

Conversion Total Hip Arthroplasty with a Direct Anterior Approach for Failed Treatment of Acetabular Fractures

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Abstract

Keywords

- ▶ acetabular fracture
- ▶ total hip arthroplasty
- ▶ direct anterior approach
- ▶ nerve palsy
- ▶ dislocation

Total hip arthroplasty (THA) is a salvage procedure after failed treatment of acetabular fractures. Technical challenges increase the risk of perioperative complications, specifically nerve palsy and dislocation. The direct anterior approach (DAA) was evaluated to mitigate these risks. Clinical and radiographic outcomes were reviewed retrospectively. Thirteen patients underwent conversion THA. Of the 13, nine had been treated with open reduction internal fixation (ORIF), one with traction, and three conservatively. When possible, retained hardware was deliberately left in place. At a mean follow-up of 4 years, there were no major complications, readmissions, revisions, or deaths. Two nonunions managed with autografting went on to union. The mean HOOS (hip disability and osteoarthritis outcome) Jr score at follow-up was 89. These data suggest that the DAA may be a reasonable alternative to the posterior approach in this high-risk population.

Despite even the best attempts at conservative treatment or acute open reduction internal fixation (ORIF) of acetabular fractures (AF), a subset of patients will develop post-traumatic hip arthritis. An analysis by Giannoudis et al reported that 13 to 44% of patients with prior surgical management of AF will develop symptomatic changes, and 9% will eventually undergo conversion total hip arthroplasty (THA).¹

The historical rates of success of conversion THA after AF are variable. One study shows a 10-year survival rate of 97% after conversion THA while more disappointing studies reveal that up to 32% may fail and require revision THA.^{2–4} Frequent complications include heterotopic ossification, instability, nerve palsy, infection, and aseptic loosening.⁵ All these series involved a posterior surgical approach to the hip.

While the posterior approach is well studied, we propose the direct anterior approach (DAA) as an alternative. Theoretically, the DAA interval may avoid the scarring and existing hardware associated with classical AF approaches. For posterior wall and

column fractures, the Kocher-Langenbeck approach used in the majority of ORIF surgeries is opposite to the anterior incision. For the treatment of anterior column and wall fractures, the ilioinguinal and modified Stoppa approaches used for acute ORIF both involve incisions that are superior to a typical DAA incision.

Given the intrinsic technical difficulty of conversion THA, the choice of an approach separate from a prior injury and surgical interval may reduce some of the complexity. Therefore, the purpose of this study is to examine the technical details, clinical outcomes, and failures of DAA conversion THA after AF.

Methods and Materials

We retrospectively reviewed a total of 13 patients with failed AF treatment who required conversion THA between 2011 and 2018. In all patients, a DAA THA was performed regardless of

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Letournel fracture pattern or surgical approach used in prior ORIF.⁶ Surgery was performed by a single surgeon at a single institution with a minimum of 2 years follow-up. Charts were reviewed for indications, medical history, and mode of treatment failure. Hospital records were reviewed for complications, reoperations, and readmissions. Outcomes measured were patient-reported HOOS Jr validated scores, revision, and death.⁷ All patients consented to participate in the database. The study was approved by the Institutional Review Board.

Surgical Technique

The patient was placed on the Hana table in the standard fashion. A DAA was performed as described by Matta et al.⁸ Dissection was taken to the level of the hip. After capsulotomy, the head was removed in the standard fashion.

Attention was turned to the acetabulum. Preoperative planning indicated if the existing hardware was likely to impinge on acetabular preparation or cup seating. Unless the presence of plates and screws conflicted with the cup, no further dissection was performed, and no attempt was made to remove the hardware. If the hardware impinged on the reamer or cup, a metal cutting burr was used to either remove a portion of the plate or to break the screw. Any metal debris was removed by copious irrigation, and the cup was placed under fluoroscopic guidance. The femur was finished in the standard fashion.

In this series, patients were allowed to progress with weight bearing as tolerated and without dislocation precautions. Patients were anticoagulated with aspirin for 3 weeks unless stronger anticoagulation was specifically indicated based on risk stratification, degree of immobility, and prior medical history.

