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Case Report

Functional outcome of type 4 Pipkin classification of femoral head fracture operated by open reduction internal fixation by ganz safe surgical dislocation approach management: a case report

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ABSTRACT

Fracture of the femoral head is a severe, relatively uncommon injury; typically, it may have associated with traumatic posterior dislocation of the hip joint with or without acetabulum fracture. The Pipkin classification is the most commonly used classification system. Controversies include the preferred surgical approach (anterior versus posterior) versus ganz safe surgical dislocation approach and whether to perform femoral head fragment excision or internal fixation. Presenting a case report of 28 years old young male with a motor vehicle road traffic accident and suffered a head of femur fracture on right hip joint with posterior wall of right acetabulum fracture with Judet-Letournel type posterior wall and type 4 Pipkin's classification of femoral head fracture. This patient was undergone for emergency surgical intervention of open reduction, internal fixation through Ganz approach and insertion of Herbert screws for femoral head and interfragmentary screw for trochanteric osteotomy. The patient was followed up for 1 year and have a complete range of motion at hip joint with painless daily lifestyle. Type 4 Pipkin classification of femoral head fracture managed timely and with surgical intervention by ganz safe surgical dislocation approach provides visualization to femoral head and whole acetabulum with internal fixation of femur head by herbert screw which preserves normal anatomic contour of femoral head shows appropriate reduction of fracture fragments and it may also avoid hemiarthroplasty surgeries. Fracture of the femoral head has been associated with a relatively poor functional outcome and requires timely management and surgical intervention. Specially type 4 Pipkin classification of femoral head fracture treated by ganz safe surgical dislocation approach with internal fixation of femur head by herbert screw shows better outcome and avoid risk of AVN of femoral head. Complications associated with fracture of the femoral head and subsequent treatment include osteonecrosis, post-traumatic osteoarthritis, heterotopic ossification and implant failure.

Keywords: Acetabulum fracture, Pipkin classification, Judet-letournel type

INTRODUCTION

Femoral head fractures are relatively uncommon injuries and are usually associated to traumatic dislocation of hip after high-velocity trauma (e.g. motor vehicle accidents or sport injuries). Approximately six to 16% of posterior hip dislocations have been noted to be associated with a femoral head fracture.[4] Degree of fragmentation, location and size of the femoral head fragment are related to the position of the hip at the time of the trauma.[3]

Pipkin classification of these fractures in four types according to fracture morphology and relation with femoral neck or acetabular fractures: fracture caudal to the fovea capitis (type I), fracture cephalad to the fovea capitis involving the weight-bearing portion of the femoral head (type II), fracture inferior to the fovea centralis (type I or II) plus femoral neck fracture (type III) and femoral fracture associated to acetabular fracture (type IV). Reduction of a dislocated hip is a true surgical emergency. Related complications of delayed reduction and the

development of osteonecrosis is highly associated in case of delayed presentation. The goals of definitive treatment for acute femoral head fractures are to achieve an anatomic hip reduction and to restore or maintain stability, and to remove interposed bony fragments if necessary.

At a presentation of our case 28 years old young male truck driver with road traffic accident suffered with type 4 Pipkin's classification of femoral head fracture with Judet-Letournel type posterior wall margin of right acetabulum fracture with posterior hip dislocation on right side and investigated by X-rays and computed tomography (CT) scan.

CASE REPORT

A 28 years old male truck driver suffered a road traffic accident while he was sitting in the truck's cockpit. 2-hour post-accident, patient was brought to casualty by an ambulance. The patient was thoroughly examined and was undergone X-ray and CT examination in the emergency.

Figure 1: Anteroposterior X-ray image of the pelvis.

