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CASE REPORT

Combined acetabular and femoral neck fractures with intrapelvic femoral head dislocation: Successful staged management of a rare injury in two cases

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ABSTRACT

Combined central acetabular and femoral neck fractures with intrapelvic femoral head dislocation is an infrequent situation that provides a problematic condition for surgeons attempting to reconstruct the hip joint. Herein, we report two cases involving central acetabular fracture-dislocation combined with intrapelvic dislocation of a fractured femoral neck. Each case involved associated injuries that made primary total hip arthroplasty (THA) impossible and necessitated using the fewest skin incisions possible. As a result, we first attempted a posterior acetabular fixation of both the anterior and posterior columns with intra-articular plating of the anterior column. Finally, a cementless acetabular cup was implanted. There were no complications identified during the stages of reconstruction up to and including THA. The two patients' final Harris Hip scores were 98 for the first patient (at five years), and 91 for the second patient (at 1 ½ years). In conclusion, staged reconstruction of the hip joint with intra-articular acetabular plating does not weaken the acetabular bone that can accept insertion of THA with cementless biological acetabular fixation without complications and with an acceptable clinical outcome up to five years.

Keywords: Central acetabular, dislocation, femoral neck, intra-articular, intrapelvic.

In the orthopedic literature, combined acetabular and femoral neck fractures with intrapelvic femoral head dislocation are rare. A 2014 study found minimal occurrences.[1] Moore[2] was the first to describe this injury configuration after post-mortem examination of a patient with a pelvic injury in 1851. Stewart and Milford[3] described only one intrapelvic femoral head dislocation case in their large series. Judet et al.[4] reported only two cases, whereas the other authors did not encounter this injury pattern in their case studies.[5,6]

This complex injury has only been managed in four cases in the English literature.[7-10] Two more cases were described in two more Spanish publications.[11,12] Meinhard et al.[7] were the first to describe the management and follow-up of a single case treated with open reduction and internal fixation with screws and developed hip arthritis within two years. More cases followed, with different procedures to replace the damaged joint over a stable acetabular bearing bone.[8-12]

In this article, we report two cases of central hip fracture-dislocation with femoral head intrusion into the pelvis. A single posterior approach was used to fixate both the anterior and posterior columns, with intra-articular plating of the anterior column. The final stage of management involved total hip arthroplasty (THA) with a cementless cup. The staged management with intra-articular acetabular plating did not compromise the acetabular ability to receive

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a cementless cup with no complications and an excellent clinical outcome.

CASE REPORT

Case 1- A 27-year-old man was crushed between the train and the platform seven years ago. A general assessment and resuscitation were performed at a local hospital with the insertion of a urinary catheter, which revealed frank hematuria. After transfer to our emergency department and a thorough examination, the extremities' neurovascular status was intact. However, a Moral-Lavallee lesion over the right hip was noted. Additionally, the left arm was broken. Pelvic X-rays, computed tomography (CT) scan and an ascending urethrogram revealed the followings: *(i)* fracture of the femoral neck, right hip; *(ii)* anterior with posterior hemi-transverse acetabular fractures according to Judet and Letournel,[4] with the femoral head completely dislocated inside the lesser pelvis; *(iii)* right sacroiliac joint disruption; *(iv)* Denis type 2 left sacral fracture; *(v)* tetra-rami fracture of the anterior pelvic ring (Figure 1); *(vi)* fracture of the left humerus (AO/ASIF; 12-A2).[7] Ascending urethrogram showed extra-peritoneal rupture of the bladder.

Urology surgeons performed a vertical midline laparotomy and discovered the femoral head embedded in the bladder tear without any soft tissue attachment and contaminated by urine and the femoral head was discarded. We stabilized the pelvic injury with a supra-acetabular external fixator and bilateral iliosacral screws following bladder repair over a suprapubic catheter. After 10 days, the patient's general condition was stabilized with corrected anemia and improved contusion around the hip. The extra-peritoneal drain was removed with non-infected healing of the laparotomy wounds allowing for fracture fixation. The external fixator rod was temporarily removed, while the patient was under general anesthesia to facilitate positioning. After stabilizing the posterior column fracture with a 4.5-mm reconstruction plate using the Kocher-Langenbeck approach, a significant central defect in the acetabular floor was noticed. With the possibility of the contaminated abdominal cavity, that was against another anterior approach, the anterior wall fracture was fixed with a 3.5-mm reconstruction plate from within the acetabular inner surface (intra-articular fixation) using two screws into the anterior wall and two screws into the acetabular dome. A static cement spacer loaded with antibiotics (2 g gentamicin + 2 g vancomycin/40 g bone cement) was inserted inside the acetabulum (Figure 2).

