Evaluation of External Fixation Results in High-risk Older Patients with Intertrochanteric Femur Fractures

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Keywords: Hip fracture; Trochanteric fracture; External fixation; High-risk patient; Osteoporosis; Pin migration

Introduction

Intertrochanteric femur fractures are common in older people. Advancing technology and treatment modalities have increased the life expectancies of males and females, so the incidence of these fractures is increasing [1]. Furthermore, with existing osteoporosis, bone fractures happen more easily with low-intensity trauma [2,3]. Given the high mortality and morbidity rates, it is important to treat these fractures surgically. In high-risk patients (American Society of Anesthesiologists (ASA) 3 and 4), however, surgery with internal fixation can cause excessive stress. Consequently, external fixation is another option for treating these high-risk patients [4,5]. External fixation [6-8], is superior to plate osteosynthesis due to shorter operation and hospitalization times, no need for blood transfusions, and earlier mobilization. We evaluated the results and complications of external fixation in elderly patients with stable and unstable intertrochanteric femur fractures.

Patients and Methods

Patients with intertrochanteric femur fractures were classified as surgically high-risk, if they had ASA scores of 3 or 4 [9,10]. Between January 2010 and November 2011, we treated 26 surgically high-risk patients with intertrochanteric femur fractures with closed reduction and external fixation under spinal anesthesia.

The fractures were classified as stable or unstable according to the modified Evans classification. In addition, the patients’ demographic information (age, sex, and involved side) was recorded. The medical conditions increasing the surgical risk were evaluated and stabilized by the anesthesiologists and internists. Once their medical condition was stabilized, the patients were taken to the operation room and operated on under spinal anesthesia using a pertrochanteric external fixator (Orthofix® pertrochanteric fixator), which is a specialized fixator for intertrochanteric femur fractures. Reduction was established by using plate and traction table under fluoroscopy guidance. Two or 3 shanz screws (6.5mm) were implanted for each proximal femoral region and femoral shaft.

No patient required transfusion during or after the operation. The operating time (minutes) and hospitalization duration (days) were recorded. The patients were given first-generation cephalosporins intravenously for 24 h postoperatively as antibiotic prophylaxis. Low-molecular-weight heparin was given subcutaneously every 12 h postoperatively for 3 weeks as venous thromboemboli prophylaxis.

The patients were mobilized with two crutches on the first postoperative day and allowed to bear partial weight. Full weight-bearing mobilization was allowed 6–8 weeks postoperatively if the radiological and clinical conditions were appropriate. Patients and their
relatives were informed how to clean and dress the wounds and how to exercise their knees and hips.

The patients were followed regularly at one month intervals. Anteroposterior and lateral x-rays were obtained. Fracture union, malunion, non-union, angulation, shortening, and implant failure (complications) were noted during follow-up. Varus malunion was defined as a >10° difference in the femoral neck-shaft angle between the fractured and uninvolved sides. Shortening malunion was defined as a >2-cm leg length discrepancy. Bipolar hemiarthroplasty was performed for hip revision if there were serious mechanical complications or non-union.

**Results**

Twenty-six high risk (ASA 3-4) patients with intertrochanteric femur fractures were admitted to our clinic over a nearly 2-year period. The average patient age was 85.5 (range 71-96) years and 16 patients (61.5%) had right-side fractures. There were 12 males (46.1%) and 14 females (53.9%). According to the modified Evans classification, there were eight (30.8%) stable and 18 (69.2%) unstable fractures.

Patients with ASA grade 3 accounted for 23.1% of the study population (six patients) and their average age was 82.6 years. The remaining 20 patients were ASA grade 4 (76.9%), and their average age was 86.3 years. All of the patients had at least one systemic disease that had to be stabilized preoperatively, including 14 in cardiac failure, 7 with prior myocardial infarctions, 3 with uncontrolled hypertension, and 2 with uncontrolled diabetes.

