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Percutaneous Column Fixation and Total Hip Arthroplasty for the Treatment of Acute Acetabular Fracture in the Elderly

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ABSTRACT

We used our database of primary total hip arthroplasties to identify those patients who had acetabular fractures fixed with percutaneous screws under the same anesthesia as for the arthroplasty procedure. There were 19 patients with the average follow-up of 22 months. Fourteen patients sustained the fracture secondary to a low-energy trauma, while the remaining patients were involved in a high-energy trauma accident. The mean survival time was calculated to be 2.5 ± 0.6 years for the low-energy group and 4 ± 1.4 years for the high-energy group. We believe that this unique treatment of acetabular fractures has a role in carefully selected patients and provides the necessary reduction and immediate stability of the fracture needed to ensure adequate fit for the acetabular cup in the subsequent THA.

The treatment of acetabular fractures remains an interesting challenge. Open reduction and internal fixation (ORIF) in the younger population has produced favorable outcomes, but has been found to have inferior outcomes in the elderly [1–11]. ORIF of acetabular fractures in the elderly is associated with higher rates of failure of fixation, early onset of heterotopic ossification, post-traumatic osteoarthritis, osteonecrosis of the femoral head and morbidity. Much of the difficulty in achieving operative success in the elderly is thought to be secondary to osteopenic bone, subchondral impaction, articular surface comminution and femoral head damage [1–4,6,8,11].

Thus various other treatment modalities for acetabular fractures in the elderly have been described, including non-operative management and delayed total hip arthroplasty (THA) [1,2,4,7–9,11]. However, they have both been found to lead to sub-optimal outcomes secondary to the lack of adequate bone quality and technical difficulties in performing THA in posttraumatic arthritis [1,2,4,8]. More recently, retrospective studies examining the role of combined ORIF and THA in the management of acetabular fractures in the elderly have demonstrated encouraging outcomes, in terms of functional scores and complications rates [1,2,4,8,11]. After taking into consideration the patient's age, comorbidities, extent of osteoporosis and fracture type, this combined method of treatment has led to faster mobility and improved functional scores [1,4,11–13]. However, a combined procedure has the associated risks of extended operative time and greater blood loss [1,4,11].

Recent studies support the use of fluoroscopic-guided percutaneous screw fixation for acetabular fractures with concomitant column involvement [14–17]. To help mitigate the risks of long operative times and extensive blood loss encountered with a formal ORIF and THA, we adopted a percutaneous fixation before the total hip arthroplasty. This unique treatment, using a minimally invasive fluoroscopic technique for the reduction and fixation of the acetabular fractures immediately followed by THA, has not been reported in the literature.

The purposes of this study are to report on the short-term outcomes of a percutaneous column fixation technique in conjunction with a THA for the treatment of acute acetabular fractures in the elderly and to note any apparent risk factors for a compromised early outcome.

Materials and Methods

Institutional review board (IRB) approval was obtained, and database of primary total hip arthroplasties (THA's) at our institution was searched to identify patients who had an acetabular fracture—with one or both columns involved—fixed by percutaneous column screws, through a minimally invasive technique, during the same anesthesia as THA. Isolated acetabular wall fractures and fractures reduced by open methods were excluded.

For identified subjects, charts were retrospectively reviewed for demographic data, BMI, type of fracture based on the classification of Letournel et al [5], mechanism of trauma based on the guidelines provided by Lonner and Koval [18] (fall, motor vehicle accident), comorbidities, complications, follow-up time, estimated blood loss (EBL), operating time (from skin to skin), length of hospital stay and

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associated injuries. The social security death index was used to identify patients who had died after their discharge from the hospital. Patients were categorized on the level of the energy of trauma that had caused the fracture. Fractures secondary to a fall from a standing height were categorized as low-energy trauma, while fractures related to motor vehicle accidents were considered a high-energy trauma. Between 2005 and 2011 there were 19 patients who met the inclusion criteria. The average age was 77 years (range, 57–90 years). The average time of follow-up was 22 months (range, 2–80 months). There were 13 males and 6 females. On average, 4.4 days passed between the date of admission and surgery (range: 0–9 days).

Kaplan–Meier survivorship curves were constructed using SPSS V. 21 with either death or revision of the hip implant as the end point. Independent *t*-tests were used to compare means between groups.

Surgical Technique

Distal femoral traction pins were inserted shortly after admission until the day of surgery. Patients underwent full medical evaluations prior to being scheduled for surgery. The decision to proceed with THA was based on the presence of degenerative joint disease warranting THA in the absence of acetabular fracture or severe joint damage secondary to the fractured acetabulum. All acetabular fracture fixations were done by one trauma fellowship-trained senior author, while all THA procedures were performed by one adult reconstruction trained surgeon.

