THE FUNCTIONAL OUTCOME OF MANAGEMENT OF SCHATZKER TYPE II AND III TIBIAL PLATEAU FRACTURES TREATED WITH INDIRECT ELEVATION, PERCUTANEOUS FIXATION AND BONE GRAFTING

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ABSTRACT

INTRODUCTION

Damage to the joint is more extensive in tibia plateau fractures than the roentgenograms Indicate. It may be associated with soft tissue trauma, ligament injuries (4-33% medial Collateral ligament being the most common), meniscal injuries (20%), lateral collateral Ligament injury (3%), peroneal nerve injuries (3%). Posttraumatic arthritis is associated with residual instability or axial malalignment rather than joint depression. So we use minimally invasive approach to the depressed tibial plateau fractures (Schatzker type II & III).

MATERIALS AND METHODS

32 patients were studied. They were followed up for maximum of 3yrs and a minimum of 1.5yrs with an average of 2.2yrs. Inclusion criteria included those patients with an age group between 20yrs and 60yrs, joint depression more than 3mm. Patients with open fracture, severe osteoporotic bones and with radiographic evidence of osteoarthritis are excluded from the study. CT was done in all patients. Mean age group was 28.8yrs and 19(76%) were males; the mean articular depression was 11.32 mm measured in CT. Pre-op evaluation includes x-rays of the knee, stress x-rays if needed, and CT was done with 2mm limited cuts. Cancellous Bone graft was taken from opposite tibia through a 3-4cm long incision made below the tibial tuberosity over the medial aspect of the tibia. Cortical window was made in the affected limb, just enough to introduce the punch, and its position was confirmed under c-arm and depressed fragment was elevated with punch and reduction was held with k wires in subarticular plane and later two cannulated cancellous screws was introduced and the defect packed with bone grafts, Post-operatively all patients were immobilized with plaster of Paris (POP) for 3 weeks and then mobilized.

RESULTS

The mean duration of the follow up was 2.2yrs. Results were excellent in 21 patients (84%), good 3(12%) and fair in 1 patients (4%) according to anatomic and functional criteria by Hohl and Luck.

There was no complication like infection or loss of reduction in the follow-up.

CONCLUSION

This minimally invasive approach is technically easy, offers good results in Schatzker II & III fractures, but since the inside of the joint is not visualized, meniscal and cruciate injuries can be missed, which can be treated later.

KEYWORDS

Tibial plateau fracture, Indirect elevation, Percutaneous fixation, Bone grafting.

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INTRODUCTION: According to Hohl, fractures of the tibial plateau make up 1% of all fractures and 8% of fractures in the elderly.[1] Plateau fractures cover a broad spectrum of injuries with differing degrees of articular depression and displacement. Published studies have shown that the majority of injuries affect the lateral plateau (55%–70%).[2] Isolated injuries to the medial plateau occur in 10% to 23% of cases, while involvement of both plateaus, the so-called bicondylar lesions, is found in 10% to 30% of reported series.[3]

The spectrum of injuries to the tibial plateau is so great that no single method of treatment has proven uniformly successful.[4]

Numerous authors have reported satisfactory results using both nonoperative and surgical methods of treatment for low-energy tibial plateau fractures, particularly in the elderly.[5,6] On the other hand, tibial plateau fractures that occur as a result of intermediate and high-energy trauma in

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physiologically young patients generally preclude nonoperative treatment.[7,8]

The stationary lower limb may be struck by a moving object, this is the common pedestrian injury so called the bumper fractures since the bumper; of most of the vehicles being placed roughly at the knee height, the exposed knee joint may be subjected to angulation and rotation or shearing strains and when the subject is upright, the body weight assists in the injury. Fractures of the proximal tibia, particularly those that extend into the knee joint, are serious injuries that frequently result in functional impairment. In the past two decades, with improvements in surgical techniques and implants, there has been an unmistakable trend toward surgical management of these injuries.[9] Nevertheless, proximal tibial fractures remain challenging because of their number, variety, and complexity.[10] Despite a plethora of articles, written in the past 50 years, that have addressed the problems of classification and results of various treatments, the optimal method of management remains controversial.[11] The indications for nonoperative versus operative treatment vary widely among surgeons, as do the specific methods of treatment for the many fracture configurations.

