ORIGINAL ARTICLE

Total hip arthroplasty for acetabular fractures: "Early Application"

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ABSTRACT

BACKGROUND: The aim of this study was to evaluate the functional and clinical results of early total hip arthroplasty performed to treat acetabulum fracture.

METHODS: Evaluation of 17 patients who were diagnosed with acetabulum fracture and treated with early total hip arthroplasty between January 2008 and October 2013 was performed. In all, 14 patients were male, and 3 were female, with mean age of 52 years (range: 29–80 years). Time elapsed between trauma and operation was mean of 13 days (range: 2–21 days). Observation period was average of 48.2 months (range: 24–70 months). Mean Harris Hip Score was 89.6 (range: 70–100).

RESULTS: In 13 patients, score was good or excellent. Total of 7 of 10 patients had returned to their pre-trauma jobs. Mean length of time for return to work was determined to be 7.2 months (range: 1.5–24 months). Of the total, 9 (52.9%) patients were diagnosed with heterotopic ossification according to Brooker Classification.

CONCLUSION: After acetabulum fracture, early total hip arthroplasty with the correct indications and appropriate patient can result in functional, pain-free hip joint with the advantages of early mobilization, early return to work, and decrease in reoperation risk. Heterotopic ossification prophylaxis should be considered in the presence of 1 or more risk factors, such as a head injury, high-energy trauma, or associated musculoskeletal injuries.

Keywords: Acetabulum fracture; heterotopic ossification; total hip arthroplasty.

INTRODUCTION

Acetabulum fracture is a rarely seen but serious orthopedic injury that can have early or late complications. Rate of incidence of osteoarthritis after acetabulum fracture varies between 12% and 67%.[1–6] The primary objective in patients diagnosed with displaced acetabular fracture is to prevent post-traumatic osteoarthritis and long-term functional limitation. Articular impaction of the medial wall,[7] marginal impaction of the posterior wall,[8,9] hip dislocation related to the posterior wall,[9,10] and femoral head injuries have been noted as poor results after internal fixation.[2,11] These complications increase the risk of neurovascular traumatization, loss of height, and aseptic and septic loosening.[12–14]

When internal fixation is done simultaneously with early total hip arthroplasty, treatment provides fracture stabilization, pain reduction, and early mobilization. It also reduces complications related to soft tissue to a minimum via wider surgical opening and avoiding reoperation through same tissue.[15–18]

The objective of this study was to retrospectively observe and assess the clinical and radiological results of total hip arthroplasty performed for acetabulum fracture.

MATERIALS AND METHODS

A total of 17 of 20 patients diagnosed with acetabulum fracture and treated with total hip arthroplasty between 2008

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and 2013 were included in the study. Three patients were excluded due to change in contact information or incomplete polyclinic check-ups.

The indications for total hip arthroplasty included an impaction fracture of the femoral head with acetabular fracture, osteoporosis with impaction or comminution of the roof of the acetabulum, pre-existing osteoarthritis, or avascular necrosis. In all, 14 of the patients were male, and 3 were female; mean age was 52 years (range: 29–80 years). Mean observation period was 48.2 months (range: 24–70 months). Time elapsed between patient trauma and operation was mean of 13 days (range: 2–21 days). Examination of type of trauma revealed 2 cases of non-vehicle traffic accident (NVTA), 12 cases of vehicle traffic accident (VTA), 2 cases of a fall from a height (FDFH), and 1 same level fall (SLF). Most frequent cause of injury in our research was VTA (70%) (Table 1).

All patients were operated on at the same center and by the same surgeon using the same technique and the same total hip prosthesis. The patient was placed in the lateral decubitus position, and standard lateral approach to the hip was used. A stable reduction of the anterior and posterior columns of the acetabulum was achieved with screws, plates, or cables. Fracture stabilization and acetabular bone structure were established, and for good fixation of the acetabular component, reconstruction plate and screw was used in 5 patients, cortical and cannulated screw in 8 patients, and cannulated screw and medical cables in 1 patient. Uncemented acetabular component was used in all fractures.

