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Credibility of Three Column Fixation in Schatzker Types V and VI Tibial Plateau Fractures

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I. INTRODUCTION

The knee joint is a complex joint and is commonly injured joint now a days because of increased vehicular trauma and sports related injuries. Being superficial joint and more exposed to external forces, the joint easily gets injury [1]. Complex tibial fracture management remains clinically challenging these are usually described as type V and type VI [2]. Tibial plateau fractures are serious but rare injury spectrum account for ~1.2% of all fractures [3]. There is a wide demographic spread from young fitter males involved high energy trauma upto frail older female with under lying osteoporosis where they may represent upto 8% [4].

Intra articular fracture of proximal tibia are difficult to treat. Age, skin condition, osteoporosis further increases the obstacles in the healing process. Various treatment modalities are available but no ideal treatment hasn't yet evolved [5].

Tibial plateau fractues are generally classified according to the method developed by schatzker [6]. Schatzker type V and type Vl are high energy fractures, often accompained by other local/systemic injuries are being most difficult to treat. They tend to have poor prognosis [7]. To achieve the goal in these types of fractures to restore joint congruity, ensure joint stability, alignment and acieve full ROM

[8] should understand on three column classification [2]. The three column fracture is defined as at least one independent articular fragment in each column [2]. To understand the three dimension complex of proximal tibia fracture CT scans of extremity was used preoperatively (figure 1) [12].

Due to the involvement of the articular surface, improper management of tibial plateau fracture can lead to devasting consequences like pain, deformity, limited ROM and eventually osteoarthritis of knee joint [9]. As such the aim of surgical fixation of tibial plateau fracture are centered around achieving anatomic reduction of the joint surface and restoring mechanical alignment of lower limb [10]. In current literature, high energy tibial plateau fractures have generally found to be associated with poorer functional outcome [11]. Three column fixation technique has developed to treat multiplanar complex tibial plateau fracture which is based on 3- dimensional understanding of the fracture [2]. However literature on complex tibial plateau fracture treated with three column plates are scarce.

The study is justified for the fact that it will be one of the solutions with the treatment of three column proximal tibia fracture with three plates, post operative loss of reduction (varus collapse) and malalignment due to in held lack of rigidity and in same cases eventually implant failure. Since there have been few publications studies focusing specially on posterolateral articular fragment. This study will help us in defining role of three column plate fixation in treatment of proximal tibia fracture in terms of functional outcome and complications like infection, rate of union, time taken for union, varus and valgus malalignment.

II. MATERIALS AND METHODS

This is a prospective study conducted at a single tertiary level center between June 2018 to October 2020. A total of 32 consecutive patients with complex tibial plateau fractures (schatzker type V and VI) were operated with three column plate fixation at our institution single center and measured role of anatomic reduction, method of fixation, early ROM and function outcomes.

- *Inclusion criteria:*

A complex tibial plateau fracture (schatzker V and VI)
Age group > 18 years

- *Exclusion criteria:*

All compound fracture will be excluded from the study
Skeletal immature patients (Age group <18Y)
Acute infection
Pathological fracture
Who doesn't give consent for participation
Tibial plateau fracture schatzker type- 1, 2, 3, 4

- *Pre operative evaluation* –

The detail history, MOI, comorbidities and other injuries were noted. The surgeries was delayed in cases with soft tissue injury indicated by soft tissue edema or blister formation. The patients were taken up for surgery once the soft tissue edema and blister had resolved with appearence of wrinkles. Proper pre operative evaluation regarding the amount of articular depression and displacement is necessary for which radiographs 2D and CT scans 3D [2, 12] were used.

- *Surgery* –

Under combined spinal and epidural anaesthesia through the anterio-lateral and postero-medial approach surgery was done. Intra operatively depressed articular fragment elevated by the punch mallate under guidance of image intensifier after making a cortical window on affected side and fixed with plated on three columns. Bone graft application if empty space below the depressed fragment is >2 mm.

Antero-medial column: Medial proximal tibia anatomical pre contour 3.5MM locking plate
Lateral column: Lateral proximal tibia anatomical pre contour 3.5MM locking plate
Posterior column: 3.5MM T-plate

➢ *Follow up –*

Post operatively after pain subsides knee ROM exercises and isometric quadriceps strengthening exercises done under supervision of physiotherapist. The 1st follow up was done at 2 weeks during which the surgical scar inspected and sutures removed. The second follow up was done at 6 weeks during which a radiograph was took to look for signs of fracture union and allow partial weight bearing and then gradually progressed to full weight bearing. The patient was then followed after 6 months and evaluated clinically and radiographically for fracture union. After 6 months the functional evaluation was done using Functional Knee Score [14] and radiographs.