Eight months later, the patient was prepared for the third stage: i.e., THA, after complete healing of fractures (assessed by X-rays and CT scan films) and exclusion of infection (average values of white blood cell [WBC], erythrocyte sedimentation rate [ESR], and C-reactive protein [CRP]). A limb length discrepancy of 2 cm was evident. Under spinal anesthesia, the spacer and the intra-articular anterior plate were removed. The anterior and posterior fractures were completely healed with no areas of non-union; however, the acetabulum showed a defect in the medial wall. The acetabulum was slightly over-reamed, and a cancellous bone graft obtained from the proximal femoral canal was used as a plug for the defect. A 62-mm Ringloc-X cementless multi-hole acetabular shell (Zimmer-Biomet, Warsaw, IN, USA) was used to achieve a perfect fit. A standard offset, size 5, cementless Exception® (Zimmer-Biomet, Warsaw, IN, USA) stem was used for the femur with a 36-mm ceramic head articulating with E1 cross-linked polyethylene liner (Zimmer-Biomet, Warsaw, IN, USA). Limb length was equalized. The wound was closed in layers over a drain.

Toe-touch weight-bearing with a frame was allowed immediately, and full weight-bearing started at six weeks. The patient returned to his pre-injury job as a civil engineer three months after the THA. At five-year follow-up, functional Harris Hip Score (HHS)

FIGURE 1. X-ray and computed tomography views of the fractures. **(a)** Anteroposterior X-ray view of the pelvis. **(b)** Coronal computed tomography cuts. **(c)** Axial computed tomography cuts.