Excised femoral head provided bone graft to introduce into residual fracture gaps or defects. Once the hemipelvis was stable, conventional acetabular reaming was performed and nonviable or damaged muscle was carefully debrided. Standard acetabular and femoral component placement and wound closure were then performed.

Radiological follow-up was performed to examine and check for acetabular component's abduction angle, medialization, loosening, wear on polyethylene insert, vertical displacement, or osteolysis, according to DeLee and Charnley.[19] Patients diagnosed with heterotopic ossification were classified using the Brooker Classification. Loosening of femoral component, osteolysis with varus or valgus shift, and collapse, as described by Gruen et al.,[20] were observed.

Clinically, patients were evaluated using the Harris Hip Score (HHS) system, which assessed items such as patient satisfaction with the hip, use of any assistive device to walk, time until return to work, and limp.

Low molecular-weight heparin was administered to patients on date of admission and continuing for postoperative 35 days. For prophylactic purposes, 1 g first-generation cephalosporin, cefazolin sodium, was administered preoperatively.

Postoperatively, all patients' standing stance was restored, and they were mobilized with crutches, with exception of patients with additional fracture.

RESULTS

Fracture classification was made according to Judet and Letournel.[2] Five patients had simple fracture, 12 had complex fracture.

Examination of femoral head and acetabulum during operation revealed fracture of the femoral head in 3 patients, severe osteoarthritic changes in 1 patient, erosion that involved more than 3% of the femoral head in 4 patients, and erosion of cartilage in the posterior and superior areas of the acetabulum in 5 patients (Figs. 1–3).

A total of 10 (58.8%) of the patients scored above 90 (excellent), 3 (17.6%) patients scored between 80 and 89 (good), 4 (23.5%) patients scored between 70 and 79 (moderate) using the HHS tool. Mean score for all patients was 89.64 (range: 70–100); outcome for 13 (76%) patients was excellent or good.

When a comparison of the patients' scores was performed according to age, it was determined that patients over the age 65 had lower HHS than other groups (Table 2).

Eight (47%) patients limped when walking; in 1 case it was of moderate degree, while it was mild in the remaining patients. Four of the patients with a limp had peroneal nerve palsy, 1 had unhealed open calcaneus fracture, 2 had grade 4 heterotopic ossification, and 1 had previous limp due to cerebrovascular event.

In the postoperative observation period, 4 (23.5%) patients were still using assistive devices to walk. Mean observa-

Table 1. Patients' injury reasons and ratio of age of these injuries

Fracture reason	Number	Percentage (%)	Average of age
Vehicle traffic accident	12	70.6	46
Non-vehicle traffic accident	2	11.8	75
Falling down from height	2	11.8	56
Same level fall	1	5.9	70

