Concomitant posterior hip dislocation, ipsilateral intertrochanteric- and proximal tibial- fractures with popliteal artery injury: a challenging trauma mélange

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Abstract

Constellation of ipsilateral posterior hip dislocation, intertrochanteric- and proximal tibial fracture with popliteal artery injury is rare. Management of this presentation is challenging. A motor vehicle accident victim presented with these injuries, but without any initial signs of vascular compromise. Popliteal artery injury was diagnosed intra-operatively and repaired. This was followed by external fixation of tibial fracture, open reduction of dislocated hip and internal fixation of intertrochanteric fracture. Patient regained bilateral complete weight bearing and returned to pre-accident activity level. Appropriate management including early repair of vascular injury in such a trauma mélange allows for a positive postoperative outcome.

Introduction

Traumatic posterior hip dislocation with ipsilateral intertrochanteric femur fracture is rare. To the best of our knowledge, this is the first case reporting the concomitant presence of posterior dislocation hip, ipsilateral intertrochanteric- and proximal tibia- fracture with popliteal artery injury. A handful of cases with similar polytrauma2,3 and a presentation similar to our case, sans the vascular injury have also been reported.5 The surgical management of patients presenting with ipsilateral multiple fractures is challenging and may lead to a poor outcome. We report our experience with successful management of this rare presentation with a relevant review of literature.

Case Report

A 25-year-old male was transferred to emergency room at our Level I trauma center shortly after a motor vehicle accident. At presentation, patient was conscious and verbal with stable vital signs and complained of severe pain and decreased sensation over left hip and left lower limb (LL). The left LL was in slight but fixed hip flexion, abduction, and external rotation and shorter than the right. A step-off was noticed on anterior surface of left proximal tibia. Skin over the LL was bilaterally equally warm to palpation. Bilateral posterior tibial (PT) and dorsalis pedis (DP) pulses were palpable. Skin overlying the right patella and volar aspect of left fore-arm had open wounds. Hip radiographs and pelvic computed tomography (CT) scans revealed a posteriorly dislocated left femoral head and an ipsilateral intertrochanteric fracture with no acetabular or femoral head injury (Figure 1A and B). A complete oblique fracture of left proximal tibia (Figure 1C) and a comminuted right patella fracture were also present. No additional skeletal, visceral or spinal injuries were noted on pertinent clinical examination, abdominal ultrasound and CT scans. The injury severity score was determined to be 17. Patient was immediately brought to the operating room (OR). In the OR, changes in exam findings on LL were noted in form of decrease in skin temperature and loss of palpable or dopplerable PT or DP pulses compared to right. Secondary to this new-developed vascular compromise an intra-operative arteriogram was obtained which revealed a complete occlusion of popliteal artery at the level of the knee. Through a posterior ‘S’ shaped incision, an approximately 10 cm focal intimal tear involving the popliteal artery was identified and repaired using the contralateral great saphenous vein graft. The distal pulsations were then dopplerable. Prophylactic double-incision fasciotomy was performed on the left leg. The meta-diaphyseal tibial fracture was reduced and stabilized using a knee-spanning multi-planar external fixator (Figure 1D). Axial traction was applied carefully to achieve closed reduction of dislocated hip, but failed. The left hip was then approached through a lateral incision and the posterior dislocation was confirmed. The sciatic nerve was identified and secured. A concentric reduction was achieved with manipulation of femoral head and confirmed under fluoroscopy. The intertrochanteric fracture was then fixed using a variable-angle hip fixation system. Wound was closed in layers leaving the distal 2/3rd open due to presence of significant wound swelling and was packed with a wet-to-dry dressing. The left fore-arm and right patella wounds were similarly explored, thoroughly irrigated and packed. On the 4th post-operative day, patient was taken back to OR for tension band wiring of the comminuted fracture right patella and repair of the left fore-arm flexor tendons. Wounds were closed with vacuum dressings, which were changed periodically until 4th post-operative week when split thickness skin grafting was performed. Concurrently, rehabilitation was initiated with crutch walking and weight bearing as tolerated on right LL but no weight bearing on left LL. At 14th week follow-up, CT scan of left tibia showed 30% fracture healing and patient was advanced to 25% partial weight bearing and to 50% weight bearing at 8th month follow-up. The tibial external fixator was removed at 15th week follow-up, eventfully (Figure 2A). Patient underwent knee and ankle range of motion exercises throughout the follow-up period. At the most recent examination at 15 months’ post-operative, there were no clinical or radiographic signs of osteonecrosis or post-traumatic arthritis (Figure 2B). The left knee achieved 100° flexion and full extension and right knee had 85° of flexion and 5° of extension. At this point, patient was evaluated for multi-ligamentous reconstruction of the left knee, however a follow-up CT scan showed proximal tibial non-union. Following this, patient underwent a repair of left proximal tibial non-union with a right iliac crest bone harvest (Figure 3). Two weeks following the non-union repair, patient was taken back to the operating room for irrigation and debridement of a left knee hematoma. Following this, patient’s recovery has been uneventful and patient is full weight bearing on bilateral lower extremities at 16 months post-operative from the initial presentation.
Discussion

Mechanism of injury

Traumatic posterior hip dislocation resulting from high velocity trauma is not uncommon; however, concomitant presence of ipsilateral femoral head- or intertrochanteric fracture is rarely reported. Injuries in our patient included left proximal tibial fracture, left posterior hip dislocation with associated proximal femoral fracture, left popliteal artery injury, comminuted fracture of right patella and open laceration involving the left fore-arm. Mechanistically, in a high velocity trauma, when a flexed knee strikes a stationary object (e.g., the dashboard); the impact vector exits through the upper end of the intact femur. This may result in posterior dislocation of hip with posterior acetabular wall- and femoral head fracture. It has been reported that the dislocated head then gets jammed by the tight ilium. However, in our case the femoral head and acetabulum were not fractured; it can be postulated that the longitudinal force did not dissipate through the femoral shaft and was concentrated at intertrochanteric region causing the intertrochanteric fracture. Additionally, excessive adduction and external rotation force also resulted in the ipsilateral intertrochanteric fracture. The initial impact on the left knee resulted in a complete fracture of ipsilateral proximal tibia, which caused popliteal artery injury, similar to a popliteal artery injury following a posterior knee dislocation.

