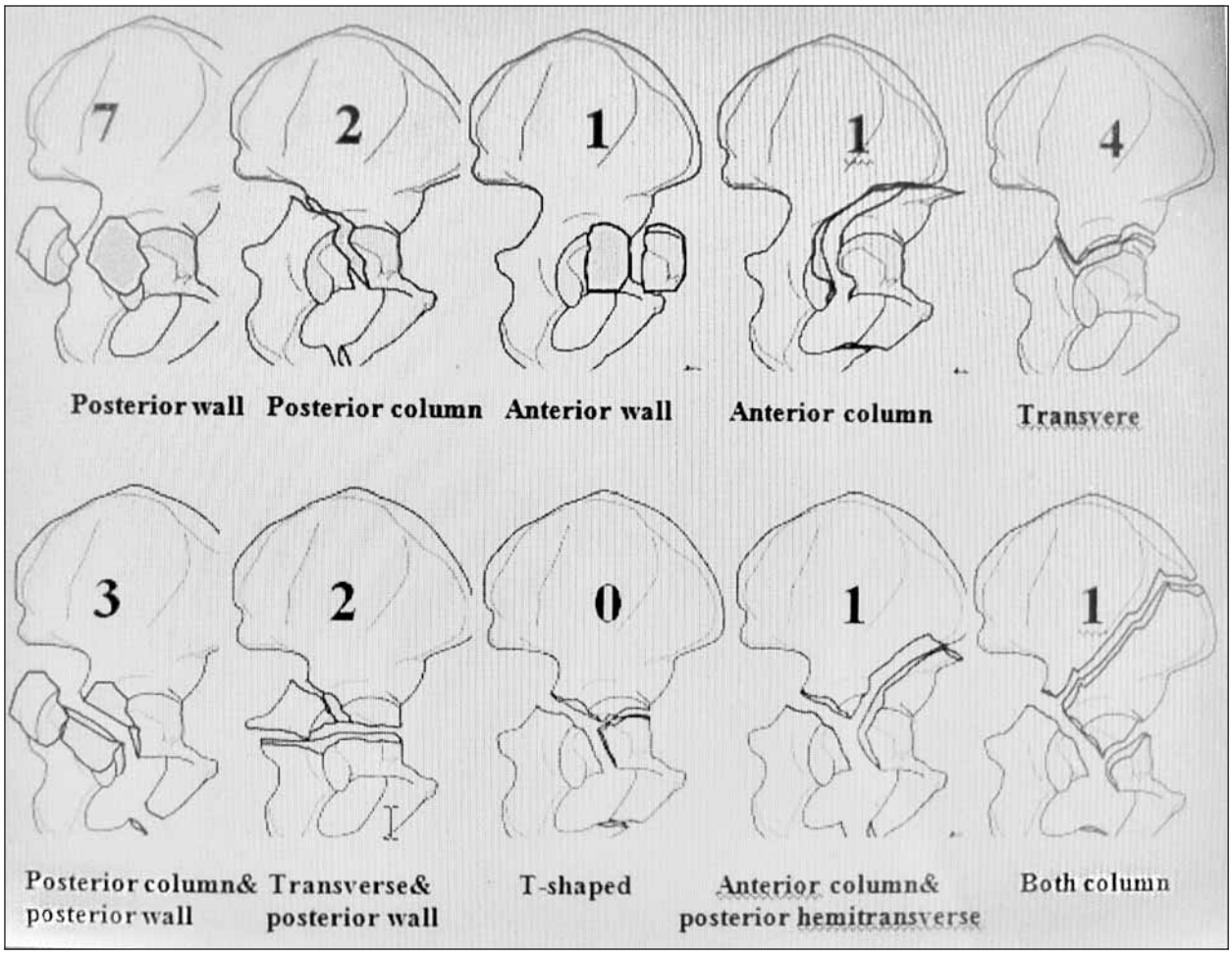

Figure 1. Distribution of acetabular fractures according to Judet and Letournel

(31.81%) patients, and moderate in three (13.63%) patients. There were no bad results.

DISCUSSION

Acetabular fractures are severe injuries and they can be a complex surgical problem. The greatest contribution towards a better understanding of acetabular fractures, their classification, the mechanism of the fracture, and surgical treatment was given by Judet and Letournel [6, 7]. They clearly defined the indications of the fractures that should be treated surgically. Acetabular fractures with a dislocation of bone fragments from 2 to 3 mm (and