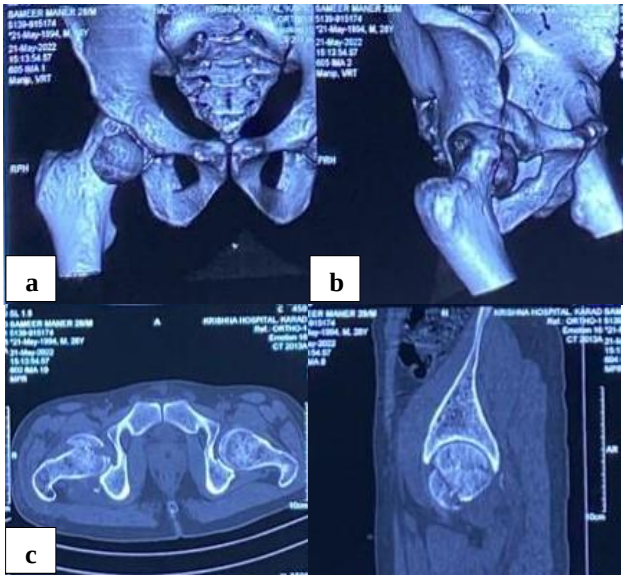

Figure 2: a) 3D CT image of pelvis, b) and c) cross-sectional image of the pelvis.

The imaging revealed the right sided posterior hip dislocation with fractured head of femur with inferior displacement of fracture fragment with fracture of posterior margin of right acetabulum was noted. Because of severe fractures and dislocation, femoral head was blocked by the posterior margin of acetabulum. After recognizing the irreducibility and severity of fracture dislocation, we opted for emergency surgical intervention.

Figure 3: Post-reduction anteroposterior X-ray image of the pelvis.

Surgical techniques

During the operation, In the lateral decubitus position, a Kocher-Langenbeck incision is made and the fascia lata split accordingly. A compromised blood supply to the femoral head is much less likely with use of Ganz method compared with posterior surgical hip dislocation approaches. The step-cut trochanteric flip osteotomy with a maximal thickness of about 1.5 cm is made along this line with an oscillating saw is performed, allowing exposure of the anterior capsule, which was incised in 'Z' shape allowing safe surgical dislocation of head anteriorly. This preserves and protects the profundus branch of the MFCA, which becomes intracapsular at the level of the superior gemellus muscle. The entire flap, including gluteus minimus, is retracted anteriorly and superiorly to expose the superior capsule. This is facilitated by further flexion and external rotation of the hip.

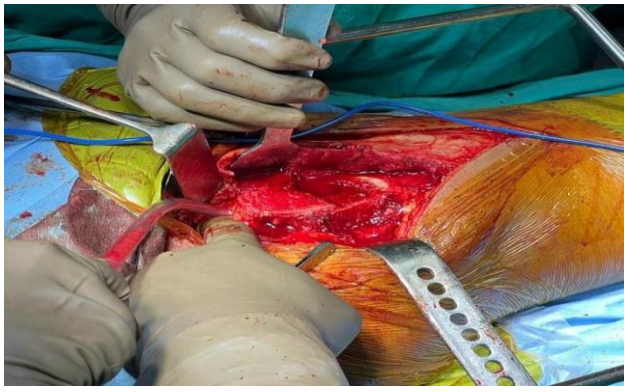

Figure 4: Intra-operative image showing step-cut trochanteric flip osteotomy.

Figure 5: Intra-operative image showing safe anterior dislocation of hip.

The hip can now be dislocated; the leg is flexed, externally rotated, brought over the front of the operating table, and placed in a sterile drape allowing inspection of most of the acetabulum. The stump of the ligamentum teres remaining on the femoral head may be resected.

The foveolar artery, which is frequently patent in the ligamentum teres, is not a major source of blood supply to the femoral head. By manipulating the leg, the surgeon now has 360° access to the acetabulum and of nearly 360° to the femoral head.

Figure 6: Intra-operative image showing internal fixation with herbert screws.

Fracture fixation is performed with use of herbert screws followed by relocation of the head, closure of the capsulotomy, and fixation of the trochanteric osteotomy. Posterior marginal fragment of acetabular wall was excised.

The mean length of stay after surgery was seven days (5 to 12). There was no special postoperative management apart from oral rivaroxaban 10 mg dose given at evening for three weeks. The standard rehabilitation programme starting after the first follow up at six weeks, included a self-administered abductor protocol.