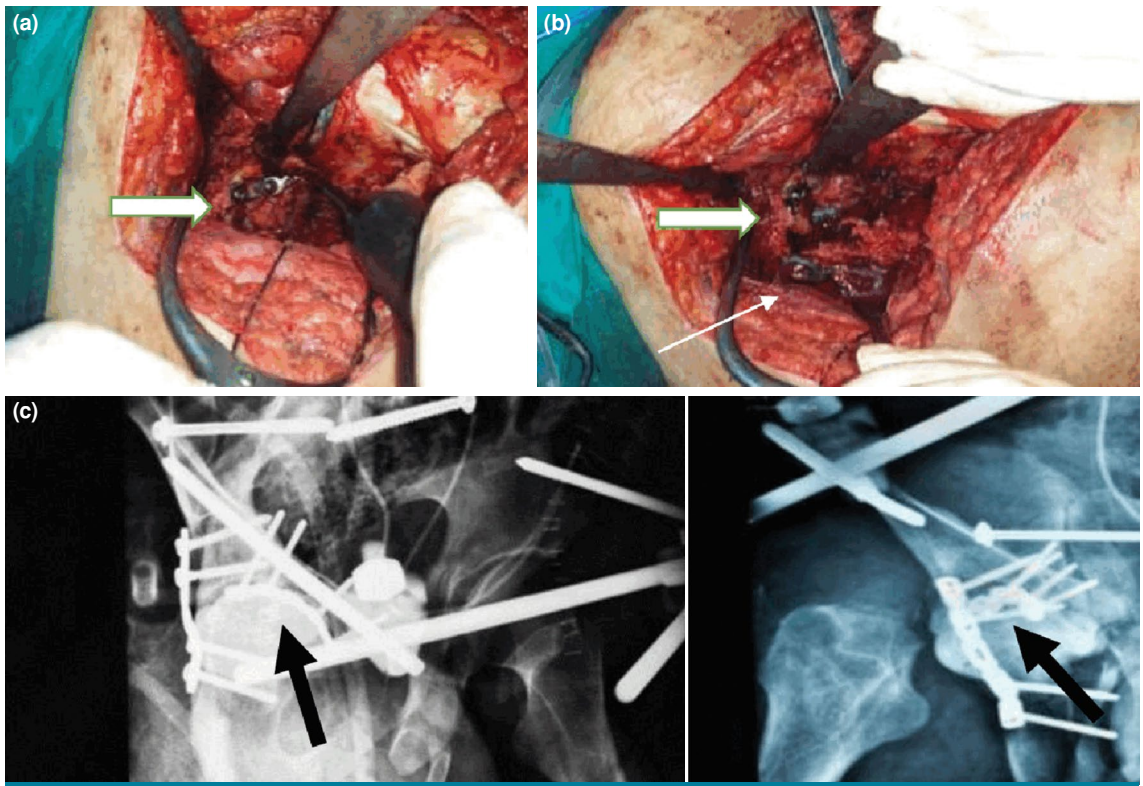

FIGURE 2. Images of the fixation of the acetabular columns. **(a)** An intraoperative image showing the intra-articular fixation of the anterior column by 3.5-mm reconstruction plate (thick arrow). **(b)** An intraoperative image showing the 4.5-mm plate for the posterior column (thin arrow) and the 3.5-mm plate for the anterior column (thick arrow). **(c)** Postoperative X-ray views after fixation of the acetabular fractures. Black arrow points to the intra-articular plating.

was 98 at the final follow-up. No signs of loosening were observed (Figure 3). A written informed consent was obtained from the patient.

Case 2- A 54-year-old man was admitted to our emergency department after a motor car accident two years ago. After initial resuscitation, orthopedic examination revealed tenderness over the left hip region with externally rotated limb position. The left knee region showed contusions with an open wound over the lateral side (Gustilo-Anderson type 2). In addition, the left ankle was swollen and deformed with skin bullae. Pelvic, left knee, and left ankle

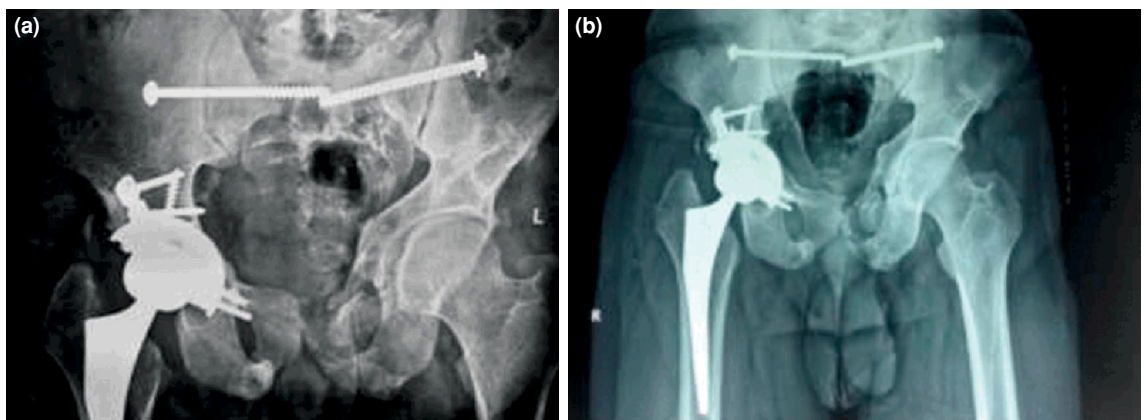

FIGURE 3. Postoperative X-ray showing the cementless total hip arthroplasty. **(a)** Immediate postoperative X-ray view. **(b)** Following a five-year follow-up.

FIGURE 4 X-ray and computed tomography views of the fractures. **(a)** Anteroposterior X-ray view of the pelvis. **(b)** Three-dimensional reconstruction CT cuts.

X-rays were done, CT scans of the pelvis, with 3-mm acetabular cuts, the left knee and left ankle revealed the followings: *(i)* T-shaped comminuted fracture of the left acetabulum; *(ii)* femoral neck fracture of the left hip with an intra-pelvic position of the head through central dislocation (Figure 4); *(iii)* tibial plateau fracture (AO/ASIF; 41-B3); and *(iv)* Pilon fracture of the left ankle (AO/ASIF;43-C3).