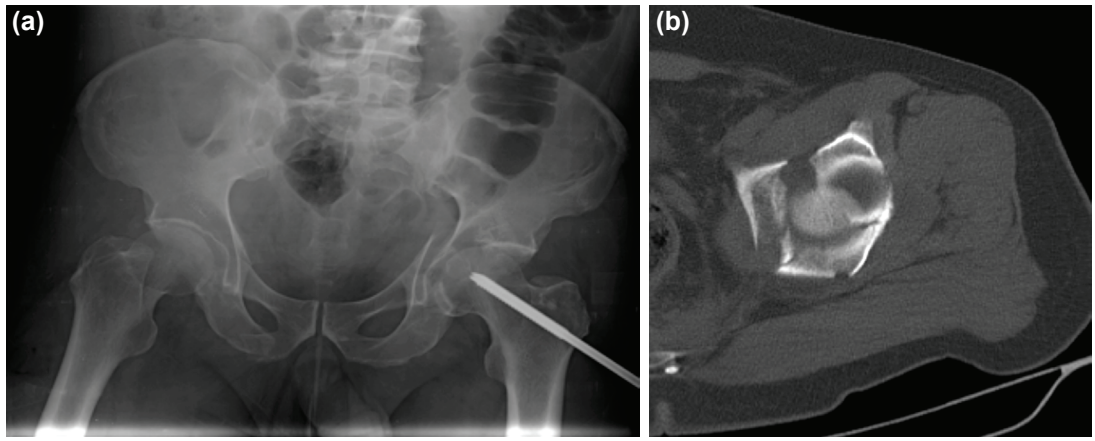

Figure 1. (a) Pelvis radiograph of right sacrum fracture and left acetabulum fracture after vehicle traffic accident in a 54-year-old male patient. **(b)** Computed tomography display of the left acetabulum fracture.

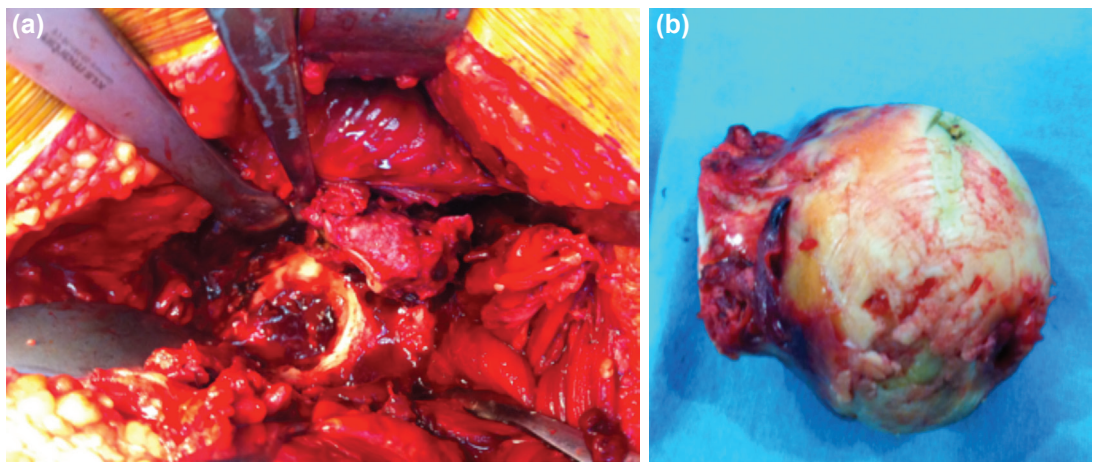

Figure 2. (a) Acetabulum fracture in a 54-year-old male patient after surgical opening. **(b)** Damage to the weight-bearing area of the femoral head.

tion period for these patients was 46 months (range: 24–58 months), and mean HHS was 79.5. Only 1 patient, who was 80 years old and was operated on for posterior wall fracture caused by NVTA, used crutches and only mobilized inside the home. Two patients used a walking stick on long walks, and 1 patient used walker.

Ten patients (58.8%) were working preoperatively. Mean age of that group was 43.7 years (range: 29–55 years). In all, 7 (70%) returned to work in mean of 7.2 months (range: 1.5–24 months). Mean length of time before return to work with the single patient who began to work after 24 months excluded was 4.4 months (range: 1.5–8 months).

Two (11.8%) patients reported continuing hip pain; however, the remaining patients had no complaints and were satisfied with the surgery.

Patient radiographs from the last follow-up were classified according to the Brooker classification for heterotopic ossification. In 8 patients (47.1%), there was determination of grade 0. In 3 patients (17.6%), the finding was grade 1; in another 3 (17.6%) patients, it was grade 2; in 1 patient (5.9%), grade 3; and in 2 patients (11.8%), grade 4 heterotopic ossification was detected (Table 3) (Fig. 4).

