Case Report

A Case Report on Tibial Plateau Fracture Fixed with Combination of Hybrid and Knee Spanning Fixator in Gustilo-Anderson Type 3b Injury

Uday Raman[1], Hardika Mangal[2]

From [1]Resident, Department of Orthopaedics, SMS Medical College, Jaipur, Rajasthan, India, [2]Resident, Department of Anesthesiology, SMS Medical College, Jaipur, Rajasthan, India

ABSTRACT

Tibial plateau fractures involve the intra-articular portion of the proximal tibia with or without metaphyseal extension. Here, we present the case of a 25-year-old male patient presented with Schatzker type 6 tibial plateau fracture associated with a lateral femoral condyle fracture and a vertical patella fracture fixed with a combination of hybrid ring fixator, cannulated cancellous screws, and a knee spanning frame in Gustilo-Anderson type 3 B injury. The purpose of this case report is to highlight the surgical challenges faced in such types of cases that include the Gustilo and Anderson type 3 B injury with complicated fracture morphology, the implant to be used with his current economic status, and the limited investigations available.

Keywords: Anderson type fracture cannulated cancellous screws, Schatzker type 6, Tibial plateau fracture

Fractures that involve the proximal portion of the tibial articular surface with or without extension into the metaphysis have been described since the 1800s. With the advent of American Orthopedics (AO), the treatment methods have changed from conservative to surgical methods and have become a popular modality amongst surgeons [1]. These fractures range from minimally displaced fractures to high-energy comminuted fractures based on the widely accepted Schatzker classification [2]. Fractures of the tibial plateau account for 1–2% of all long bone fractures with bimodal age distribution [3]. These fractures mostly affect young males considering the mode of injury majorly being road traffic accidents and high-velocity injuries.

The rationale of this case report is to describe the surgical management of a 25-year-old male patient with Schatzker type 6 tibial plateau fracture associated with lateral femoral condyle and vertical patella fracture in a Gustilo and Anderson type 3b [4] injury and the surgical challenges associated with it as the fracture fixation was further complicated because of patient's economic status.

CASE REPORT

A 25-year-old male presented at our hospital 3 h after a high-velocity road traffic accident. The patient gave a history of left knee pressing amongst vehicles after which, he fell on the ground. Following that, he was brought to the hospital in an ambulance. There was no history of loss of consciousness, vomiting, and bleeding of the ear, nose, or throat.

On presentation, the patient was conscious and oriented to time, place, and person. After the initial Advanced Trauma Life Support (ATLS) protocol, the patient was examined. On general physical examination, the pulse was 110 beats per minute and the blood pressure was 100/60 mm of Hg. The thoracic examination was unremarkable and the pelvic compression test was negative. On local examination, the left limb had traces of smudge ground, and in the knee, there was a complete limitation in range of motion, swelling, and severe tenderness with bleeding. A lacerated wound measuring 12 cm in length and 5 cm in breadth was present in the anterolateral aspect of the knee and distal thigh with exposed bone and soft tissues. Skin degloving was noted in the anteromedial aspect of the leg below the knee joint of about 5 cm in length and 5 cm in breadth. The neurovascular examination was done where sensations and motor examination distal to the injury was normal.

X-rays of the knee demonstrated a Schatzker type 6 tibial plateau fracture, lateral femoral condyle fracture (AO 33 B3), and a completely deviated non-comminuted vertical patella fracture (AO 34 B) (Fig. 1). X-rays of the bilateral hip, chest, and spine were unremarkable.

The patient was taken to the operation theater and intravenous antibiotic prophylaxis was given. After adequate painting and

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Correspondence to: Dr. Uday Raman, Department of Orthopaedics, SMS Medical College, Jaipur, Rajasthan, India.

draping under full aseptic precautions, the wound size was confirmed to be 12 cm in length and 5 cm in breadth before debridement, where the loss of quadriceps muscle (vastus lateralis) and small pieces of external paint of the vehicle with soil contamination were noted. The margins of the wound were extended and an adequate debridement with the removal of gross contamination and necrotic tissue was done till fresh bleeding tissue was observed. Small pieces of the external paint and soil were removed. The post-debridement dimension of the wound was 13 cm in length and 5 cm in breadth.