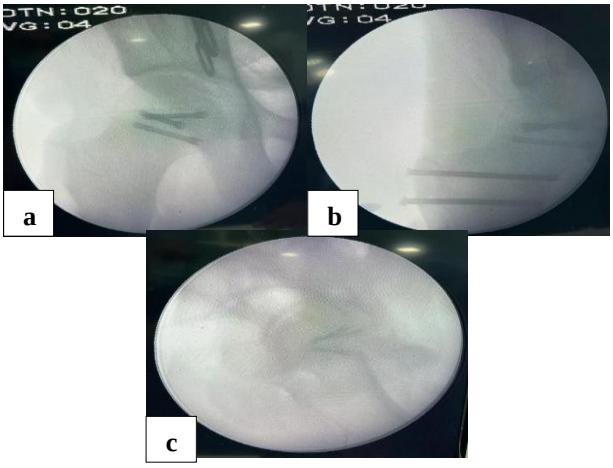

Figure 7: Intra-operative C-arm image showing internal fixation (a) AP image showing femoral head fixation with herbert screws, (b) AP image showing trochanteric fixation and (c) lateral image showing femoral head fixation with herbert screws.

Figure 8: Post-operative anteroposterior and lateral X-ray image of the pelvis.

DISCUSSION

Fracture of the femoral head after hip dislocation is a rare injury. The incidence reported in the literature varies from approximately 6% to 16%.[4] Controversies include surgical fixation techniques, radiographic evaluation, surgical approaches, classification schemes, and type of treatment for fractures caudal to the fovea. The radiographic evaluation of patients with femoral head fractures always begins with an AP radiograph of the pelvis. Additional views will be dictated by the findings on the AP radiograph, and may include a lateral view of the hip, oblique views of the pelvis, pelvis inlet and outlet views and a computed tomography (CT) scan of the hip. Magnetic resonance imaging (MRI) also may have a role in the evaluation of patients with femoral head fractures. MRI is excellent for showing contusions and associated soft tissue injuries.

Femoral head fractures are generally classified using the criteria of Pipkin subdivided into five types of femoral head fractures. Epstein–Thomas type V fracture

dislocation was divided into 4 subtypes by Pipkin, fracture caudal to the fovea capitis (type I), fracture cephalad to the fovea capitis involving the weight-bearing portion of the femoral head (type II), fracture inferior to the fovea centralis (type I or II) plus femoral neck fracture (type III) and femoral fracture associated to acetabular fracture (type IV). Of which type III lesions are relative rare, caused by severe high energy injuries and characterized by fractures of the femoral head and neck. It is difficult to make surgical operation for type III fractures which often have poor prognosis.

Using an anterior (Smith-Petersen) approach the femoral head can be dislocated safely, but inspection of the acetabulum is limited, unless the tensor fascia lata and gluteus medius are extensively detached from their origins. Reattachment and rehabilitation of these muscles are associated with considerable morbidity. Anterolateral and direct lateral approaches may allow dislocation of the femoral head, but again exposure of the acetabulum is diffificult and incomplete.[5,6] With the posterior approach, tenomyotomy of the external rotator muscles is necessary, which interrupts the anastomosis between the inferior gluteal artery and the deep branch of the MFCA. The deep branch itself may also be vulnerable, although there have been no cases of avascular necrosis reported after a resurfacing procedure using this approach.[7] Stable reattachment of the external rotator muscles may also be difficult. A classic trochanteric osteotomy or use of the V-shaped myofascial flap allows easy dislocation without detaching the external rotator muscles.[8] Both offer an excellent view of the femoral head and acetabulum. Trochanteric osteotomy requires more care in regard to union, since there is no balancing of the force of gluteus medius by vastus lateralis; the myofascial flap approach needs special attention until the resutured soft tissues have healed.

