The purpose of this retrospective clinical study was to evaluate the rates of wound and neurologic complications and clinically significant heterotopic ossification, Brooker stage 3 and 4, with the modified Ollier transtrochanteric approach for the treatment of acetabular fractures. The study group comprised 94 consecutive patients (95 acetabuli) who had unstable acetabular fractures requiring surgical fixation. All patients were treated with open reduction internal fixation via the Ollier approach by a single surgeon (L.E.D.). Demographic and clinical information regarding rates of wound and neurologic complications and remaining articular stepoff at fixation was obtained from a chart review. The degree of heterotopic ossification was graded from standard anteroposterior pelvis radiographs according to the Brooker classification.

Six (6%) patients underwent reoperation for infection; however, only 3 (3%) of these patients had deep infections. Three (3%) patients had iatrogenic sciatic nerve injuries; only 1 patient had persistent sensory changes at final follow-up. Thirteen (18%) of the 73 patients with radiographs available for review at a minimum of 3-month follow-up had Brooker grade III heterotopic ossification and 1 (1%) patient had grade IV. Five (5%) patients underwent excision of heterotopic ossification. Fourteen (17%) of 81 patients had no radiographic union of the greater trochanteric osteotomy, but none of these patients required further surgery.

The complication rates of the Ollier approach in this study compare favorably with alternative surgical approaches reported in large series. We believe this approach provides excellent exposure without increasing the risk of complications.

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Multiple surgical approaches exist for the operative treatment of acetabular fractures. The extended iliofemoral and triradiate approaches are extensive and provide simultaneous access to the anterior and posterior columns, as well as direct visualization of the articular surface. Although they provide excellent exposure, these approaches are associated with higher complication rates, including heterotopic ossification. The triradiate incision has been associated with a high rate of wound complications.

At the senior author’s (L.E.D.) institution, the triradiate transtrochanteric approach was initially used in the treatment of all acetabular fractures. Realizing the rare need for the inferior limb of this incision to achieve adequate exposure, he stopped using this portion of the incision. The resultant incision was U-shaped. Ollier previously described this approach, and modifications of the Ollier approach were described for the treatment of acetabular fractures, as well as for periacetabular osteotomies for dysplastic hips.

We hypothesized that the rates of wound and neurologic complications and clinically significant heterotopic ossification (Brooker stage 3 and 4) with the modified Ollier transtrochanteric approach would be no higher than with other surgical approaches reported in large series.

**Materials and Methods**

After obtaining Institutional Review Board approval, a retrospective review was performed of a consecutive series of patients who underwent open reduction and internal fixation (ORIF) of an acetabular fracture by a single surgeon (L.E.D.). This review identified 94 patients (95 acetabula) who underwent operative fixation via a modified Ollier transtrochanteric approach between January 1994 and December 2003.

Ninety-four patients (95 acetabula) had charts available for review, including 69 men and 25 women with a mean age of 36 years. Minimum follow-up was 3 months, with an average of 9 months of follow-up for the series. Forty-two patients fractured the right acetabulum, and 53 patients fractured the left acetabulum. The stratification of the different fracture types, classified according to Judet et al., is listed in Table 1. All patients, regardless of fracture type, were treated using the modified Ollier approach at the discretion of the senior author.

Fifty-one (54%) patients had concomitant extremity fractures at injury. Twelve (13%) patients also sustained head injuries. Mean time from injury to operative fixation was 7 days. Mean surgical time for ORIF was 170 minutes, with a mean estimated blood loss of 732 cc. Eleven (12%) patients developed deep venous thrombosis. Sixty-three (66%) patients received prophylaxis for the development of heterotopic ossification, which consisted of scheduled indomethacin or naproxen. Forty-eight (76%) of these patients received prophylactic medication postoperatively and on discharge from the hospital for 6 weeks, whereas the remaining patients received indomethacin while they were inpatients.

Demographic and clinical information was obtained from a chart review. In addition, standard anteroposterior (AP) pelvis and Judet views were taken at the final clinic visit and were reviewed for evidence of heterotopic ossification and trochanteric osteotomy union. The degree of heterotopic ossification was graded according to the Brooker classification.

**Surgical Technique**

The patient is turned into the lateral position with the injured hip up and prepped and draped in the usual fashion. The hip is extended and the knee flexed throughout the procedure. An incision is made starting at the anterior superior iliac spine, curving down 2 cm inferior to the greater trochanter and back up into the buttock along the orientation of the fibers of the gluteus maximus (Figure 1).

Scarpa’s fascia and the tensor fascia lata are transected in line with the incision. The
Gluteus maximus is split bluntly similar to a Kocher-Langenbach exposure. The sciatic nerve is identified early and protected throughout the procedure. The knee is kept flexed throughout the procedure to keep tension off the nerve, and care is taken when working posteriorly to identify the nerve and protect it from injury.

A trochanteric osteotomy is performed, taking care to protect the circumflex artery posteriorly, and the trochanter and abductor musculature is elevated superiorly using a Cobb elevator and Mayo scissors to dissect it from the capsule and the lateral wall of the ilium. A Schantz pin is placed in the femur just distal to the osteotomy site. A Charnley retractor is then placed with the fixed end over the osteomized trochanter to retract the gluteus musculature and the adjustable end reversed on the peg with the end hole over the Schantz pin. A capsulotomy is then made around the periphery of the acetabulum at the edge of the labrum, and the capsule is reflected to expose the femoral head and the acetabulum (Figure 2). Once this capsule is cut, distraction from the Charnley retractor and manipulation of the femur via the Schantz pin allows visualization of the articular portions of the acetabulum (Figure 3).

