

## Total Hip Arthroplasty in Untreated Posterior Acetabular Wall Fracture

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### Abstract

**Background:** Total hip arthroplasty (THA) in patients with chronic untreated fracture of the posterior acetabular wall represents a rare and challenging scenario for joint surgeons. There are many reports on THA following acetabular fractures treated by internal fixation; however, there are few previous reports on THA following missed posterior wall fracture.

**Objectives:** In this study, a case series of patients with untreated posterior wall fracture of the acetabulum managed by cementless THA and superior placement of acetabular cup was presented.

**Materials and Methods:** Seven patients (mean age of 42 years) with untreated posterior wall fracture of the acetabulum, presented to our institution with severe osteoarthritis 5 months after primary trauma (ranged 3.4 to 7.2). There were 5 pure posterior wall fractures and 2 posterior wall and column fractures. It was decided to put the cup in a little higher center rather than reconstruct the posterior wall. All cases were performed with the lateral approach in supine position. All patients were ambulated on the day after surgery with weight bearing as tolerated program. We did not apply hip precautions to these patients.

**Results:** Acetabular implants were placed within 8-18 mm upward from the tear drop (upward distance average 14.4 mm). Postoperatively, the function of hip joints improved with HHS rising from  $42.5 \pm 6.42$  to  $88.3 \pm 7.27$  after one year, which was significantly different ( $T = 12.49$ ,  $P < 0.0001$ , 95% confidence interval: -53.7872 to -37.8128). At the latest follow-up (mean: 45 months, ranged 39 - 52 months), radiographic assessment showed satisfactory cup position with bone ingrowth and no signs of loosening.

**Conclusions:** Putting acetabular cup in a higher but more supportive bone offers a reliable and easier technique for reconstruction of acetabular posterior wall deficiencies. Further studies are needed to prove long-term outcomes of this method.

**Keywords:** Acetabular, Total Hip Arthroplasty, Anteroposterior

## 1. Background

Chronic untreated fracture of the posterior acetabular wall represents a rare scenario. It would result in limping and dysfunction of the hip joint. Therefore, once a missed posterior wall fracture is diagnosed, delayed open reduction and internal fixation is usually not indicated because of joint destruction. Altered anatomy, compromised bone stock, femoral head osteonecrosis and a high riding femoral head can complicate management of these patients (1). Although, total hip arthroplasty (THA) is favored in such patients, there are several technical difficulties regarding bone reconstruction and component placement (2-8).

There are many reports on THA following acetabular fractures treated by internal fixation (6, 9, 10) however, there are few studies discussing reconstruction of these acetabular deficiencies due to neglected or untreated posterior wall fracture (11). We believe that appropriate upward placement of the acetabular implants could be acceptable to meet 60% - 70% host bone coverage and implant stability. This is consistent with previous studies in the literature (3, 9, 12, 13).

## 2. Objectives

In this study, a case series of patients with untreated posterior wall fracture of the acetabulum managed by cementless THA and superior placement of acetabular cup was presented.

## 3. Materials and Methods

This study was conducted on seven patients of untreated posterior wall fracture in our center. Six patients were male and 1 female. The average age was 42 years (ranged 34 - 62). Initial visit in our center was at least 5 months after trauma (ranged 3.4 to 7.2). All patients were injured in high-energy trauma. There were 5 pure posterior wall fractures and 2 posterior wall and column fractures. Five patients were treated conservatively and 2 patients were missed initially. In all cases, posttraumatic arthritis occurred. Furthermore, all the cases had a degree of limb shortening from 1 cm to 4.5 cm (2.78 cm on average) (Table 1).

For all patients, anteroposterior (AP) radiography, obturator-oblique radiography, iliac-oblique radiography, as well as three-dimensional computed tomography (CT) scan of the pelvis were performed to evaluate the degree of acetabular deficiency and determine the preoperative planning. All cases had posterior segmental deficiency according to the AAOS classification system.

### 3.1. Operative Techniques

A single stage cementless THA without reconstruction was planned while preparing for reconstruction of the posterior wall and column for necessary situations. All patients received cefazolin as prophylaxis. Under spinal anesthesia, all hips were approached laterally in supine position. Femoral head allograft and titanium acetabular rings were ready at operating room. There were large posterosuperior segmental defects in all cases. Instead of using grafts to reconstruct posterosuperior acetabular deficiency, we tried to place acetabular implant more superior. After reaming, a cementless shell (Pinnacle, DePuy Inc./Accolate, Stryker) was inserted (Table 1). All acetabular cups fixed with two or three screws. All of them were found to be stable with > 90% bony contact. The femoral sides were treated using standard techniques and cementless stems (Corail, DePuy Inc/Trident, Stryker) of appropriate size were inserted (Table 1). The hip joints were stable through range of motion. In all cases, the limb length was restored.

Postoperative X-rays were performed in operation room to assess the acetabular sockets position. Superior displacement of the cup was evaluated by measuring the distance between the teardrop and the medial part of the cup in AP pelvic X-ray.