III. RESULTS

In our study total 32 patients out of this 2 patients were lost the follow up and 30 patients were followed up for atleast 6 months. The patient aged ranged from 18 to 74 years with the mean age of 44 years(Table 1 & Figure1). Twenty three fractures involved right side and nine fractures involved left side (Table 2 & Figure2). Twenty five were male and 7 were females (Table 3 & Figure 3). The causes of fractures were motor vehicle accident in 27 patients and simple slip and fall in remaining 5 patients (Table 4 & Figures 4). All of them are fresh fractures. According to schatzker's classification of proximal tibia fracture 19 were type V and 13 were type Vl (Table 5 & Figure 5). All of them had closed fractures. 8 patients had associated injuries. 4 patients had rib fractures. 1 patients with both bones fracture of forearm i.e radius and ulna fractures on ipsilateral side. 1 patient had distal radius fracture. 2 patients had I/L clavicle fracture. All associated injuries were treated at the same time accordingly. All patients were operated within 7 days of injury. The average surgery time was 2 hours 20 mins. The size of the all plates used for fixation were 3.5 mm buttress plates. Average blood loss was 150ml. 3 patients had primary autogenic bone graft at the time of surgery. These 3 primary bone graftings were done to 3 elderly patients with osteoporosis. Of 30 patients (2 patients lost follow up) 26 (87%) showed radiological union within 5 months (mean 16 weeks) (Figure 6). Partial weight bearing started 6-9 weeks after surgery during early signs of radiological callus formation. Full weight bearing started on an average 90-100 days after surgery based on patients tolerance (Figure 7). Average knee flexion was 115 degrees (Figure 8). The compliations (Table 6) in our study, 2 patients had superficial infection and were treated with iv antibiotics. 1 patient with varus malalignment.

The functional outcome was assessed at the end of 6th month using FKS scoring system as excellent in 22 (73.26%), good in 4 (3.32%), fair in 3 (9.9%) and poor in 1 (3.3%) (Figure 9). Only 1 patient had poor outcome due to varus malalignment.