The acetabulum is debrided of organized clots, and the fracture site is exposed intra-articularly. After debriding the fracture site, the fracture is reduced and secured with the appropriate internal fixation (Figure 4). Direct intra-articular inspection is used to confirm that the reduction of the articular surface is adequate and that none of the screws are intra-articular. The capsule is closed with interrupted #0 resorbable sutures. The greater trochanter is repaired using two 4.5-mm cortical screws with washers lagged to the medial cortex of the femur. The remainder of the wound is closed using #0 resorbable interrupted sutures in the iliotibial band and fascia, with running sutures in Scarpa’s fascia. The subcutaneous tissue is closed with #2-0 resorbable sutures, and the skin is closed with staples.

RESULTS

Data regarding the degree of articular stepoff noted by direct visualization of the articular surface at the end of the procedure was available in the operative notes of 65 patients. Eighty-four percent of those patients had <1 mm of articular stepoff by direct visualization intraoperatively. Ninety-eight percent of patients had <3 mm of articular stepoff.

Six (6%) patients underwent reoperation for infection. Of these 6 patients, 3 (3%) had superficial infections that re-
solved with antibiotics following the initial irrigation and debridement. Three (3%) patients had deep infections that led to additional procedures. One patient underwent irrigation and debridement 2 weeks after ORIF of her acetabulum, and then underwent a Girdlestone procedure 3 months later. The other 2 patients underwent Girdlestone procedures at initial irrigation and debridement, 6 weeks and 14 months following fixation of their fractures, respectively. Average operative time for the patients who developed an infection was 199 minutes, compared with 162 minutes for those without infection. Average body mass index (BMI) for patients who developed infections was 32 vs 28 for the patients without infections.

Three (3%) patients had incomplete iatrogenic nerve injury following ORIF of their acetabular fracture. One patient developed a slight decrease in sensation involving the deep peroneal nerve distribution, which was completely resolved 6 months postoperatively. The second patient had worsening of a partial preoperative sciatic nerve palsy with increased weakness of his tibialis anterior following ORIF. The patient’s neurologic examination was normal at 6-month follow-up. The final patient developed a partial motor and sensory sciatic nerve palsy postoperatively. At final follow-up, >4 years later, he had grade 4 plantar flexion strength and persistent decreased sensation in the tibial nerve distribution.

Seventy-three (77%) patients had radiographs available for review at a minimum of 3 months of follow-up. Thirteen (18%) of these patients had Brooker grade 3 heterotopic ossification, and 1 (1%) patient had grade 4. Three (23%) of the 13 patients with grade 3 heterotopic ossification also sustained head injuries, and 7 (54%) of the patients with grade 3 heterotopic ossification received no prophylaxis. The patient who developed grade 4 heterotopic ossification did not have a head injury and also received no heterotopic ossification prophylaxis. Five (5%) patients had excision of heterotopic ossification, 1 of whom had Brooker grade 4.

Eighty-three percent (67/81) of the patients who had radiographs for review showed complete radiographic union of their greater trochanter osteotomy. No patients with incomplete radiographic union of their osteotomy required additional procedures, such as bone grafting or revision fixation. Thirteen (14%) patients underwent removal of the greater trochanteric screws. In addition to hardware removal, 2 of these patients underwent greater trochanteric bursectomy and osteoplasty. One patient sustained an avulsion fracture through the previous greater trochanter osteotomy site 1 month postoperatively, which required revision ORIF. This patient went on to heal this fracture uneventfully and underwent removal of the greater trochanter screws 3 years later.

**DISCUSSION**

Complication rates using the modified Ollier approach in our study compared favorably with those found in previous studies (Tables 2, 3). Assuming an acceptable complication rate, a complete view of the articular surface of the acetabulum (Figure 3B) is especially advantageous in the treatment of the more complex fracture types where dependence on indirect reduction techniques may be insufficient to attain acceptable reduction.

This modification of the previously described Ollier approach allows wide exposure and direct reduction of complex acetabular fractures through a single approach. This includes visualization and reduction of the articular portion of the fracture, which cannot be done using only intraoperative fluoroscopy.

The strength of this study is a large series describing what may be an unfamiliar approach to many acetabulum surgeons used to more standard approaches. It provides excellent exposure with a relatively low complication rate relative to historical rates associated with other extensile exposures. Weaknesses of this study relate to the retrospective design and the bias that is inherent to such a study. Also, this article only addresses the complication rate of the exposure and does not attempt to address the functional outcome scores or long-term radiographic evidence of maintenance of reduction without posttraumatic arthritis, which may or may not be achieved with any approach. However, given the exposure afforded intraoperatively, which allows the surgeon visualization of the quality of the anatomic reduction of the articular surface even in the most complex cases, the long-term outcomes should depend on the ability of the surgeon to achieve an anatomic reduction.

**CONCLUSION**

The modified Ollier transtrochanteric approach provides extensile exposure and direct visualization of the articular surface of the acetabulum. Although the senior author finds this approach useful for all acetabular fracture types, the approach is most useful for the optimal visualization of the more complex, associated fracture patterns. The complication rates associated with the modified Ollier approach in this study compare favorably with alternative surgical approaches reported in large series. This surgical approach provides excellent exposure with an acceptable risk of complications.

**REFERENCES**