### 3.2. Postoperative Management

No hip precaution was performed for these patients. Aspirin 325 mg twice a day was emphasized to be used for at least 4 weeks to prevent deep venous thrombosis.

The patients were mobilized the day after operation using walker with weight bearing as tolerated program.

The patients were visited at 3 weeks, 6 weeks, 3 months and 6 months after surgery. Then they have been visited once a year. The patients were evaluated with the Harris hip scores (HHS), the length of the limbs and the pelvic X-ray preoperatively and postoperatively.

Loosening of the acetabular prosthesis was defined as over 4 mm displacement in any directions and over 4 degrees deviation from the acetabular abduction angle.

### 3.3. Statistical Analyses

T-test was used to compare the differences of HHS before and after surgery. A P value less than 0.5 was considered statistically significant. All analyses were performed using SPSS v.16 (Chicago Inc.).

## 4. Results

The mean operative time for these 7 patients was 70 minutes. There was an average of 45 months follow-up (ranged 39 - 52 months). Table 1 shows the characteristics of patients.

Postoperatively, the function of hip joints improved with HHS increasing from  $42.5 \pm 6.42$  to  $88.3 \pm 7.27$  (evaluated at 1 year postoperatively), which was significantly different ( $T = 12.49$ ,  $P < 0.0001$ , 95% confidence interval: -53.7872 to -37.8128). Preoperatively, there was an average of 2.78 cm shortening of limb, while the limb length increased on average 1.9 cm postoperatively.

Postoperative X-rays showed that the acetabular sockets were placed at a slightly higher position. In all cases, superior displacement of the center of rotation of the hip was 8 - 18 mm (average 14.4 mm), which was acceptable. The acceptable position for the acetabular cup is within 25 mm of the anatomical position (14).

No DVT and dislocation occurred in our patients. One early infection was occurred, which was managed with irrigation and debridement as well as antibiotic therapy for six weeks.

Heterotopic ossification of Brooker type I occurred in one patient after 5 months of surgery without any progression in the later follow-up.

**Table 1.** The Characteristics of Patients

Case	Age	Gender	BMI	Fracture Type	Preoperative HHS	Last HHS	Component Brand	Degree of Superior Displacement
1	41	Male	23.2	PW + PC	34.2	78.5	Pinnacle/Corail	12.8
2	34	Male	25.3	PW	45.6	91.3	Accolate/Trident	14.1
3	43	Female	32.1	PW	36.1	85.9	Pinnacle/Corail	15.0
4	62	Male	28.7	PC + PW	50.7	87.4	Accolate/Trident	16.6
5	41	Male	26.9	PW	47.8	93.9	Pinnacle/Corail	17.9
6	38	Male	21.4	PW	37.6	81.5	Pinnacle/Corail	8.1
7	35	Male	27.3	PW	45.5	99.6	Pinnacle/Corail	16.3

Abbreviations: PC, posterior column; PW, posterior wall.

## 5. Discussion

Generally, clinical outcomes of THA after conservatively treated, untreated or failed acetabular fracture fixation are often not as well as osteoarthritis because of unexpected acetabular bone deficiency (1). THA after untreated acetabular fracture is indicated in dysfunction of hip joint due to traumatic arthritis or femoral head necrosis after a few months (1). THA in these patients is time consuming and complicated. Acetabular bone deficiency should be estimated in preoperation planning. AP radiography, obturator oblique and iliac oblique radiography of the pelvis (6) and pelvic three-dimensional reconstruction of CT scan are essential to evaluate the acetabular defect. The surgical approach, the method for reconstruction of acetabular defect and the type of prosthesis should be considered in preoperative planning (9, 12). The perfect cup position is the anatomic center of hip rotation. In these patients, segmental acetabular defect should be managed to put the cup in the anatomic hip center. If cup coverage is more than 60% of host bone, structural bone grafting might be needed and if cup coverage is less than 50%, titanium cage is used (5, 12, 15).

Reconstruction techniques would be time consuming and need extensive surgical approaches with greater blood loss. However, we can place the cup superiorly at a high hip center for management of acetabular bone stock deficiency (3-5) although biomechanical studies have shown that superolateral placement of cup may lead to increased joint reaction forces (potentially higher rates of loosening) (7, 10, 13). Proximal placement of the hip center increases contact between intact, viable host bone and the acetabular implant. It also reduces the need for structural bone grafts and increases the chances for stable bony ingrowth between the host bone and the porous coating prosthesis when uncemented porous coated components are used (6, 10, 12).

The present study had some limitations; it was a case series with all the innate shortcomings of such study design. Our study reported the outcome of THA at a relatively short follow-up.

### 5.1. Conclusions

Total hip arthroplasty might be an effective treatment for missed or untreated posterior wall acetabular fracture. One of the most important challenges is how to approach the acetabular defect to make a stable construct and stable hip. The high hip center offers a technique for

reconstruction of an acetabulum with severe bony deficiency, while the majority of the remaining host bone is superior to the anatomic hip center. Further studies are needed to prove the long-term outcomes of this method.

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