Results

The average age of patients at the time of index surgery was 61 years (range, 45–80). Patients included seven men and six women. Using the Letournel classification, there were six elementary fractures and seven associated fractures.⁶ Nine patients had undergone ORIF, one was treated by 6 weeks of femoral traction, and three were treated conservatively. For the nine surgical patients, the most common method of fixation was plates and screws. Seven had undergone a

posterior Kocher-Langenbeck approach, and two had been treated through an ilioinguinal approach.

The modes of initial treatment failure requiring conversion THA varied. Nine patients presented with post-traumatic arthritis, two with avascular necrosis, and two with nonunions. The average time from fracture to conversion DAA THA was 16 years (range, 1–28).

At the time of surgery, no secondary incisions were needed, and no attempts were made to remove any hardware that was not directly impinging on the acetabular implants. Cementless acetabular cups and femoral stems were used in all cases. The two cases of nonunion were treated with adjunctive morcellized femoral head autografting and partial weight bearing postoperatively for 6 weeks (►Fig. 1). Both nonunions progressed to union by follow-up.

The average EBL was 165 mL (range, 100–300). The average time of surgery was 78 minutes (range, 61–90). No patient required transfusion. No patient required care in the ICU. The average length of stay was 2 days (range, 1–6). Twelve patients were discharged to home, and one patient was discharged to a skilled nursing facility.

Outcomes

The mean follow-up was 4 years (range 2–9). At the final follow-up, the average HOOS Jr was 89 points (range, 49–100). A preoperative HOOS Jr score was not available for comparison. The patient with a score of 49 complained of severe knee pain limiting her ability to navigate stairs and chairs but commented that her hip was no longer painful.

Complications

At final follow-up, there were no perioperative fractures, nerve injuries, dislocations, infections, readmissions, revisions, or deaths.

Discussion

Seven of the patients in this series had undergone ORIF through a Kocher-Langenbeck approach. Use of the posterior approach through a prior Kocher-Langenbeck incision is an obvious and expedient way to access scar tissue and existing

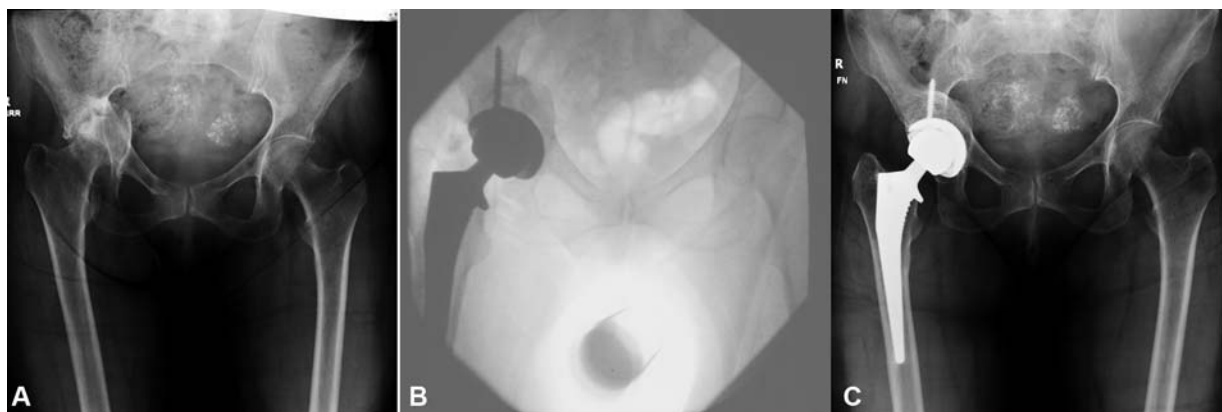


Fig. 1 Radiographs of a 68 year old with a central fracture dislocation 1 year after injury. (A) Preoperative radiograph of the pelvis. The right hip with an unstable anterior column, posterior hemitransverse fracture with nonunion. (B) Intraoperative fluoroscopy shows adjunctive morcellized femoral head autografting. (C) Anteroposterior radiograph of the pelvis taken at 8 years of follow-up.

hardware for removal. The concern, however, is that operating in this area of prior surgery may potentially increase the risk of postoperative complications. A DAA approach may be a reasonable alternative in these challenging cases.