Management

Management of patients with multiple fractures with concomitant vascular injury is challenging. The concept of damage control orthopedics (DCO) involves primary temporary stabilization of long bone fractures using minimally invasive surgical techniques. Studies have shown that external fixation has a role in initial as well as definitive stabilization of extremity fractures in multiply fractured patients with concomitant vascular injury. Based on the DCO concept, we triaged the injuries based on the severity and stabilized the left proximal tibia fracture with a knee-spanning external fixator first. Notably our patient had no signs of vascular compromise at presentation, however, in the OR, clinical exam deteriorated and the arteriogram detected the left popliteal artery damage. In patients with multiple fractures, definitive restoration of vascular continuity is recommended in a clinically stable patient with clean wound and adequate amount of viable soft tissue. Similarly, in our case the left popliteal artery was bypass grafted with successful revascularization before fracture fixation. In contrast, in a similar case reported earlier, a through knee amputation could not be avoided despite of repairing the vascular injury after 8 hours of injury. In our patient, presence of multiple long bone fractures including a tibial fracture and presence of a vascular injury requiring a revascularization procedure increased the risk of development of compartment syndrome. In view of these findings, a prophylactic multiple compartment fasciotomy of left leg and thigh was performed which was eventually closed by split thickness skin grafting at 4 weeks’ post-operative. Posterior hip dislocation with associated proximal femoral fracture is considered an orthopedic emergency with poor prognosis. The ideal time to reduce dislocated femoral head is within 6 hours and no later than 12 hours after dislocation. Interestingly, presence of associated proximal femoral fracture and absence of posterior wall acetabular fracture is thought to be the reason for irreducibility, and closed reduction of such cases may lead to iatrogenic femoral neck fractures. If the concentric reduction is not achieved with 1 or 2 attempts; open reduction internal fixation (ORIF) with removal of loose intra-articular fracture debris should be considered without a delay. This case presented with intertrochanteric fracture without acetabular fracture and it was not possible to close reduce the dislocation. We approached the hip laterally and a large Steinmann pin was inserted into the femoral neck through the fracture site and was used as a joystick to unlock and relocate the posteriorly dislocated head. The left intertrochanteric fracture was internally fixed using a variable-angle hip fixation system. Hip replacement arthroplasty is also an option to manage such cases, however, especially in young patients, it is advisable to consider ORIF and postpone arthroplasty for future. Notably, due to the concomitant vascular injury, patient was not positioned on the fracture table; hence it was difficult to get the lateral radiographs. In such situations, a near 90° passive flexion of the contralateral hip may effectively scissor the lower extremities to obtain an optimum lateral view of operative lower extremity for confirmation of internal fixation. Additionally, owing to the anatomic proximity of sciatic nerve to the posterior rim of acetabulum, up-to 10-28% of patients with posterior hip dislocation present with sciatic nerve injury. We identified the sciatic nerve intra-operatively and secured it before any relocation attempts. However, during the follow-up, patient complained of severe pain in sciatic nerve distribution area which was managed with pregabalin and ultra-sound guided sciatic nerve block. Rehabilitation protocol included gradual weight bearing as tolerated along with manipulation of knee and ankle joints under anesthesia and range of motion exercises during the follow-up. At 15 months’ follow-up, patient regained near full range of motion and there are no signs or symptoms of head collapse at last follow-up (Figure 2B), however, osteonecrosis of the femoral head may develop late and a periodic follow-up is necessary. Patient was offered a ligamemous reconstruction of the left knee at this point, however due to presence of left proximal tibial non-union, patient underwent bone graft.

Figure 1. A) Axial view of left hip on computed tomography scan confirming posterior hip dislocation with ipsilateral inter-trochanteric fracture. B) 3D Reconstruction of left hip demonstrating the posterior dislocation with ipsilateral inter-trochanteric fracture. C) Left knee radiograph demonstrating the oblique proximal tibia fracture. D) Left proximal tibia fracture stabilized with external fixator.
repair of the non-union at 15 months from the index presentation. At 16 months follow-up, patient has regained full range of motion of the left hip and knee and has returned to baseline functional level.

Conclusions

In summary, combination of ipsilateral traumatic posterior hip dislocation, intertrochanteric fracture and proximal tibia fracture with popliteal artery injury constitutes a rare and challenging case for orthopedic surgeons. This constellation of injuries can likely lead to poor clinical outcomes however, apt surgical management may result in favorable outcomes. The importance of continuous assessment of distal pulses should not be underestimated and vascular injuries should be addressed promptly. In the OR, scissoring of lower extremities is recommended to obtain lateral radiographs for confirmation of internal fixation. Trauma surgeons should be aware of this rare combination of injuries and should be prepared for utmost care of such patients.

References