There are two categories of proximal tibial fractures: Articular and Nonarticular. Articular fractures, termed tibial plateau or tibial condylar fractures, affect knee alignment, stability, and movement. Nonarticular fractures affect knee alignment, stability, and strength.[12]

Fractures of the upper tibia are difficult to treat, apart from the usual problem of confining the patients to bed, conservative treatment at any age may be complicated by knee stiffness, Malunion, and non-union. Open reduction and internal Fixation has been advocated using various implants including buttress plates, cancellous screws, external fixator, hybrid fixator, MIPO technique etc.[13]

In this study we have analysed and reported the results of surgical management of type II and type III Schatzker tibial plateau fractures treated by indirect elevation, percutaneous fixation and bone grafting.

MATERIALS AND METHODS: A prospective study was conducted in tertiary care hospital between June 2006 and January 2007. Approval from the hospital ethical committee was obtained before the study was begun and informed consent was obtained from the patients. Those who satisfied the inclusion criteria were taken up for the procedure. All patients between age group between 20yrs and 65yrs, articular depression more than 3mm with Schatzker type II and III fractures were included in the study. Post operatively there were followed for a minimum period of one year.

Patients with open fracture, old injury to the knee, Refracture, deformity in the knee e.g. polio. Associated femoral/tibial shaft/patellar/ankle fractures severe osteoporotic bones, and patients with radiographic evidence of moderate to severe osteoarthritis were excluded from the study.

The patients were operated by two consultants following the same principles of fracture fixation. Thorough clinical examination was done in all patients and neurovascular status and associated injuries was noted. Patients with severe swelling and soft tissue compromise were operated only after the swelling had subsided.

In all the fractures, plain radiographs which included supine AP and lateral and stress views was done, CT scan with 2mm cuts was done in all patients to study the fracture configuration and to know the position of the depressed fragment and the amount of articular depression. All patients received pre operatively, one dose of antibiotic a third generation cephalosporin and post operatively third generation cephalosporin 12th hourly and amikacin 15 mg/kg body wt. 12th hourly for a period of 48-72hrs. A standard operative protocol was followed in all patients.

Operative Procedure: Cancellous bone graft was harvested from opposite normal tibia through a 2.5cm incision, a cortical window made medial to the tibial tuberosity and cancellous bone curetted from the tibial donor site. On the fractured tibia, 2cm incision made below the tibial tuberosity over the medial aspect of tibia, a cortical window 1x1cm made with a drill just enough to introduce the bone punch or impactor, the position of the punch confirmed under the c arm guidance in AP and Lateral views.

The depressed fragment was elevated using sequential hits with a mallet until the depressed fragment was elevated fully under C arm guidance. The reduction was held with subarticular k wires and after pre drilling on the k wires, Two 6.5 mm cannulated cancellous screws introduced with punch still in place, Punch removed and a bone grafting funnel packed with bone grafts is introduced through the cortical window and stacked in the subarticular plane gradually withdrawing the funnel filling the empty space. Wound closed with ethylon sutures, and an above knee cast was applied (Figure 1-6)

Post-Operative Care: Early post-operative complications like infection, compartment syndrome, and fat embolism were recorded.

Patients who had evidence of satisfactory wound healing made through plaster window wound inspection on the 4th day and they were discharged from the hospital after suture removal. These patients were advised to remain non weight bearing for a period of first three weeks irrespective of the fracture configuration. At the end of 3rd week the plaster was removed, X rays taken and the patient was sent for continuous passive motion. Partial weight bearing was permitted at 10 wks. and gradually increased

After discharge we examined the patients clinically and radiologically after removal of plaster at 3 weeks, then at 10wks, 14wks, 18wks, 22wks, 26wks, 40wks and at the end of one year.

Follow up data were accumulated from hospital reviews and direct interviews. All radiographs were assessed with regard to their pattern, displacement, and vertical subsidence and healing of the fracture and complications posed.

The patients were followed for a minimum follow up of one year.

GRADING OF RESULTS: Anatomic and functional criteria of Hohl and Luck was used.[14]

The results were judged independently by the anatomic and functional grading reduction of the fracture, development of the degenerative changes, in determining the functional grade, the degree of motion, extension of the knee, abnormal mobility, strength and pain were included. For convenience in the analysis the excellent and good results were combined in to acceptable group and fair and poor in to the non-acceptable group.