Table 1

Age	Number	Percentage
<60 Years	24	75%
>60 Years	8	25%
Total	32	100%

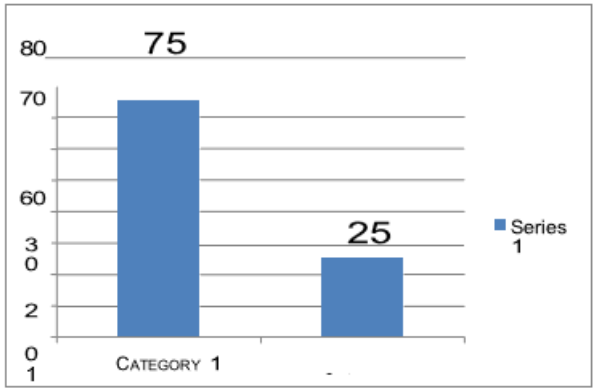

Figure 1: Age

Table 2

Side	Number	Percentage
Right	23	71.80%
Left	9	28.20%

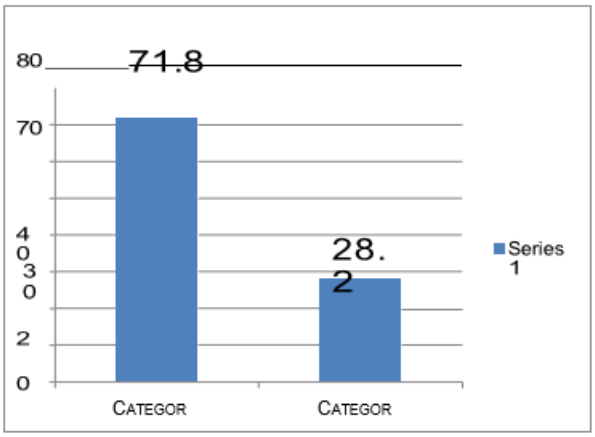

Figure 2: Side

Table 3

Sex	Number	Percentage
Male	25	78.10%
Female	7	21.90%

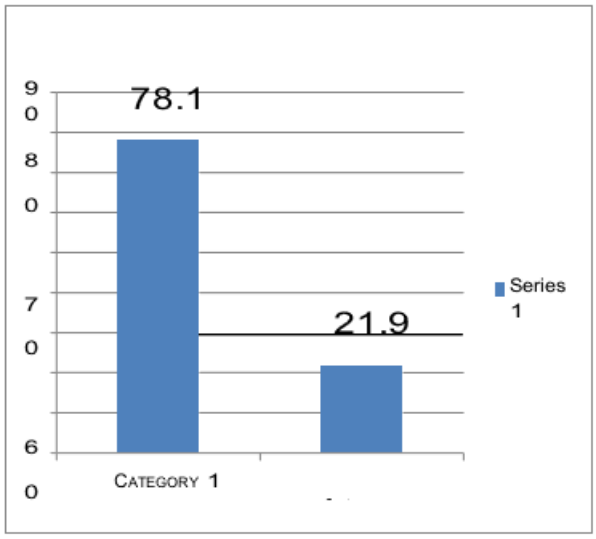

Figure 3: Gender

Table 4

Mode Of Injury	Number	Percentage
MVA	27	84.30%
Simple fall	5	15.70%

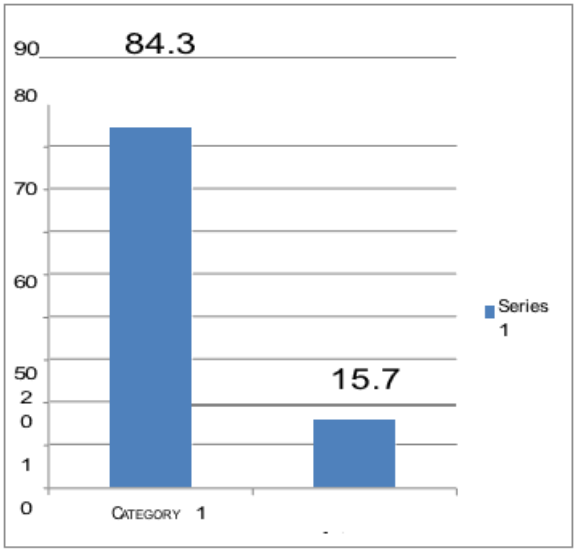

Figure 4: Mode of Injury

Table 5

Types	Number	Percentage
Five	19	59.30%
Six	13	40.70%

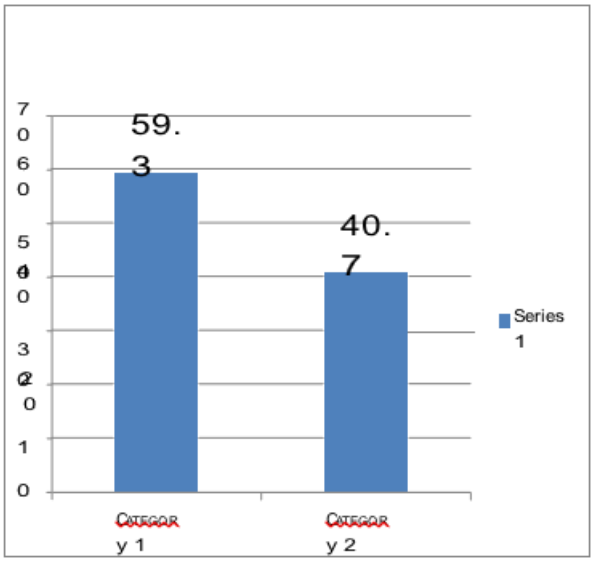

Figure 5: Types

Table: 6

Sr. No	Complications	Patients Number
1	Superficial Infection	2
2	Deep Infection	0
3	Varus Malalignment	1
4	Personal Nerve Palsy	0
5	Hardware related problems	0
6	Early Osteoarthritis	0

