

Jail Technique for the Fixation of Unicondylar Tibial Plateau Fractures

Operative Management of Split Unicondylar Tibial Plateau Fracture using “Three-Screw Jail Technique”

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Abstract

Unicondylar tibial plateau fractures with non-comminuted fragments can be treated using cannulated screws. We describe a new reconstructive technique of unicondylar tibial plateau fracture fixation known as “three screw-jail technique” in place of conventional two screw osteosynthesis technique. The advantages of putting an additional “Jail screw” implanted in the proximal tibia from the anterior at an angle of 90° below the two screw reconstruction are prevention of subchondral collapse and prevention of screw cut-outs through the cancellous bone.

Keywords: *Tibial plateau fractures, Jail technique, Cannulated screws.*

INTRODUCTION

Tibial plateau fractures constitute approximately 1% of all the fractures in the body and result from axial loading with varus or valgus stress applied to knee^[1]. Road traffic accidents and sports related

injuries are most common causes of tibial plateau fractures^[2]. The high energy tibial plateau fractures are usually associated with crushing of soft tissues, compartment syndrome, neurovascular injuries in addition to variety of

intra-articular soft tissue injuries, the unicondylar tibial plateau fracture although externally seem to be simple but are associated with different types of intra-articular ligamentous and meniscal injuries^[3]. The primary goal in the treatment of tibial plateau fracture includes restoration of articular congruity, axial alignment, joint stability, functional range of motion, and ultimately prevention of degenerative osteoarthritis^[4]. Schatzker Classification is currently most accepted classification system for tibial plateau fractures used all over the world. There are many treatment options for the management of tibial plateau fractures from conservative cast application to arthroscopic-assisted osteosynthesis of unicondylar tibial plateau fractures to ilizarov ring fixator for complex tibial plateau fractures^[5]. We describe a new reconstructive fixation technique for the fixation of split unicondylar (type I and type IV) tibial plateau fracture. Implantation of 3rd screw below the conventional two-screw osteosynthesis prevents screw cut-out through the cancellous bone, and avoids the bulky hardware in the form of peri-articular plate for the tibial plateau fractures where two-screw osteosynthesis cannot be done^[7].

MATERIALS AND METHODS

This study consisted of 10 patients with closed fractures of tibial plateau in adults of both sexes and was conducted in the post-graduate department of orthopedics Bone and Joint Surgery Hospital, Government Medical College Srinagar from September 2012 to October 2013. As tibial plateau fractures are rare, 1% of all fractures and

complex tibial plateau fractures with articular surface depression were excluded from the study so only 10 cases of split unicondylar tibial plateau fractures (type I and type IV) were included. Final follow up was done at 6 months. All the cases were initially assessed and resuscitated in the emergency section of bone and joint hospital. They were provided first aid in the form of analgesia, splints and other resuscitation measures. General physical and systemic examination was carried out. Local examination included examination of fracture site, and distal neurovascular status of injured limb. Radiological examination was done to assess the type of fracture, amount of articular depression and fracture displacement. Radiological examination included X-rays of injured knee or knee with leg AP and lateral views, and CT scan of knee with 3D reconstruction images. After complete radiological examination split unicondylar tibial plateau fractures type I and type IV with condylar widening of more than 5mm were selected for operative fixation using “three-screw jail technique”. Written and informed consent was taken from the patient after explaining the procedure in local language. Preoperative anesthetic check up was carried out, and any contraindication for anesthesia or surgery was ruled out and dealt appropriately. The part to be operated was prepared for operation. Preoperative prophylactic antibiotics were given at that time of induction of anesthesia.

Operative technique: The patient was positioned supine in operating table. In all patients surgery was conducted under spinal anesthesia. For type I

tibial plateau which compromised 80% of all fractures in our study, fracture site was approached via lateral inverted L-shaped incision. Horizontal limb of the incision was extended from the tibial tuberosity to Gerdy's tubercle and vertical limb was extended lateral to the tibial crest just below the fracture line, muscle origin was reflected laterally until fracture was exposed. Lateral Fracture fragment was reduced and fixation was done using "three- screw jail technique". Two 6.5 mm cannulated screws of adequate length were passed from lateral to medial and a 3rd Jail screw was placed in an angle of 90° below the two conventional screws in the intact part of the bone next to the fracture site. Wound was closed and antiseptic dressing was applied. For split medial condylar fractures (type IV) fixation was done by approaching the fracture site by posteromedial incision.