Figure 2. Anteroposterior X-ray of acetabular and iliac bone fractures

Figure 3. MSCT of acetabular and iliac bone fractures

Figure 4. Anteroposterior X-ray after open reduction and internal fixation

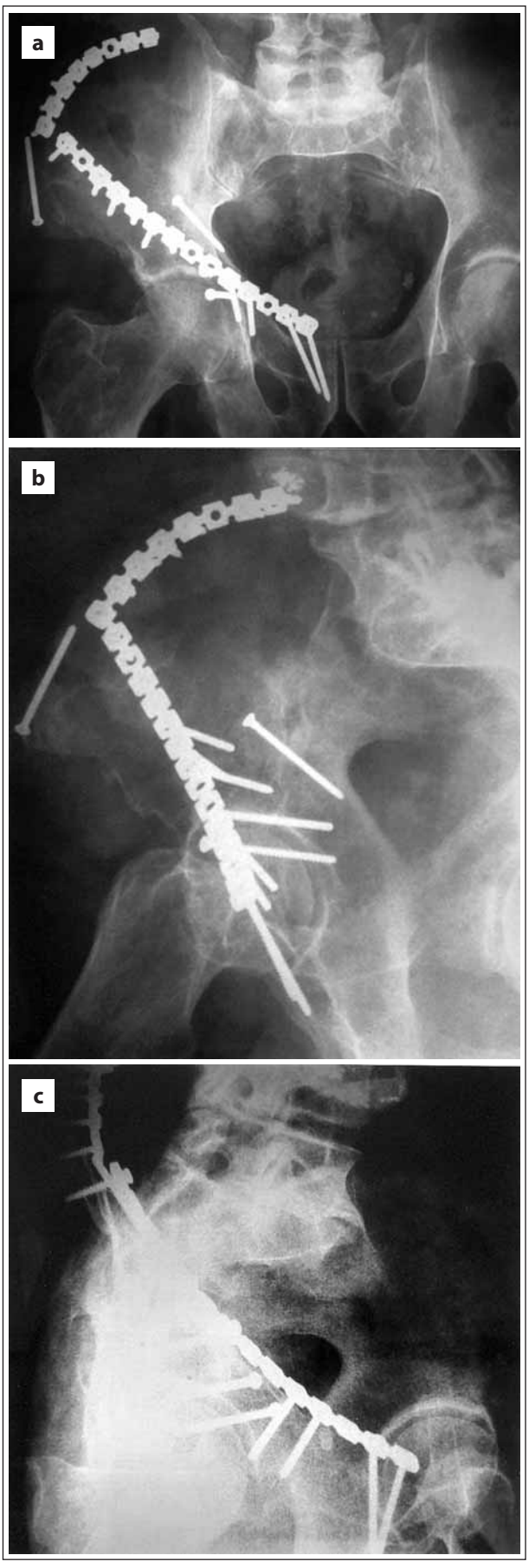

Figure 5. Postoperative X-rays, 12 months after open reduction and internal fixation: a) anteroposterior view; b) oblique iliac view; c) obturator oblique view

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larger dislocations) require surgical reduction and a stable internal fixation, which will enable an early mobilisation of the patient. The selection of the treatment of the acetabular fracture depends on many factors, such as the patient factor, the fracture factor and the surgical team factor. The general medical condition of the patient, and his/her age; accompanying injuries, polytrauma can also determine the manner of the treatment. In younger patients with a good bone structure and overall good health surgical treatment is an option; it is identically so with dislocated fractures of the acetabulum, unstable hips and incongruence. Acetabular fractures can be a serious medical problem; therefore, these fractures should be dealt with by an experienced team of surgeons. This specifically applies to complex acetabular fractures.

The main cause of the acetabular fracture is a traffic accident trauma. Traffic accidents are causes of acetabular fractures in 80.5% of fractures, falls from heights are causes in 10.7% of fractures, and other causes in 8.8% of fractures. These fractures happen more frequently to young patients, considerably more to patients of male gender. According to medical resources, the average age of patients is 38.6±4.6 years, and 69.4% of patients are of male gender [17]. The average age of patient in our series was 43.13 years, and there were 86.36% patients of male gender.

The majority of authors use Judet and Letournel classification of acetabular fractures in their publications. According to medical resources, fractures of the posterior wall of the acetabulum are most frequent fractures; they occur in around 23.6% cases, based on the meta-analysis of 34 publications, which included 3670 patients [17]. In our series of patients, we had 31.8% fractures of the posterior wall of the acetabulum. The operation should be performed in the first week after injury (from 4 to 6 days). According to 14 publications (1496 patients), the average time of performing the operation was 8.9±2.9 days [15]. All our patients were operated on between 4 and 11 days after injury (5.7 days on the average).

The standard procedure of the preoperative evaluation of the patient includes a clinical examination and radiographic diagnostics (anteroposterior pelvic view, 45-degree iliac view, 45-degree obturator view according to Judet), as well as MSCT.

The Kocher-Langenbeck approach is most frequently used, in 48.7% cases, ilio-inguinal in 21.9%, and the ilio-femoral in 12.4% cases. In 17% of the patients, other surgical approaches are used including direct lateral, the triradiate, extensive and combined approaches [17]. As regards our series, 63.63% patients were operated on using the Kocher-Langenbeck approach.