The fracture fixation was performed step by step. First, the lateral condyle of the femur was reduced and was fixed with two 6.5 mm cannulated cancellous screws (CC screws) from the lateral to the medial side. Vertical patella fracture was fixed with a single 3.5 mm CC screw. Then, fixation of tibial plateau fracture was dealt with. First, the fracture was temporarily reduced with two 1.8 mm K-wires and then fixed with three 1.8 mm beaded wires inclined at 60° to each other so as to get compression in the intercondylar part of the fracture. These were connected to a 5/8 Ilizarov ring (Fig. 2). Then, two Schanz pins were used for the tibial diaphysis and these were connected with the 5/8 ring with two connecting rods to complete the hybrid fixator assembly while maintaining limb length and rotational alignment. To supplement wound healing and prevent vertical shear force on the tibial plateau, an additional knee spanning frame was attached to the hybrid ring. This was done with the help of connecting rods connected with the ring and two Schanz pins in the lateral midshaft of the femur (Fig. 2). The joint congruence was maintained and visualized under direct vision and confirmed by image intensification. Primary closure of the wound on the distal thigh was performed intraoperatively and the wound of the anteromedial side of the leg was freshened till bleeding tissue was observed after which SSG was performed to cover the skin defect after 2 days. A splint was used to assist in analgesia and healing of the wound. Joint congruence was maintained (Fig. 3a).

The patient was discharged after 5 days and no sign of infection was present at that time. The sutures and splint were removed 2 weeks after the surgery and it was seen that the injury had healed without infection, after which the knee spanning assembly was removed, leaving the hybrid frame *in situ* so as to initiate knee movement. Two months after the surgery, radiographs demonstrated signs of fracture healing in the intercondylar region of tibia, lateral condyle femur, and patella with the little to no callus formation in tibial diaphysis (Fig. 3b). At 5 months, the patella, the femur, and the tibial condyles had healed with the tibial diaphysis showing callus formation with ongoing knee mobilization and toe touch weight-bearing (Fig. 3c).

Postoperatively, the patient complained of pain at the pin sites after 6 months, and thus, it was observed that Schanz pins were showing the discharge of serosanguinous nature and thus fixator assembly was removed. On examination, after fixator removal, minimal mobility was seen in the tibia and the patient had full extension and 60° of knee flexion without pain (Fig. 4a). Muscle strength force of the quadriceps was considered normal, Grade V (MRC) and there was a restriction of flexion. No joint effusion and instability were seen, and thus, the patient was put on a walking long leg cast to further supplement bone healing with walker support. No signs of arthritis were observed in the X-ray which also demonstrated abundant callous at the metaphysis and diaphysis of the tibia (Fig. 4b). Postoperatively, the patient was on

Figure 1: Radiograph of the femur, knee, and tibia showing Schatzker type 6 fracture with fracture lateral condyle femur and vertical patella fracture

Figure 2: Hybrid fixator assembly with knee spanning frame

Figure 3: (a) Immediate post-operative radiograph; radiograph after (b) 2 and (c) 5 months

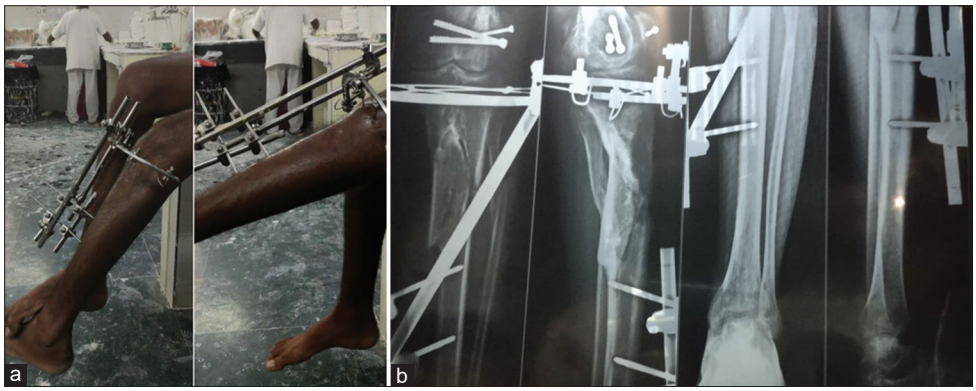

Figure 4: (a) Six months postoperatively showing knee flexion and extension; (b) post-operative radiograph at 6 months