RESULTS: A total of 25 patients with Schatzker type II and III fractures were followed for 12 months. Analysis of results was done in relationship to age, sex, laterality of fracture, type of fracture, complications and final outcome.

In our series, the majority of the patients are found to be between the age group of 30-40years. Mean age group was 38.8yrs and youngest being 21 and oldest being 65 yrs. (Table 1).

Age (yrs)	No. of cases	Percentage
<20	0	0
21-30	7	28
31-40	8	32
41-50	7	28
51-60	2	8
>60	1	4
Total	25	100

Table 1: Distribution of cases according to age group

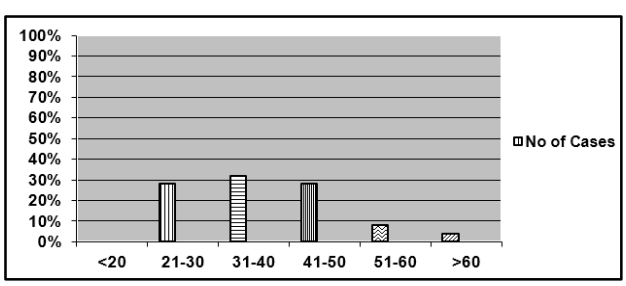


Fig. 1

Out of 25 patients 19 patients were males and 6 patients were females. (Table 2).

Sex	No. of cases	Percentages
Male	19	76
Female	6	24

Table 2: Distribution of cases according to gender

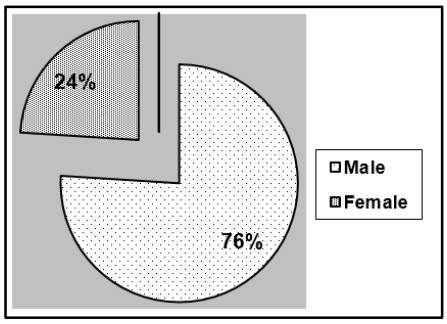


Fig. 2

In this series, the majority of the patients treated are due to road accidents or automobile accidents to extent of 84 %. (Table 3).

Mode of injury	No. of cases	Percentage
RTA	21	84
Fall from height	3	12
Athletic injury	1	4
Total	**25**	**100**

Table 3: Distribution of cases according to mode of injury

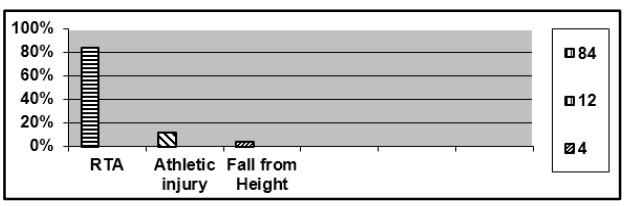


Fig. 3

In our series, there is a right sided predominance possibly due to involvement of the right side in the automobile accidents.

Side	No. of cases	Percentages
Right side	16	64
Left side	9	36
Total	**25**	**100**

Table 4: Distribution of cases according to laterality

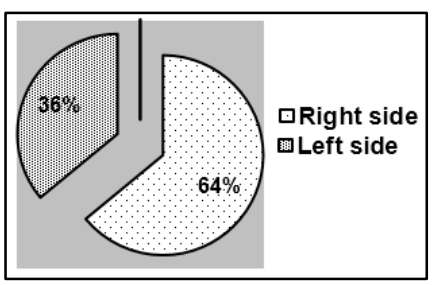


Fig. 4

SCHATZKER'S CLASSIFICATION:

Type of fracture	No of cases	Percentages
Type II	08	32
Type III	17	68
Total	25	100

Table 5: Distribution of cases according to type of fracture

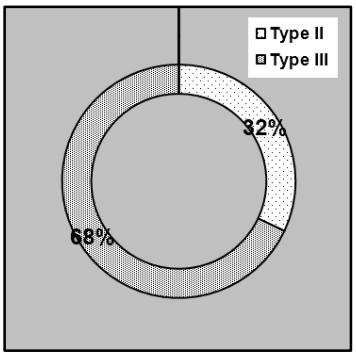


Fig. 5

In our series, Schatzker type III was more common than type II.