Avascular necrosis of the femoral head is the most significant complication of dislocation of the hip. After traumatic dislocation, it is the result of an extraosseous, and probably extracapsular, injury to the nutrient vessels. Its development is also dependent on the severity of the injury to the hip and the duration of the dislocation.[9] Traumatic posterior dislocations have a higher incidence of avascular necrosis than anterior dislocations. Surgical dislocation as described here produces an anterior dislocation using low-grade controlled trauma. The time of dislocation is much shorter than the six-hour limit which is thought to be critical after traumatic dislocations.[11]

All external rotator muscles are left intact and, therefore, protect the MFCA. Intraoperative monitoring of perfusion of the femoral head is possible. Although it may be argued that bleeding from a drill hole in the femoral head after dislocation does not exclude the possibility of subsequent avascular necrosis, a high correlation has been shown between this and the presence of a viable head in a study on fractures of the femoral neck.[12]

The treatment of patients with femoral head fractures is a controversial subject in many respects. As mentioned previously, many of the series in the literature are either small, the patients have short follow-up. Changes in treatment options, rehabilitation protocols, severity of associated injuries, and outcome measures make it difficult to compare methods from different studies.

Controversies include indications for fixation versus excision, timing of surgical fixation, and the appropriate surgical approach. Closed reduction and skeletal traction is a treatment option for some patients with hip dislocations with femoral head fractures. Key elements in determining the suitability of this treatment are the ability to obtain a closed reduction, the quality of the reduction, a lack of bone fragments in the joint after reduction, and the ability of the patient to tolerate an extended period of traction.

Bipolar or total hip arthroplasty is an excellent treatment option for older patients. Advantages include relatively short operating time, avoidance of avascular necrosis as a complication, and early functional rehabilitation. This treatment option is not ideal for younger patients who have sustained high energy trauma, but may be the treatment of choice for age appropriate patients.

Open reduction has become the primary treatment for hip dislocations associated with femoral head fractures. The fracture then can be treated by debridement of any small bone and cartilage fragments from the joint, with excision of larger fragments that make up the femoral head fracture, or with internal fixation of the fracture which was our choice of treatment. It is somewhat controversial whether closed reduction followed by delayed open reduction and internal fixation or an immediate open reduction and fixation or excision is preferable. The outcome data did not show any difference between the patients who had a closed reduction followed by a definitive surgical procedure more than 24 hours after admission when compared with patients who had their surgical procedure less than 24 hours after admission. The timing of the definitive surgical procedure should be based on patient factors and injury factors. If there is a large fragment in the joint, representing a non-congruous reduction, early open reduction clearly would be desirable. If the patient's condition is not stable, delaying the definitive surgical procedure is appropriate. Based on the outcome data and that of Marchetti et al, it is thought that the definitive surgical procedure can be safely delayed to stabilize the patient's medical condition as long as a congruous closed reduction is achieved.[13]

Several authors agree that large fractures that are cephalad to the fovea should be fixed rigidly, because this area is clearly in contact with the articular cartilage of the acetabulum and involved in weight bearing. Internal fixation of femoral head fractures should achieve rigid fixation, preferably with compression between the fracture fragment and the remainder of the femoral head. There are

numerous implants that currently are available to surgeons who are treating patients with femoral head fractures. Countersunk AO screws, Herbert screws, and bioabsorbable pins all have been reported with success.

The technique of surgical dislocation presented in our study allows visualization of the femoral head of almost 360° and complete access to the acetabulum. With more experience, subluxation of the head, preserving the round ligament, is sufficient for many pathological conditions. By surgically dislocating the hip using the technique described, intra-articular surgery can be carried out safely, without the limitations and difficulties inherent in hip arthroscopy or arthrotomy without dislocation. Iatrogenic injury to the cartilaginous surfaces of the femoral head and acetabulum is minimized.

CONCLUSION

The Ganz trochanteric flip osteotomy combined with safe surgical dislocation of the hip allows optimal visualization and fixation of both injuries, controlled reduction of the hip, and thorough debridement of the hip joint with minimal damage to retinacular vessels.

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