walker support after 6 months and at 8 months, he was walking without any support on a long leg cast (Fig. 5).

DISCUSSION

Schatzker *et al*. in 1979 introduced a classification of fracture of the tibial plateau which distinguished low-energy split depression fractures from high-energy fractures (Schatzker V and VI) [2]. Many authors have tried other ways to classify this based on bony injury or degree of soft-tissue damage [4].

The surgical treatment of such fractures is a stable fixation with the anatomic restoration of the knee joint congruence with knee mobilization to prevent knee stiffness and early osteoarthritis. The classic method of dual plating is a treatment option but is associated with dreadful complications such as a failure of fixation, non-union, joint stiffness, secondary osteoarthritis, infection, and severe soft-tissue breakdown and flap necrosis [4,5]. Therefore, to prevent the above-mentioned complications and to achieve a stable fixation, surgeons have resorted to a more semiconservative approach with indirect reduction and external fixation. Thus, hybrid external fixation is the method of choice and shown to produce good results in fractures with such complicated morphology [5-7].

Watson *et al*. applied the term of hybrid fixation by stating that it is a combination of devices used [8]. Kumar and Paige in their study differentiate conventional Ilizarov frame from hybrid Ilizarov frame using Schanz pins rather than wires through the distal ring for fixation of the diaphysis [9]. With the evolution of technique and hardware used, the current hybrid fixator

Figure 5: Eight months postoperatively showing walking without support

frames consist of small tensioned wires (beaded for intercondylar fragment fixation and non-beaded for simple proximal tibial fractures) on a proximal ring (mostly a 5/8th ring) frame to maintain and reduce the metaphyseal fragments, while the remainder of the distal frame is attached to the shaft using standard external fixators half pins [10] that are connected to the proximal ring with connecting rods. The hybrid external fixator can be used for tibial plateau fractures with associated soft-tissue problems such as compartment syndrome, compound fractures, and severe soft-tissue injury in osteoporotic patients [10]. Gustilo-Anderson III B/C open tibial fractures are more difficult to manage than I, II, and IIIA fractures. Staged treatment for this severe trauma is

very necessary which minimizes further injury to the soft-tissue envelope, provides optimum stability, and reduction to allow early mobilization and prevention of joint stiffness [4].

In a matched cohort study on the treatment of high-grade tibial plateau fractures comparing internal fixation and ring fixator, Veri *et al*. noted high rates of wound complications and reoperation when open reduction internal fixation utilizing a single incision with dual plating was used [11]. Hutson *et al*. in their study noted 38 cases of superficial pin-tract infection (10%), 5 cases of septic arthritis (1%), and 13 cases of deep infection (4%) [12]. The most common complication encountered is pin-tract infection. This is reasonably acceptable as compared to a long and unhealthy wound of an ill-planned open reduction. Furthermore, septic arthritis can be prevented by placing pins 14 mm away from the joint line so as to avoid the capsular reflection of the joint [13].

CONCLUSION

The associated soft-tissue injury and the associated fractures with tibial plateau fracture greatly determine the method of fixation to be used and also predict the outcome of the treatment. Our method of fixing Schatzker type VI tibial plateau fracture with fracture of lateral condyle femur and vertical fracture of the patella with a combination of hybrid external fixator, CC screws, and additional knee spanning frame is safe, effective, economical, and favors bony union, soft-tissue healing, and acceptable return of function considering the fracture morphology and Gustilo-Anderson type 3b nature of the injury.

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