Postoperatively Limb was kept elevated. Antibiotics and analgesics were given. Gentle active exercises of the knee were encouraged as soon as the pain allows usually first postoperative day. Crutch walking with non weight bearing was allowed as soon as pain was relieved and anesthesia effects were over usually on first post operative day. Active ROM exercises was started 2nd post-operative day onwards with goals of 0 -90 deg. at 2 wks and full range of motion at 6wks. Partial weight bearing was allowed at 8-12 weeks and full weight at 12-16 weeks depending upon clinical and radiological assessment of fracture

healing and type of fracture and any other complication. The patients were then followed at 2, 4, 6 weeks then at monthly intervals. Final Follow-up was done at six months. At Final follow-up patients were assessed clinically using Rasmussen grading system^[7].

RESULTS

The patients in our study ranged in age from 22-45 years of age with mean age of 31.6 years. In present study there were 4(40%) males and 6(60%) females. Right limb was involved in 3 (30%) cases and left limb was involved in 7(70%) cases, left side was involved more than right side. RTA was most common mode of trauma in 4(40%) cases, in 3(30%) cases mode of trauma was sports related injuries, in 2 (20%) cases injury was due to fall from standing height, in 1 (10%) patient sustained injury due to fall from height. In our study 8(80%) patients had type I (split lateral condyle) tibial plateau fractures, 2 (20%) patients had type IV fractures. In our study average partial weight bearing time was 10.3 weeks and ranged from 8 to 12 weeks. In our study average time to full weight bearing was 14.66weeks with range of 12-16weeks. Rasmussen score in our series ranged from 19 to 30 with mean score of 27.5. Over all 7 out of 10 patients showed excellent results, 2 patients with good and one patient with fair results. There was no case with poor results. All fractures united and most of patients 7 out of 10 returned to their pre injury status.



Pre-operative AP and lateral view of left knee showing type-I lateral tibial plateau fracture with 5mm condylar widening



Post fixation AP and lateral view of left knee. Fixation done using three-screw jail technique.



Functional outcome at 6 months Follow up. Full ROM and no extension lag.

DISCUSSION

Tibial plateau fractures have always been a challenge for orthopedic surgeon. The goals of treatment are to achieve anatomical reduction and to give a stable fixation to fracture fragments in order to begin early mobilization. This is further facilitated if soft tissue damage can be kept to a minimum degree. Indications for surgical management of tibial plateau fractures have been inconsistent with limits of acceptable articular displacement ranging from 2 to 10 mm^[8]. Residual tilt of the tibial plateau and varus or valgus malalignment have been associated with higher risk of arthrosis. Biomechanical studies on articular step off show that a 6-mm stepoff of the lateral plateau produces 7.6 degrees of increased valgus and a 208% increase in contact pressure^[9]. Honkonen(1994) evaluated outcomes in 131 tibial plateau fractures and recommended surgical management for more than 5 degrees of

valgus malalignment, more than 3 mm of articular step-off and more than 5 mm of condylar widening^[10]. Schatzker classification system is most widely used classification system for the management of tibial plateau fractures.

SCHATZKER CLASSIFICATION (1979)^[11]

- I. Lateral split fracture
- II. Lateral split with depression
- III. Pure lateral depression; no splitting
- IV. Medial tibial plateau split or split-depression type
- V. Split fractures of both medial and lateral tibial plateaus. Bicondylar fracture
- VI. Split extends to metaphysis separating metaphysis from diaphysis:

Conservative techniques of treating fractures of the tibial plateau were common in the past but many of these techniques resulted in poor

outcomes and even caused lifelong disability in many cases^[12]. A revolution in the operative treatments of these injuries was introduced by the AO Foundation which led to the development of different reconstruction techniques including minimally invasive options through arthroscopy. A minimally invasive technique using two parallel tensionscrews was first introduced by Schatzker et al. in 1979^[13]. Since then, minimally invasive arthroscopically assisted procedures have become the norm in treating unicondylar tibial plateau fractures. We present a new reconstructive technique known as Three- screw jail technique in place of conventional two screw osteosynthesis for unicondylar tibial plateau fractures as many biomedical studies have shown that 3rd jail screw implanted in the proximal tibia from anterior below the conventional cannulated screws at a 90° angle prevents screw cut-out in the cancellous bone and prevents subchondral collapse, this was proved by Andre Weimann (2013)^[14]. Tibial plateau fractures with articular depression are best managed by elevation of the depressed articular surface bone grafting and rigid internal fixation using peri-articular locking compression plates^[15]. Cannulated screws are generally used for fixation of split unicondylar fractures with minimal or no articular depression^[16]. So we recommend cannulated screw fixation of properly selected split condylar fractures using three-screw jail technique as a substitute for conventional two screw technique.

CONCLUSION

Jail technique may be a feasible alternative to conventional screw osteosynthesis in the reconstruction of split unicondylar tibial plateau fractures. Potential advantages of the jail technique are prevention of screw cut-outs through the cancellous bone and prevention of progressive subchondral collapse with weight bearing.

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