Thorough debridement of the knee wounds with the application of a bridging external fixator was performed together with an under-image reduction of the ankle joint, followed by applying a Delta-frame external fixator.

Within seven days, the local condition of the knee joint improved, allowing for the fixation stage. Through the Kocher-Langenbeck's posterior approach, the posterior column fracture component was distracted, allowing delivery of the femoral head through the floor defect. The femoral neck stump appeared end-on, facilitating the extraction of the head using bone rongeurs. Then, fixation of the posterior column was done using two 4.5-mm reconstruction

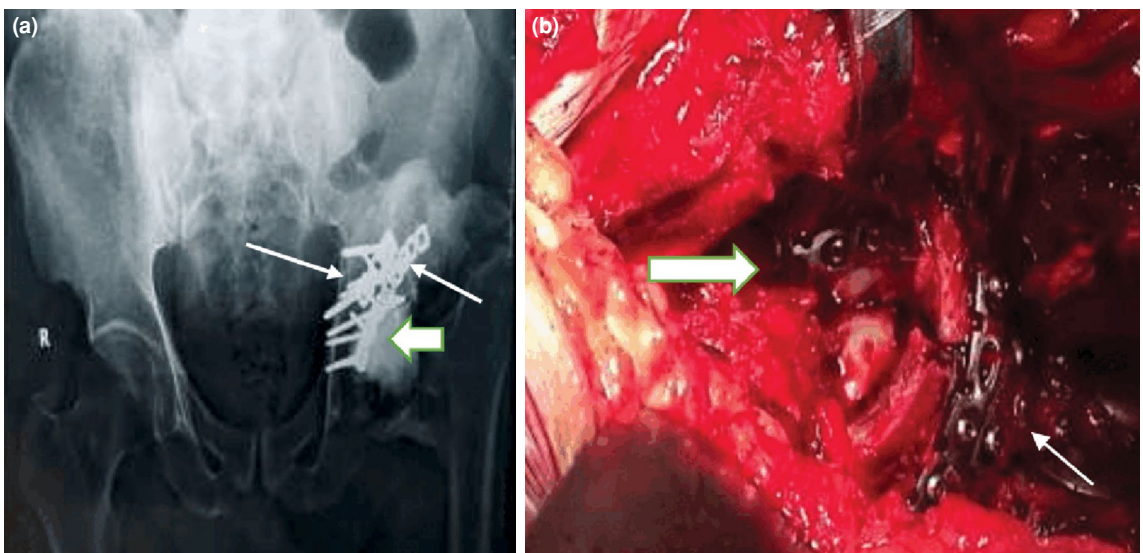

FIGURE 5. Images of the fixation of the acetabular columns. **(a)** Postoperative X-ray views after fixation of the acetabular fractures. Thick arrows point to the intra-articular anterior plate and thin arrows to the posterior plates. **(b)** An intra-operative image showing the 4.5-mm plate for the posterior column (thin arrow) and the 3.5-mm plate for the anterior column (thick arrow).