Figure 3. (a) Radiography of 54-year-old male patient's right sacrum fracture and left acetabulum fracture 7 months after surgical operation.

Table 2. Harris hip scores with ages

Age	Number	Harris hip score	Percentage (%)
20–29	1	94	5.9
30–39	3	92.6	17.6
40–49	3	89	17.6
50v59	7	93.2	41.1
60–69	–	–	–
70–80	3	77.3	17.6

Table 3. Patients' heterotopic ossification numbers and ratio according to Brooker Classification

Brooker Classification	Patient number	Percentage (%)
Grade 0	8	47.1
Grade 1	3	17.6
Grade 2	3	17.6
Grade 3	1	5.9
Grade 4	2	11.8

Acetabular component angle measurements were made by analyzing anteroposterior pelvis and anteroposterior hip radiographs. Mean acetabular component angle was determined to be 44.4° (range: 34°–55°). Bone union was seen on all radiographs of acetabulum fractures of all patients. One (5.9%) patient had revision surgery due to infection and medialization of the acetabular component. No acetabular component loosening, medial displacement, osteolysis according to DeLee and Charnley[19] or polyethylene corrosion were seen in any patient.

Femoral component had varus tilt in 2 (11.8%) patients. Osteolysis, collapse on femur, or valgus were not seen in any zone, as defined by Gruen.[20]

Two patients were reoperated on due to complications: 1 (5.9%) patient was diagnosed with infection, and the other experienced dislocation. Deep surgical site infection was treated with 2-stage revision. Acetabular revision was performed in the patient with repeated dislocation at fourth month.

DISCUSSION

Open reduction and internal fixation are generally accepted in the literature as the ideal treatment modalities for comminuted acetabulum fracture.[2,11] However, especially in comminuted acetabulum fractures, internal fixation may result in poor prognosis as result of acetabular and femoral surface impaction and erosion, even with good reduction.[21]

A meta-analysis conducted by Giannoudis[22] reported 20% rate of post-traumatic arthritis as the most frequent long-term complication following acetabulum fracture, and some other authors have reported up to 60% post-traumatic arthritis. Osteonecrosis of femoral head has been reported at 5.6% to 53%.[23]

U.G. De Bellis reported indications for early total hip arthroplasty on acetabulum fracture of complex fracture according to Letournel and Judet,[19] osteoarthritis in hips, femur head fracture, pathological fracture, bad bone quality, or fractures that cannot be reconstructed.[3,12,18,24] Mears added these criteria to the indications: severe impaction, wide femur head abrasion, acetabular impaction more than 30% of its surface, multipartite acetabular fracture, and more.[8] Relative indications are reported as: delayed case, medical comorbidities, obesity, and senility.[25] In the present study, 5 patients had a simple fracture and 12 patients had a complex fracture. One of these simple fracture cases had severe osteoarthritis, and 2 had osteoarthritic changes; however, these patients were over the age 70.

Tidemark's study stated 30% of patients used an assistive device for walking after undergoing total hip arthroplasty for