The reported risk of sciatic nerve injury is greater after conversion THA. In a review of 654 patients, Makridis et al reported an iatrogenic nerve palsy rate of 2%.⁹ In a series of 53 patients, Zhang et al noted three sciatic injuries (5.7%).¹⁰ The sciatic nerve is typically encased in scar tissue after a Kocher-Langenbeck approach, and its anatomical position may be altered from posterior plating. Surgically, it is common to dissect out the sciatic nerve and isolate it with a penrose drain to keep it out of harm's way. However, even this subtle, protective maneuver may contribute to nerve dysfunction. In contrast, the sciatic nerve and surrounding scar are avoided from an anterior approach. Though nerve injury will always remain a significant risk, we found no postoperative sciatic nerve palsies in this series.

Another major risk of conversion THA is dislocation. Initially, the posterior soft tissues and hip capsule are disrupted by both the trauma of the injury and the further dissection needed to accurately reduce the fracture. At the time of conversion THA through a posterior approach, the scar tissue and pseudocapsule which stabilize the joint may have to be excised. Ranawat et al reported a dislocation rate of 9% in describing the "removal of all scar debris and hardware in conflict with the acetabulum."¹¹ The risk of dislocation, therefore, may be minimized by approaching the joint anteriorly and maintaining the protective connective tissue that has formed over the hardware (→Fig. 2).

Two patients in this series had a history of anterior column fractures with an ORIF performed through an ilioinguinal approach. As the incision for the ilioinguinal approach is curvilinear and runs medial to the anterior superior iliac spine, the anterior dissection down to the hip capsule for conversion

THA was not impeded by scar tissue. No additional difficulty was noted in these associate-type anterior fractures (→Fig. 3).

In this series, additional dissection was rarely needed through the DAA. In working anteriorly, not only was scarring around the sciatic nerve bypassed, but the plates and screws were rarely obstructive during exposure of the hip or seating of the cup (→Fig. 4). In those instances of hardware conflict, the presence of an intervening screw became clear by the chatter it created during reaming. A metal cutting burr was then used at the two visible edges of the screw to remove the mid portion, and a bone tamp was used to rotate away the residual ends. The hemisphere of the underlying cancellous bone was now fully accessible for implant seating.

Functional outcomes after THA are dependent on the presence of adequate bone stock for restoration of the hip center. While the articulation itself may have become arthritic from the initial injury and there was some loss of congruency, there was sufficient bone stock without the need for augments or structural grafts in 11 of our cases.

In comparing AFs treated with or without ORIF, Gavaskar et al noted that initial surgery facilitated later reconstruction, and conversely that 75% of the patients treated without ORIF required further management of major bone defects.¹² Lai et al also noted significant bone defects in 67% of the cases treated conservatively.¹³ In our series, two patients required bone grafting in the presence of a nonunion, one who was treated conservatively and one with prior ORIF.

While it is possible to use structural graft from a DAA approach, it is likely we might have chosen a more traditional extensile approach should the need for more extensive augmentation have been identified on preoperative planning. In one of our cases, however, a transverse T-type AF nonunion that had not been expected was identified. Because the posterior plating from prior ORIF was found to maintain stability of the columns, we proceeded to restore bone stock using morcellized