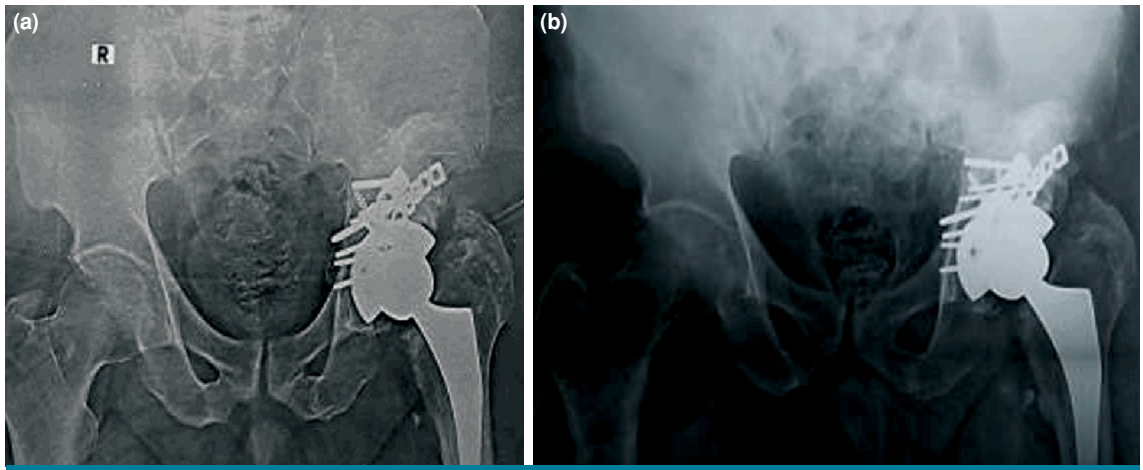

FIGURE 6. Postoperative X-ray showing the total hip arthroplasty. **(a)** Immediate postoperative X-ray view. **(b)** Following an 18-month follow-up.

TABLE I
Overview of the cases of combined central acetabular and femoral neck fractures with intra-pelvic femoral

	No. of patients	Age (years)	Fractures (+ femoral neck)	Management	Consequences
Meinhard et al.[7]	1st	27	Acetabular	Fixation of the neck + vascularized graft/ posterior approach	
Mestdag et al.[8]	1st	52	Acetabular Pelvic ring	Traction for 3 months	
Mesa et al.[10]	1st	27	Acetabular	Delayed primary THA after 6 month	-
Aparicio et al.[11]	1st	56	Acetabular Pelvic ring Greater trochanter	Extraction of the femoral head Fixation of the Gtrochanter/lateral approach	Patient rejected second operation. Traction and rehabilitation
Hidalgo-Pérez et al.[12]	1st	57	Acetabular	Extraction of the femoral head Primary cementless THA + femoral head autograft/Lateral approach	Incorporated graft Excellent score at 4 years
Dusak et al.[9]	1st	57	Acetabular	Femoral head autograft-primary THA	Excellent score at 5 year. Return to a pre-injury job.
This study, 2022	1st	27	Acetabular (anterior column + posterior hemitransverse) Pelvic ring	Staged: 1st Pelvic fixator + percutaneous iliosacral screws. 2nd acetabular plating (posterior column + intra-articular anterior column) 3rd after 8 months; cementless THA/posterior approach	Excellent at 18 months
	2nd	54	Acetabular (T-shaped fracture)	Staged: Fixation posterior + intra-articular anterior columns 9 months: THA	

THA: Total hip arthroplasty.

plates. The floor fragment was reduced with fixation of the anterior column with a 3.5-mm intra-articular reconstruction plate. A cement spacer loaded with antibiotics was inserted inside the acetabulum (Figure 5). Fixation of knee fracture was done in the same session. The ankle joint needed two more weeks for the skin condition to improve to allow for internal fixation.

Nine months after the fixation stage, total healing of the acetabular fractures was confirmed by CT and X-ray films permitting the THA stage. Through the posterior approach, removing the anterior plate and the spacer was done, followed by the insertion of a cementless Trilogy® multi-hole cup with a Longevity® polyethylene insert (Zimmer-Biomet, Warsaw, IN, USA). A 36-mm head was used over a cemented Exception® stem of standard offset (Zimmer-Biomet, Warsaw, IN, USA) (Figure 6). The postoperative period passed uneventfully. Toe-touch weight-bearing with a frame was allowed immediately, and full weight-bearing started at six weeks. At the latest follow-up, 18 months after THA, there was a limb length discrepancy of 1.5-cm; however, the HHS was 91. A written informed consent was obtained from the patient.

DISCUSSION

This report presents staged management of two cases with intrapelvic femoral head dislocation following the acetabulum and femoral neck fractures. Intra-articular fixation of the anterior column through the posterior acetabular approach was challenged to produce the best possible results that enabled successful implantation of the delayed THA using cementless biological acetabular fixation without complications and with an acceptable clinical outcome up to five years of follow-up.

Central acetabular dislocation results either from a direct blow to the greater trochanter with the hip in 30 to 50° of internal rotation or an axially directed blow to the flexed knee with the hip flexed to 90° with abducted to 40 to 50°.[4] Experimentally, it could be produced by an impact on the trochanteric region.[13]

Meinhard et al.[7] believed that the proximal femur in one moment of impact (in internal rotation) could transmit most of the force to the central portion of the acetabular fracturing it. Then, some abduction degrees occurred in a second moment, concentrating the forces on the weakest element: i.e., the incarcerated femoral neck causing its fracture.