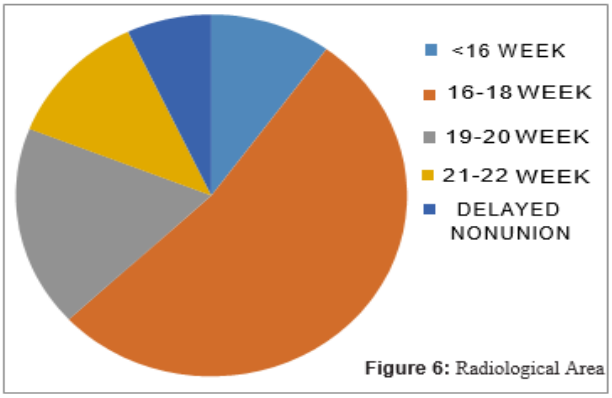

Figure 6: Radiological Area

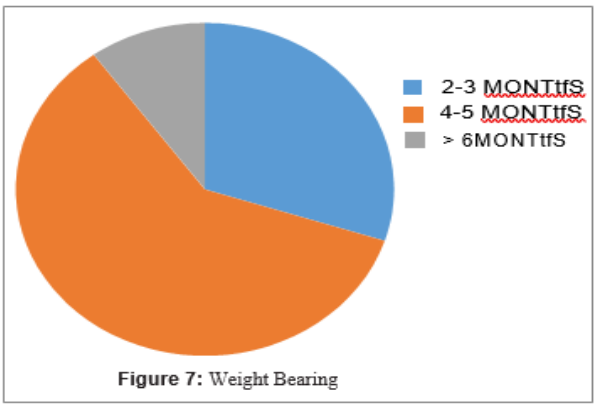

Figure 7: Weight Bearing

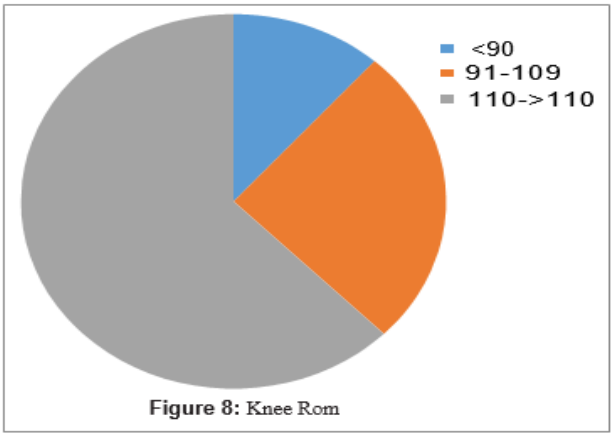

Figure 8: Knee Rom

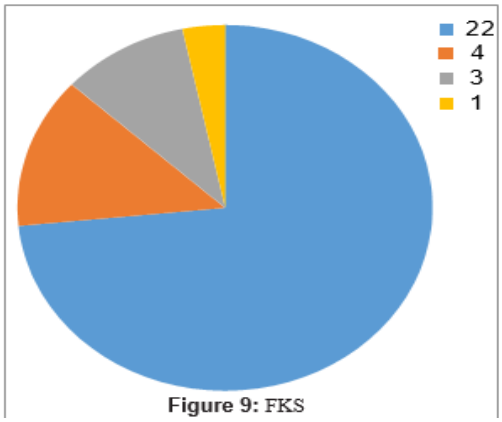

Figure 9: FKS


Fig 10:- Pre-operative Radiograph (Ap View; Lateral View)

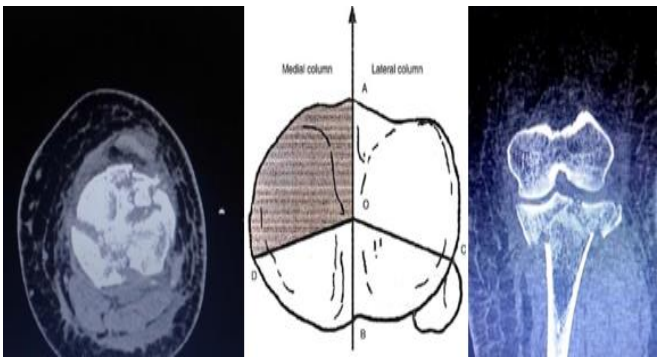

Fig 12: Pre-operative CT Scan Knee (Coronal View; Transverse View

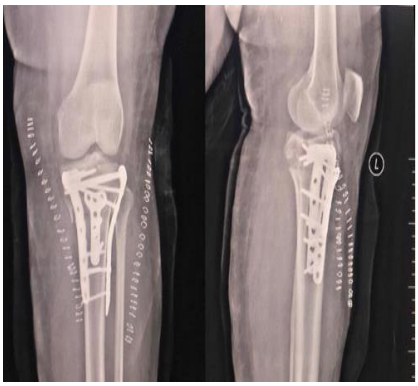
Fig 11:- Post operative radiograph

IV. DISCUSSION

A knowledge on normal anatomy of proximal tibia and post traumatic anatomy of proximal tibia fracture has lead to demand for exact reduction and rigid fixation in three columns. In a study by Wicky s et al [15], CT scans are the best to interpret the fracture fragments in three dimensional. Plain radiographs are two dimensional and are difficult to interpret the fracture fragments and also makes diagnosis and pre operative planning difficult. Macarine et al [16] studied 25 cases of tibial plateau fractures and classified according to the schatzker classification appearance on 2 dimensional antero- posterior radiographs [6] and reviewed after CT scan of the knee. Obeserved only 48% of cases had the same classification as before CT scans and 60% of the cases had changes in operative plan. CT scan adds information to the treatment of tibial plateau fractures especially posterior shearing [17]. In our study pre operative