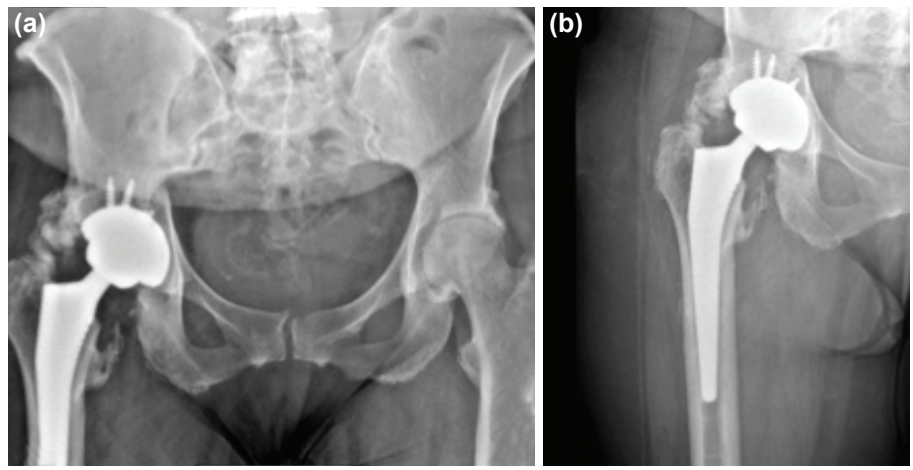

Figure 4. (a, b) A 47-year-old female patient diagnosed with grade 4 heterotopic ossification.

acetabular fracture.[18] Another study performed by Mears reported 23% of patients used assistive devices for long walks, and 9% of them could even walk without device but with human support.[8] Hersovici's study with 22 patients indicated that 5 patients used a crutch and 5 patients used a walker.[26] In our research, 4 (23.5%) of patients continued to use assistive devices for walking. The mean observation period was 42 months (range: 24–48 months), and mean HHS was 79.5. At last evaluation, 1 patient used walker, 1 other used walker and 2 used a walking stick for long walks.

In Mears' study with 57 patients, 18 (32%) patients returned to work.[8] Our study included 10 (58.8%) patients who were working preoperatively with mean age of 43.7 (range: 29–55 years). In all, 7 (70%) of them returned to work, and mean return-to-work time was 7.2 months (range: 1.5–24). When the patient who had 24-month return-to-work time was excluded, mean for the remainder of the group was 4.4 months (range: 1.5–8 months).

In the present study, 11 (64.7%) patients had additional fractures: 1 humerus fracture, 4 tibia fractures, 5 femur fractures, 2 patella fractures, 1 sacrum fracture, 2 wrist fractures, 2 metacarpus fractures, and 1 calcaneus fracture. We believe these fractures delayed patients' recovery, early walking, and early return to work.

Early total hip arthroplasty patients' implants vary in terms of acetabulum reduction and acetabular cup fixation. In our study, a reconstruction plaque and screw was used in 5 patients, cortical and cannulated screw in 8 patients, and cannulated screw and medical cables in 1 patient. In 1 patient, only uncemented acetabular component was used.

When we look at complications and the ratio seen in the literature, Sermon et al. reported that of 64 patients, 18 (28%) were diagnosed with heterotopic ossification and 4 (89%) patients underwent revision.[24] Mears' study with 57 patients indicated that 3 (5%) patients were diagnosed with deep venous thrombosis, 6 (10%) with heterotopic ossification, 2 (4%) with dislocation, and 3 (5%) underwent revision.[8] Hersovici's research on 22 patients reported 1 (4%) transient ischemic attack, 4 (18%) cases of heterotopic ossification, 1 (4%) wound site infection, 3 (14%) dislocations, 2 (9%) instances of loosening, and 5 (23%) revisions.[26]

Heterotopic ossification is a frequent complication of acetabular fracture surgery. High-energy trauma with significant inflammation, polytrauma, head injury, extensive surgery with muscle dissection and hematoma formation, blood loss, and prolonged operating time may explain it. According to Letournel and Judet,[2] the more extensive the stripping of the gluteal muscles, the greater the risk for heterotopic ossification. A meta-analysis by Giannoudis et al.[22] published in 2005 reviewed 2394 acetabular fractures and found an overall incidence of heterotopic ossification of 25.6%. The specific cause of heterotopic ossification remains unclear, although many risk factors, such as the surgical approach, have been implicated. Some level of prevention seems possible with anti-inflammatory prophylaxis, especially indomethacin and/or radiotherapy,[27] but other studies have reported no benefit. Furthermore, the superiority of a single form of prophylaxis has not been proven. In our study, 9 (52.9%) of 17 patients were diagnosed with heterotopic ossification. In 3 patients, it was determined to be grade 1 (17.6%); in 3 patients, grade 2 (17.6%); in 1 patient, grade 3 (5.9%), and in 2 (11.8%) patients it was classified as grade 4 heterotopic ossification. Eight (47.1%) patients were clear for heterotopic ossification. Our patients did not receive any heterotopic ossification prophylaxis, and we think that indomethacin or radiotherapy application can diminish the heterotopic ossification rate.

