Conversion Hemiarthroplasty and Valgus Osteotomy After Failed ORIF of Hip Intertrochanteric Fractures

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Abstract: Hip arthroplasty after open reduction and internal fixation of the proximal femur presents a challenge to reconstructive surgeons. Bony defects, fracture malunion, and nonunion increase the risk of complications, including intraoperative fracture, unrecognized perforation, and trochanteric nonunion. The authors describe a novel surgical technique using conversion hemiarthroplasty and valgus osteotomy for failed open reduction and internal fixation of intertrochanteric hip fractures. The described surgical technique resulted in trochanteric advancement and preservation of the bone stock in the intertrochanteric region. This technique was successful in eliminating pain and restoring ambulation and abductor function and resulted in stable ingrowth and healing in these patients.

Mechanical failure and the need for reoperation after open reduction and internal fixation (ORIF) of the proximal femur can be a devastating complication with significant risk to the patient and challenges for the surgeon.\(^1\)\(^2\) Internal fixation devices frequently gain poor purchase in the osteopenic bone of elderly patients, and the limited life expectancy, poor compliance, and potential need for immediate full weight bearing support the use of conversion to a rigidly fixed prosthetic arthroplasty in this population.\(^3\)\(^4\) Previous studies for failed intertrochanteric fractures have dealt mainly with cemented prostheses, resulting in a significant rate of complications.\(^5\)\(^6\) Cement extravasation from nonunited fractures and screw holes has been a concern, contributing to prolonged operative times and increased operative difficulty.\(^9\)\(^10\) Intraoperative fractures and trochanteric nonunions have also been reported.\(^4\)\(^11\) Malunion and nonunion within the proximal femur may necessitate osteotomy of the proximal femur during arthroplasty and the need for supplementary fixation devices, which can be additional sources of complications.\(^4\)

The current authors describe a novel surgical technique (Table 1) that uses existing defects in the proximal femur from internal fixation devices to correct malunion and protect and preserve the intertrochanteric portion of the femur during conversion hemiarthroplasty. This technique has been successfully used at the authors’ institution in 4 patients presenting with mechanical failure following ORIF of the proximal femur. The S-ROM (DePuy, Warsaw, Indiana) system was used in all patients. These patients presented with pain, difficulty ambulating, and radiographic failure following ORIF of an intertrochanteric fracture.

Surgical Technique

With the patient in the lateral decubitus position, a standard posterolateral approach was performed. The hip was dislocated and the hardware was identified. Dr Bono is a consultant for Stryker Orthopedics; and receives royalties from Stryker, Sectra, and Springer.

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would be required to correct the nonunion or malunion. The defect from the lag screw was then identified and curetted of any fibrous tissue.

Following prophylactic cerclage wiring of the femur, the cylindrical proximal reamers were then inserted into the screw tract proximally, aiming out of the defect in the lateral femoral cortex distally. The screw tract was serially reamed to accept a trial sleeve from the S-ROM system (Figure 1A). Using an oscillating saw, a freshening osteotomy was then performed at or below the base of the proximal sleeve trial, which allowed for definitive correction of the deformity and for access to the femoral shaft for distal preparation (Figure 1B).

The proximal femur was then retracted and protected as reaming of the femoral canal was performed. Trial components were then inserted, resulting in a relative advancement of the trochanter for improved stability. Because minimal radiographic evidence of degenerative disease on the acetabulum was observed, a bipolar component was used (Figure 2A). The modularity of the S-ROM system allowed for appropriate restoration of offset, length, and version. The spout of the proximal sleeve component was oriented in the region of maximal bone stock.

The final components were then inserted, and the osteotomy site was inspected while the hip was taken through a full range of motion to ensure complete seating of the components and rigid fixation of the proximal and distal femur. Prior to closure, reamings and autogenous bone graft from the femoral head were then packed around the osteotomy site to promote healing. Postoperatively, patients maintained protected weight bearing for 6 to 12 weeks postoperatively until radiographic evidence of bony consolidation at the osteotomy site.

**RESULTS**

**Patient 1**

A 67-year-old woman presented with progressive hip pain 4 months after ORIF of a left intertrochanteric hip fracture with a 4-hole sliding hip screw performed at another institution. Clinically, she had severe pain with range of motion and 1 cm of shortening and required crutches for ambulation. Radiographs revealed progressive varus collapse and nonunion at the fracture site with superior migration of the screw. The patient underwent conversion to bipolar hemiarthroplasty using the S-ROM system after 4 months postoperatively. The patient tolerated the procedure well, and no peri- or postoperative complications were observed. Radiograph evidence of calcius at the osteotomy site was observed 6 weeks postoperatively, and the patient advanced to full weight bearing as tolerated. At her most recent follow-up 12 months postoperatively, the patient was pain free and ambulated without assistive devices. Her Harris Hip score was excellent (100 points). Radiographs showed complete union of the osteotomy site and no evidence of component migration (Figure 2B).