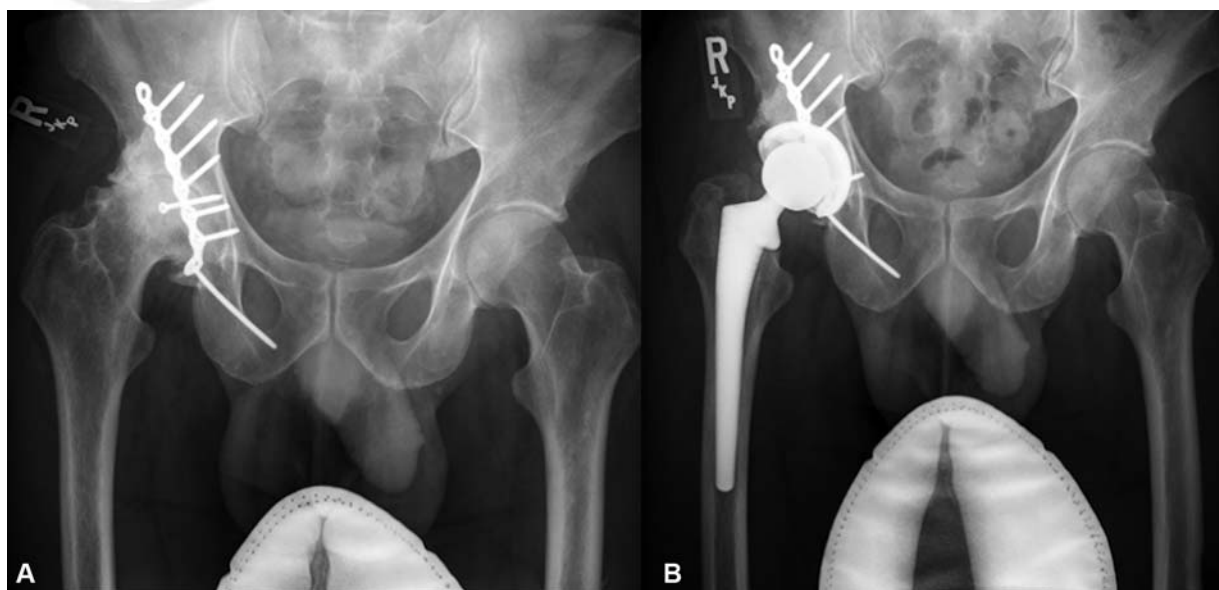


Fig. 2 Radiographs of a THA after ORIF of posterior wall and posterior column fractures. (A) Preoperative radiograph of the right hip shows posterior plating and post-traumatic arthritis. (B) Posterior plate is retained around a THA. A middle screw in the plate and the posterior wall fixation screw were removed through the acetabulum. ORIF, open reduction internal fixation; THA, total hip arthroplasty.

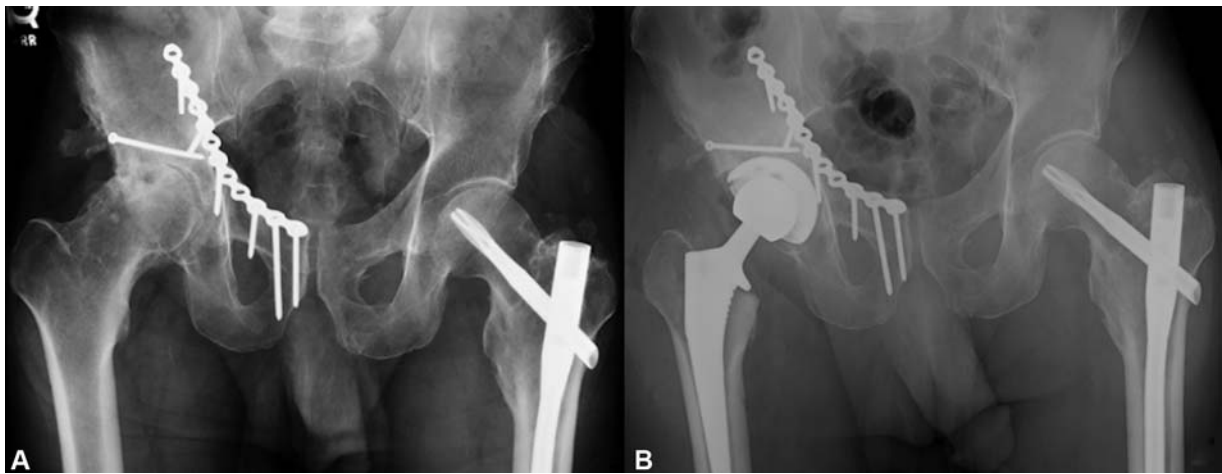


Fig. 3 Radiographs of an anterior column fracture treated through an ilioinguinal approach. (A) Preoperative radiograph of the right hip shows anterior plating with post-traumatic arthritis. (B) Postoperative radiograph showing THA in place with retention of all prior hardware. THA, total hip arthroplasty.