The reduction of the fracture is regarded as satisfactory if the dislocation is smaller than 2 mm. Anatomical reduction depends on the type of the fracture and the interval between the injury and the surgical intervention. The percentage of the satisfactory reduction in our series was 86.36%. Mears et al. showed in their study of 424 fractures treated by operation, that simple fractures were reduced anatomically in 87% of patients, whereas associated fractures could be reduced anatomically in only 59% [18]. Resources describe 4.3% thromboembolic complications and 4.4% local infections [17]. In our series, we had one (4.54%) patient with a deep vein thrombosis. No infections occurred. We had one (4.54%) patient who was diagnosed with peroneus nerve palsy. According to resources, around 16.4% nerve injuries were recorded, as well as 8% iatrogenic nerve palsy, most frequently the sciatic nerve [17]. Post-traumatic and iatrogenic injuries of the femoral nerve are significantly less frequent [19, 20]. In some series, in acetabular fractures with posterior hip dislocation, sciatic nerve injuries increased to 40.3% [21, 22, 23].

Heterotopic ossification (Brooker I-IV) was described in 25.6% cases; 5.7% were of the third and fourth grades [17, 24]. There were two (9.09%) patients with heterotopic ossification.

Two (9.09%) patients had a post-traumatic osteoarthritis and one (4.54%) patient had avascular necrosis of the femoral head. No revision surgery in the form of reosteosynthesis occurred, and three (13.63%) patients with postraumatic osteoarthritis and avascular necrosis of the femoral head had hip arthroplasty. Also, around 26.6% of cases of post-traumatic osteoarthritis following the osteosynthesis of acetabular fractures were described, as well as 5.6% of cases of avascular necrosis of the femoral head [17]. The percentage of avascular necrosis of the femoral head was higher occurring in 9.2% of patients with a posterior dislocation of the hip [25]. Revision surgery, reosteosynthesis, was performed in 2.5% of patients, and total hip arthroplasty was done in 8.5% [17]. The incidence of post-traumatic osteoarthritis depends on the success of fracture reduction. When reduction is satisfactory, the incidence of post-traumatic osteoarthrit is 13.2%. In cases of unsatisfactory reduction, the incidence is 43.5% [1, 5, 20, 26]. Also, the final functional results are in direct correlation with the level of satisfactory reduction. Excellent and good results are expected in 83- 89% [27]. We had 86.35% of excellent and good results. Other factors which affect the final functional results are the patient's age, osteopenia, comorbidity, obesity and delayed surgical intervention [3, 12, 18, 28].

CONCLUSION

Surgical treatment of displaced acetabular fractures is an open reduction and a stable internal fixation which allows early mobilisation. This type of treatment is a standard in the management of acetabular fractures. Excellent and good results are achieved only if anatomical reduction and stable internal fixation are achieved. There is a direct correlation between excellent and good results, anatomical reduction and radiographic results.

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Хируршко лечење дислоцираних прелома ацетабулума

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КРАТАК САДРЖАЈ

Увод Преломи ацетабулума су тешке повреде. Настају најчешће у саобраћајним удесима или при паду с висине, односно при дејству силе јаког интензитета. Настају као изоловани или удружени с повредом карлице, главе, грудног коша, абдомена, екстремитета или у склопу политрауме.

Циљ рада Циљ истраживања је био да се оцене резултати примене отворене репозиције и унутрашње фиксације прелома ацетабулума. Отворена анатомска репозиција зглобне површине комбинована с ригидном унутрашњом фиксацијом и рана мобилизација постали су стандард у лечењу ових повреда.

Методе рада Ретроспективном студијом анализирана су 22 болесника (просечне старости 43,13 година) која су лечена методом отворене репозиције и унутрашње фиксације на Ортопедско-трауматолошкој клиници Клиничког центра у Нишу у периоду 2005–2009. године. Болесници су после операције у просеку клинички праћени 21,18 месеци (распон 12–60 месеци).

Резултати Сви испитаници су оперисани између четвртог и једанаестог дана од повређивања (у просеку око шестог дана). На основу Жидеове (*Judet*) и Летурнелове (*Letournel*) класификације, код 15 болесника (68,18%) установљен је елементарни прелом ацетабулума, а код седам испитаника (31,82%) комплексни прелом ацетабулума. Задовољавајућа репозиција, која подразумева мање од 2 *mm* дислокације, постигнута је код 19 оперисаних болесника (86,36%). Радиолошко стање зглоба кука, одређено на основу Матовог (*Matta*) скора, било је одлично код 15 болесника (68,18%), добро код четири (18,18%), а умерено код три (13,63%). Крајњи функционални резултати лечења свих оперисаних испитаника на основу скале по Мерл д'Обињеу (*Merle d'Aubigné*) били су одлични код 12 болесника (54,54%), добри код седам (31,81%), а умерени код три (13,63%).

Закључак Операција дислоцираних прелома ацетабулума подразумева примену отворене репозиције и унутрашње фиксације. Одлични и добри резултати лечења постижу се само ако су постигнуте анатомска репозиција и стабилна унутрашња фиксација.

Кључне речи: преломи; ацетабулум; хируршко лечење

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