**Patient 2**

A 71-year-old woman presented with increasing hip pain 17 months after ORIF of a comminuted reverse obliquity intertrochanteric fracture with a 6-hole sliding hip screw. She required a walker for ambulation and noted progressive shortening of the extremity. Radiographs revealed progressive varus collapse and nonunion at the fracture site with superior migration of the screw. The patient underwent conversion to bipolar hemiarthroplasty using the S-ROM system as described. The patient tolerated the procedure well, and no peri- or postoperative complications were observed. Radiographic evidence of calcius at the osteotomy site was observed 6 weeks postoperatively, and the patient advanced to full weight bearing as tolerated. At her most recent follow-up 74 months postoperatively, the patient was pain free and ambulated without assistive devices. Her Harris Hip score was excellent (100 points). Radiographs showed complete union of the osteotomy site and no evidence of component migration (Figure 2B).
plasty using the S-ROM system as described. The patient tolerated the procedure well, and no peri- or postoperative complications were observed. At her most recent follow-up 68 months postoperatively, the patient was pain free and ambulated without assistive devices. Her Harris Hip score was excellent (100 points). Radiographs showed complete union at the osteotomy site and no evidence of component migration (Figure 3B).

**DISCUSSION**

Several factors may complicate conversion arthroplasty following ORIF of the proximal femur. Nonunion, screw holes, and screw tracts have the potential to weaken the proximal femur. Malunion and remodeling, typically into a varus position, complicate insertion of a prosthetic device, necessitating an osteotomy to avoid further damage to the greater trochanter. The proximal femur may also be distorted by callus, which may obscure access to the intra-medullary canal.

Multiple authors have reported prosthetic replacement after failed ORIF of fractures of the proximal femur, mainly using cemented components, which yielded variable results. Good to excellent results have been reported in 66% to 100% of cases using predominately cemented total hip arthroplasty (THA) or hemiarthroplasty. Reported complications included trochanteric nonunion, fracture, lateral hip pain, and an increased rate of dislocation. A history of fracture or nonunion of the proximal femur is one of the most significant risk factors for dislocation following THA.

Haidukewych and Berry reviewed the results of prosthetic replacement in 60 patients with failed ORIF: 32 treated with THA and 28 with hemiarthroplasty. The majority of patients were treated with cemented components, with a 20% rate of complications. At 5 years postoperatively, 89% of the surviving patients reported mild or no pain and 91% continued to ambulate (45% unassisted). Five patients reported moderate or severe pain in the region of the greater trochanter, and 5 patients had trochanteric nonunion with greater than 1 cm of proximal migration. Five reoperations and 2 dislocations were also reported.

Zhang et al reviewed the results of arthroplasty in 19 patients after intertrochanteric fracture using cemented components and noted a high rate of complications (47%), including a 32% rate of intraoperative fracture and a 16% rate of postoperative dislocation. After a minimum follow-up of 2 years, Harris Hip scores averaged 79.8, and no loose components were observed. Mariani and Rand compared the results of arthroplasty and revision ORIF in a group of 20 similar patients with intertrochanteric nonunion. At a mean of 6.6 years, all patients in the arthroplasty group demonstrated improved pain and function; however, Harris Hip scores were best in those patients who achieved union after revision ORIF. In addition, recent studies have demonstrated superior results for THA over hemiarthroplasty in cases of acute fracture; however, many reports on patients undergoing conversion arthroplasty following ORIF for fracture have not noted a significant difference in results between those treated with THA and those treated with hemiarthroplasty.

The described technique has many theoretical advantages. Cannulation of the proximal femur to allow for prosthesis provides rigid fixation and ingrowth of the prosthesis. This potentially improves hip strength, hip stability, and the quality of ambulation. The modular prosthesis provides rigid fixation of the femur to allow for reliable healing of the osteotomy, as well as options for version, length, and offset. This technique also obviates the need for trochanteric fixation or supplementary plating, a potential source of pain, as well as cement, which has the potential for extravasation, prolonging operative time and increasing operative difficulty.

Potential limitations of this technique should be addressed. In cases of severe compromise of proximal bone stock or nonunion involving the shaft of the femur, a distally coated or cemented stem should be considered to avoid early prosthetic loosening. Furthermore, elderly patients with severe compromise of proximal bone...
stock may require a proximal femoral replacement to address the pathology. In addition, younger patients may be better served with an attempt at revision ORIF and bone grafting prior to salvage with arthroplasty.

CONCLUSION

This novel technique has provided excellent clinical and radiographic results in the authors’ patients with intermediate-term follow-up. Conversion hemiarthroplasty and femoral osteotomy using a modular prosthesis may be an appropriate alternative to more traditional cemented and non-cemented arthroplasty techniques while avoiding trochanteric complications.

REFERENCES