The average operating time was 27.1 (range 20–35) minutes and the median hospitalization was 7.8 days. The average time from fracture to operation was 2.4 days. The mean follow-up time was 24.4 months. Four (15.4%) patients died during early post-operative period due to systemic diseases; three of them were female. All four patients who died were ASA grade 4, so 20% of the ASA grade 4 patients died during follow-up (2 of them died during follow-up after revision surgery).

No complications occurred in 13 patients, 2 of them died during follow-up. Of the remaining 13 patients with complications during follow-up, 10 (38%) had implant failure (6 patients with pin migration, 4 patients with pin cut-out) and 3 (11.5%) had pin tract infections before union. Six (2 patients with pin migration, 4 patients with pin cut-out) of the twenty-six patients (23.1%) underwent revision surgery, and two of these died after the revision operation. There were no infections after revision (Figure 1).

Of the patients who had implant failure, 60% were underwent re-operation. The revision involved a bipolar hemiarthroplasty of the hip. Of the revision patients with pin migration, one of them died after the re-operation. The remaining four implant failure patients, who did not have revision, had delayed union resulting in shortening and varus malunion. Two of 3 patients with pin tract infections had varus malunion and shortening after union. Six patients had malunion (shortening and varus), comprising 46% of the patients with complications (Figure 2).

The patients with pin tract infections were treated with antibiotics, regular dressings, and periodic debridement. The external fixators were removed as soon as possible after union.

In the patients with no complications, the time to union was 13.4 weeks. The patients with complications (except dead and revised ones) achieved union after 17 weeks.

**Discussion**

Advancing technology and treatment modalities have increased the life expectancies of males and females, so the incidence of intertrochanteric femur fractures [1] has increased. Given the high mortality and morbidity rates of these fractures [11,12], especially in older people, there are concerns about surgical treatment options. Furthermore, osteoporosis causes mechanical complications such as shortening, collapse, and pin penetration, increasing the concerns about the stability of fixation methods. In our series, although we demonstrated the advantages of external fixation [6-8], such as shorter operating and hospitalization times, no need for blood transfusions, and earlier mobilization, there was a high complication rate in our high-risk patient group especially due to mechanical causes. Some patients with complications underwent revision using bipolar hemiarthroplasty, which increases the hospital stay and blood loss, impairs the biology due to open surgical trauma, and places excessive stress on the patients’ general health. Increased costs are another important concern. Although external fixation is useful for reducing patient mortality and morbidity, the results of complications can cause more devastating situations.

Pin tract infection is an important complication because of the high postoperative incidence [13-15]. However, treatment is relatively easy, especially after pin removal. In our study, the pin tract infection rate....

**Figure 1:** a) Preoperative x-ray of a patient in the no-complication group. b) X-ray of the same patient at 14 weeks shows union.

**Figure 2:** a) Preoperative x-ray of a patient in the complication group. b) The x-rays at 4th week, c) The x-rays at 8th week, d) The x-rays at 11th week. There was pin migration and the hip was revised with a bipolar hemiarthroplasty.
was moderate and the infections were treated easily with antibiotics, debridement, and pin removal. However, this caused some patient discomfort.

Some clinical studies emphasize the advantages and benefits of external fixation in high-risk older people with intertrochanteric femur fractures, especially with newer-design external fixators. The surgical technique is an important determinant of mechanical complications. With optimum technique and improved implant design [7,14,16], mechanical complications can be reduced to a negligible level. Until that time, the golden standard treatments of pertrochanteric fractures should be DHS/DCS fixation systems or proximal femoral intramedullary nails. Because they have superior mechanical properties and less mechanical complications in compared to external fixation [17].

In conclusion, in light of our findings, we do not recommend using pertrochanteric external fixators in high-risk patients due to the high revision rate and mechanical complications. Well-designed prospective controlled studies with more subjects are needed to quantify the advantages and disadvantages of this technique.

Conflict of interests

Authors have no conflict of interests to disclose

References