radiograph and CT scans are done for proper preoperative evaluation regarding the amount of articular depression and displacement in thee columns 2 of proximal tibia for stable reduction and rigid fixation.

Luo et al [2], Kamareddy B et al [18] mentioned proximal tibia fractures in young population due to high velocity injury (RTA) and also males are more common than females in the ratio. The statements mentioned were similarly found in our study i.e twenty five were males and 9 were females. The causes of fractures were motor vehicle accident (high velocity injury) in 27 patients and simple slip and fall in remaining 5 patients.

Prat-Fabregat S et al [25] studied treatment strategy for tibial plateau fractures. tibial plateau fractures are serious injuries, usually associated with soft-tissue complications. Staged treatment is recommended in severe cases. Minimally-invasive osteosynthesis, when possible, is recommended in partial articular fractures. Arthroscopy can assist fracture reduction and makes possible the repair of meniscal/ ligament tears.

Complete articular fractures can be treated by ORIF or by wire fixators and minimally-invasive osteo-synthesis techniques. Anatomical reduction and stable fixation of posteromedial and posterolateral fracture fragments is very important to avoid secondary malreductions. In our study open reduction and three column fixation was done for stable and rigid fixation including posterior lateral fragment.

In the study of Ruffolo M et al [26] ORIF constructs necessitates more soft-tissue dissection; however, it facilitates direct visualization of the articular surface during surgery and in theory provides a more solid construct of both the medial and lateral columns to maintain the reduction. In our study dual incision through antero-lateral and postero medial approach done for direct visualization of articular surface and rigid fixation.

K.Kathri et al [24] studied 62 patients and noted complication rate was 30.65%. Twelve patients were advised second procedure and concluded number of complications encountered in the management of these fractures is high. In our study rate of complications are less. complications are 2 patients had superficial infection and were treated with iv antibiotics, 1 patient with varus malalignment. No patients had deep infection, peroneal nerve injury, harware related problems and early onset of osteoarthritis.

In our study, we treated 32 cases of complicated proximal tibia fracture with an average age of 44 years. 2 patients were lost follow up. The average union time was 16 weeks. The time required for surgery average of 2 hours 20 mins. We did primary autogenic bone grafting in 3 elderly patients who had severe intraarticular comminution with osteoporosis. The three 3.5 mm butress locking platea were used for three column fixation. 7% had superficial infections, 3% each of varus malalignment. In our study, partial weight bearing was started at an average 6-8 weeks after surgery when there were early signs of callus formation. Full weight bearing was started on an average 12-14 weeks after surgery as per patient's tolerance. At a follow-up of 6 months the mean knee range of motion in our study cohort was 0 to 115 degrees. Functional outcomes at the end of one year were assessed using FKS scoring system. Results were excellent in 19 patients (64%), good in 6 (20%), fair in 4 (13%) and poor in 1 (3%). In our studies, functional results are close to the functional results achieved in other studies, but the rate of complications is less (Table ???).

All cases were fresh trauma. 25 patients were males and 7 patients were females. The median age was 44 years; ranging from 18 to 72 years. Out of these, 5 of the fractures were caused by domestic fall and 27 were due to road traffic accidents. Road traffic accident as a mechanism of injury was observed more commonly in younger males and domestic fall was seen commonly in elderly females. 23 patients were with a fracture on right side and 9 on left side. The Epidemiology of group is consistent with previous studies. We compared our outcomes with standard studies, and found the following similarities. Three column plating is preferred over the other technique as it has several advantage better visualization of the fracture fragments on lateral, medial and posterior columns. Fractures are fixed easily to obtain rigid stabilization. As the tricolumn fixation obtain rigid so started early knee ROM immediately post operative period. Thus early aggressive knee ROM exercises has helped us achieve excellent functional outcome. In this study limitations are a small sample and follow up duration is short.

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