All acetabular reductions and fixations were performed in a supine position. Arthroplasties were undertaken using a posterior approach with the patient in a lateral decubitus position.

Under general anesthesia, reduction of the acetabular fracture was attained through manipulation and longitudinal traction. Fracture reduction was judged using fluoroscopy and stabilized by percutaneously placed cannulated screws. One or two 6.5-mm cannulated screws were utilized for fixation of the displaced column fragment to the hemipelvis. In the case of both column fracture, the first screw was utilized to fix the anterior column fracture while a second screw was placed in an anterior to posterior direction through the ilium to fix the posterior column. After completion of the procedure, final fluoroscopic images confirmed accurate placement of screws and adequate reduction of the fracture.

Immediately following percutaneous column screw fixation, under the same general anesthesia, patients were turned into the lateral position and prepared for THA. Except for two stems, which were fixed by cement, all other THA components were cementless. Two or three screws were used to stabilize the metal shell in most patients (Figs. 1 and 2). All bearing surfaces were metal heads on polyethylene liners.

Results

Fourteen patients fractured their acetabulum by falling from a standing height (low-energy group) and five were involved in motor vehicle accidents (high-energy group) [18]. All patients had pre-existing medical conditions. Table 1 shows the demographic data, comorbidities and acetabular fracture patterns present at the time of admission.

Average estimated blood loss was 700 ml (range: 220–1800 ml), and the average operative time was 231 minutes (range: 125–465 minutes). Ten patients (53%) received intraoperative blood transfusions, averaging 1.9 units per operation used.

Ten patients were described as having osteoarthritis of hip after pathologic examination.

Eight patients (42%) suffered from postoperative medical and/or surgical complications related to the index surgery, as detailed in Table 2. Deep vein thrombosis and pulmonary emboli were found in two cases (10%), while heterotopic ossification was seen in four patients (21%). Wound infection, common peroneal nerve injury and hip dislocation were also seen in one case (5%) each.

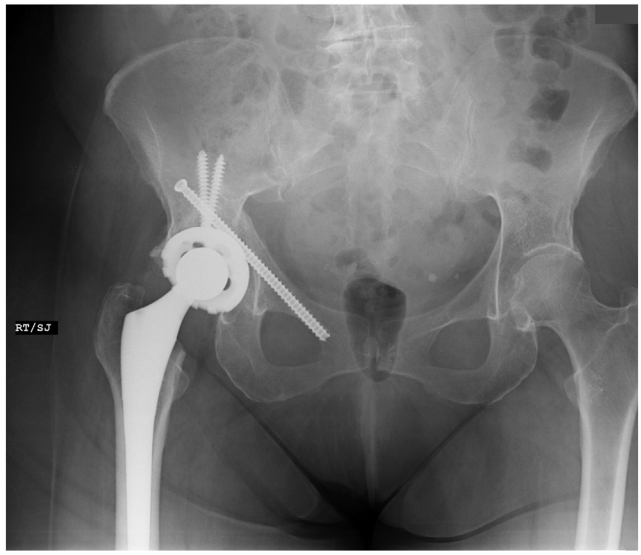

Fig. 1. Postoperative view of a patient with an anterior column fracture of the right acetabulum.

All patients who sustained a high-energy trauma had injuries other than acetabular fracture, while only three patients with a low-energy trauma had associated injuries. In total, eight patients sustained concomitant injuries from the original insult requiring further intervention. Associated injuries are presented in Table 3.

Eleven patients (58%) died within 38 months of the index surgery, with five (26%) of those dying within 1 year. Two patients (10%) died at the hospital following surgery secondary to cardiovascular complications. Both patients had sustained low-energy trauma.

Significant differences existed between the low- and high-energy groups with regard to survivorship, BMI, age and length of hospital stay. Average age at the time of surgery was 80 years for the low-energy group and 65 years for the high-energy group ($P = 0.01$), while the average BMI was 24.2 and 28.9 ($P = 0.01$), respectively. The average length of hospital stay was 13 days versus 40 days ($P = 0.03$), when comparing low- versus high-energy groups. Mean survival time was calculated to be 2.5 ± 0.6 years for the low-energy group and 4 ± 1.4 years for the high-energy group. Fig. 3 displays the Kaplan–Meier survivorship curve for the two groups.

Fig. 2. Postoperative view of a patient with a transverse type fracture of the left acetabulum.