Two (11.8%) patients underwent revision operation: 1 (5.9%) of the patients was diagnosed with infection and the other patient (5.9%) had dislocation. We did not observe any case of loosening, deep venous thrombosis, pulmonary embolism, or periprostatic fracture in our research. When comparing our study to others, we believe that the greater rate of heterotopic ossification seen in our study was due to non-use of any prophylactic treatment.

Acetabulum fracture is a serious and rarely seen orthopedic injury that can have early or late complications. Treatment of acetabulum fracture is debated in the medical literature. We think that with the correct indications and the correct selection of patient, simultaneous open reduction-internal fixation with acute total hip arthroplasty can provide excellent fracture stabilization, successful pain reduction, early mobilization, and a wider surgical approach, which by avoiding reoperation through same tissue, reduces complications related to soft tissue injury. Our study is limited by small number of patients, and lacks a longer average observation period and comparison group. Additional research on acetabulum fracture with these qualities is needed.

Conclusion

Early period total hip arthroplasty for acetabulum fracture is effective based on functional and radiological results, as well as patient satisfaction, when performed with the correct indications and correct surgical technique.
Conflict of interest: None declared.

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ORİJİNAL ÇALIŞMA - *ÖZET*

Asetabulum kırıklarında total kalça protezi

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AMAÇ: Asetabulum kırıkları sonrası erken Total Kalça Protezi (TKP) uygulamasının fonksiyonel ve klinik sonuçlarının değerlendirilmesi amaçlandı.
GEREÇ VE YÖNTEM: Ocak 2008–Ekim 2013 tarihleri arasında asetabulum kırığı tanısıyla erken total kalça protezi uygulanan 17 hastanın klinik ve radyolojik sonuçları değerlendirildi. On dördü erkek, üçü kadın olmak üzere, ortalama yaşları 52 (29–80) idi. Hastaların ortalama takip süresi 48.2 aydır (24 ay–70 ay). Hastaların travmaları ile operasyonları arasındaki ortalama süre 13 gündür (2 gün–21 gün).
BULGULAR: Hastaların fonksiyonel sonuçları Harris kalça skoru ile değerlendirildi. Ortalama Harris kalça skoru 89.6 (70–100) olarak bulundu. On üç (%76) hastada ise mükemmel ve iyi olarak bulundu. On hastanın yedisi travmadan önce çalıştıkları işe geri döndü. Ortalama işe dönüş süresi ise 7.2 ay (1.5 ay–24 ay) idi. Komplikasyon olarak kısalık, enfeksiyon, dislokasyon ve heterotopik ossifikasyon görüldü. Enfeksiyon ve dislokasyon nedeniyle iki hastaya revizyon uygulandı. Dokuz (%52.9) hastada Brooker sınıflamasına göre heterotopik ossifikasyon tespit edildi.
TARTIŞMA: Asetabulum kırıklarından sonra doğru endikasyon ve doğru hasta seçimi ile yapılan erken TKP ile ağrısız ve fonksiyonel bir kalça eklemi elde edilirken, erken mobilizasyon, erken işe dönüş ve tekrar operasyon riskinde azalma avantajları olduğu anlaşılmıştır ve kafa travması, yüksek enerjili travma ya da ek kas iskelet sistemi yaralanmasından biri veya daha fazlası olan hastalarda heterotopik ossifikasyon profilaksisi akılda tutulmalıdır.

Anahtar sözcükler: Asetabulum kırığı; heterotopik ossifikasyon; total kalça artroplastisi.

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