Moya Aparicio and de la Torre García[11] described the second step of the abduction of the femur that placed the femoral neck under the solid upper lip of the acetabulum, similar to a guillotine for the femoral neck.

The highly severe combination that intrudes the femoral head into an utterly intrapelvic position to float freely inside the pelvis is a scarce situation. Based on our literature search, such injuries were reported only in four cases in the English literature.[7-10] In Spanish literature, two more reports were published that described two cases.[11,12]

The management of these cases varied. Meinhard et al.[7] fixed the head using 4 'Kadar' type screws with a vascularized graft. After two years, the patient had symptomatic post-traumatic hip arthritis. Mestdagh et al.[8] performed cementless total hip replacement three months after skeletal traction to integrate the acetabular fracture. Mesa et al.[10] described the management of a patient with delayed cementless THA six months after injury. The result was satisfying, and the patient walked without aids. The follow-up included only the first six months after surgery. Dusak et al.[9] reported a managed case three weeks after injury by primary cemented THA after femoral head autograft of the defect and insertion of acetabular cage fixed with multiple screws. However, the follow-up period of this case was not mentioned. Hidalgo-Péreza et al.[12] also used a single-stage reconstruction, presuming the primary THA would provide greater benefits and prevent complications, if there was no technical contraindication due to associated pelvic or sacrum fractures.

Delayed THA after more than three months was successful in two studies.[8,10] This load-deprivation period allowed for proper healing of the acetabulum, and insertion of cementless acetabular cups were feasible afterward. Moya Aparicio and de la Torre García[11] proposed a two-stage reconstruction with the femoral head extraction and the fractured greater trochanter fixation as the first stage. The second stage was aborted as the patient was content at that management level. Table I shows the overview of the cases of combined central acetabular and femoral neck fractures with intra-pelvic head dislocation and their management.

The situation in our cases was more cumbersome. In the first case, pelvic injuries with acetabular comminution were associated with urological injuries necessitating staged reconstruction. The potentially contaminated anterior field, due to urological intervention, prevented an anterior approaching of the acetabulum and provided a chance to fix

the anterior column with an intra-articular plating through the posterior approach. Afterward, the acetabular column healing allowed delayed THA with cementless acetabular cup implantation. In the second case, in the presence of potentially infected distal injuries to the acetabular fracture, we decided against primary THA and fixed both acetabular columns through a single posterior approach. Delayed THA was done with an excellent score.

Intra-articular fixation of the anterior acetabular column was not described before in the literature. This method was attempted to help stabilize the acetabulum through one approach, thereby reducing the complication rates, including infection and wound problems. In both cases, non-infected healing was achieved without weakening of the acetabular bone that could accept the insertion of stable cementless acetabular cups, and a five-year follow-up of the first case showed no signs of loosening.

Both of our cases were treated with cementless acetabular cups. While certain arguments concerning the best cup attachment method exist,[14,15] this is not the case with acetabular reconstruction following a fracture. Initially, acetabular components, both cemented and uncemented, were used to treat post-acetabular fracture arthritis.[16,17] Subsequent research indicated that a sclerotic acetabular bone bed following fractures is inappropriate for cement fixation. Recent developments in cementless acetabular fixation have improved the radiological and functional characteristics of THA following acetabular fractures; as a result, this technique of fixation is used for cup placement in these situations.[18,19]

Although this study includes the most extended follow-up of a case suffering this form of injury, a primary conclusion can only be taken about the effectiveness of the intra-articular acetabular fixation method due to the limited number of cases and the need for it due to circumstances. It cannot be concluded whether this procedure can be performed in all similar cases. However, due to the scarcity of this fracture pattern, this method may serve as an aiding tool under certain situations.

In conclusion, staged reconstruction of the hip joint with intra-articular acetabular plating enabled successful implantation of the total hip prosthesis without complications and with an acceptable clinical outcome in this complex situation. Intra-articular acetabular fixation method did not weaken the acetabular bone and allowed for a delayed cementless cup insertion.

Declaration of conflicting interests

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