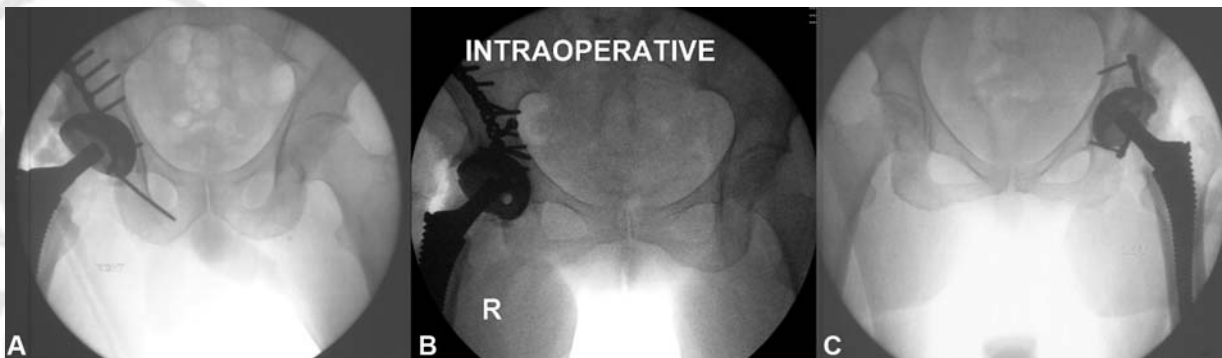


Fig. 4 Intraoperative imaging used to guide placement of the cup around retained hardware. (A) Posterior column ORIF conversion THA. (B) Anterior column ORIF conversion THA. (C) Posterior wall ORIF conversion THA. ORIF, open reduction internal fixation; THA, total hip arthroplasty.



Fig. 5 THA in a patient with nonunion after ORIF. (A) Transverse T-type fracture managed with posterior plating. (B) Intraoperative imaging confirming cup position and placement of morcellized femoral head autograft to fill the bone defect. (C) At 6 years follow-up, fracture with union and restoration of bone stock. Vertical migration of the cup noted 3 weeks postoperatively with no further positional change since then and no instability. ORIF, open reduction internal fixation; THA, total hip arthroplasty.

autograft from the femoral head and canal. The patient is doing well at 6 years follow-up (→Fig. 5).

Restoring the hip center of rotation (COR) also reduces the risk of acetabular failure after conversion THA. Ranawat et al reported that a nonanatomic hip center significantly increased the risk of revision surgery.¹¹ Elevating the COR is sometimes intentional and at times unintentional after prior treatment

of AFs. During surgery, it is not uncommon that malunions and scarring often distort the gross anatomy and potentially obscure the proper starting point for reaming. Thus, the adjunctive use of fluoroscopy with DAA approach is a helpful guide in locating the proper COR for cup placement. It was not uncommon to either reposition or redirect the acetabular orientation after reviewing the live images.

For patients with prior AF, delayed THA offers the potential for an improved quality of life. Makridis et al reviewed 11 studies of nonacute THA that showed Harris Hip Scores ranging from 74 to 93 points in follow-up. In this series, the HOOS Jr mean score was 89.

Modern anesthetic and surgical techniques may make conversion THA safer and more resistant to failure. Medically, Lai et al noted a mean transfusion rate of 2.7 units packed red blood cells after conversion THA.¹³ Current usage of tranexamic acid may lead to a decrease in these historical rates. In this smallish series, the rate of blood transfusion was 0%. Further, changing trends in implant choice and improvements in implant durability are likely to improve the prognosis for these patients. The earliest studies by Romness and Lewallen using cemented cups and stems described a revision rate of 41.6%.¹⁴ Using cementless components, several authors reported longer term survival rates of up to 97% at 10 years.⁴ Another significant advance is the routine use of HXLP. Further the use of HXLP may reduce the risk of wear, osteolysis, and revision associated with conventional polyethylene.³

The limitation of this study is that it is a single surgeon's small retrospective series. Larger number of patients and longer follow-up may reveal a complication profile similar to that of other series. Finally, a preoperative HOOS Jr score was not available for comparison.

Conclusion

In conclusion, the sequelae of a prior AF greatly increase the relative complexity of conversion THA. Retained hardware, tissue scarring, distorted anatomy, and bone deficiency present formidable challenges. Historical outcomes with a posterior approach reveal a high incidence of perioperative complications, especially nerve injury and dislocation. This small series presents a potential alternative to prior techniques in an attempt to minimize complications. Conversion DAA THA is a reproducible technique associated with acceptable perioperative risks and reasonable long-term outcomes.

Conflict of Interest
None declared.

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