Mean Articular Depression:

Depression(mm)	No of cases	Percentages
5-10	7	36
10-15	17	60
>15	1	4
Total	25	100

Table 6: Distribution of cases according to articular depression

Mean articular depression in our study was 11.32mm.

It was observed there was associated nasal bone fracture, stable L1 compression fracture, eye injuries, and zygomatic bone fracture, 5th metacarpal fracture in one case there was a medial collateral injury with an associated lateral collateral injury tear.

All patients were immobilized for a period of 3 wks. Later they were started on a mobilization program on CPM (Continuous Passive Motion), before full weight bearing with support except in 1 patient who had an associated MCL tear which was immobilized for 5 wks.

In our study there were two cases of failed implant due to screw back out, and 2 cases of persisting locking (was treated later Arthroscopically). There were no cases of compartment syndrome, deep vein thrombosis, non-union, Varus or valgus angulation/deformity, peroneal nerve injuries or vascular injury.

Range of Motion: Final range of motion achieved was tabulated below (Table 7). Range of motion with flexion >120 was achieved in 23(92%), and no extension lag.

Criteria	Degree of flexion	No. of cases	%
flexion	>120	23	92
	<80	2	8

Table 7: Range of Motion

Out of 25 cases treated with surgical procedure, 21 cases gave excellent result, 03cases came out with good result, both (acceptable) and 1 with fair result (non acceptable).

Grading	No. of cases	Percentages
Excellent	21	84
Good	3	12
Fair	1	4
Poor	0	0
Total	25	100

Table 8: Distribution of cases according to clinical results

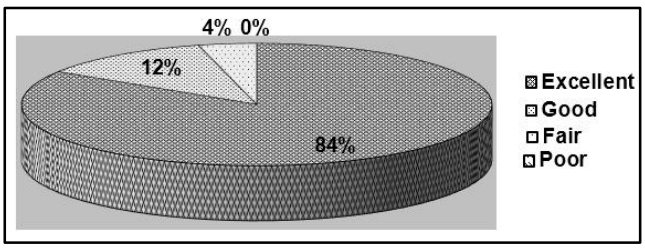
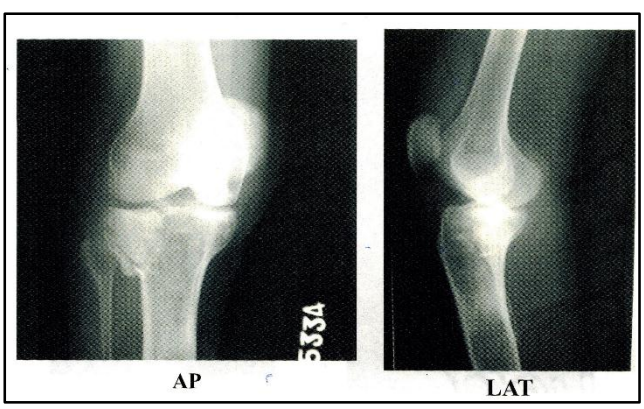
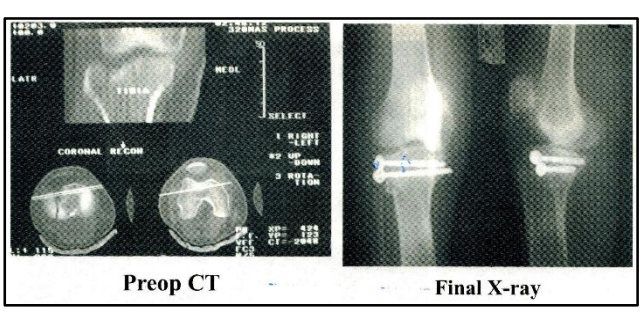
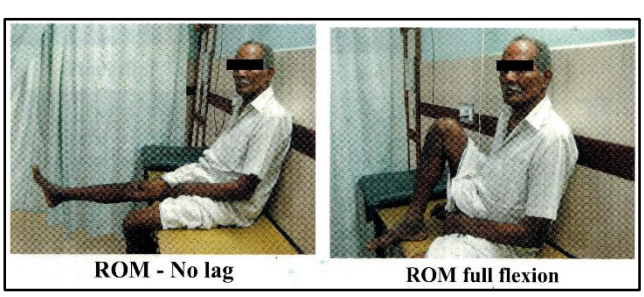


Fig. 6: Outcome

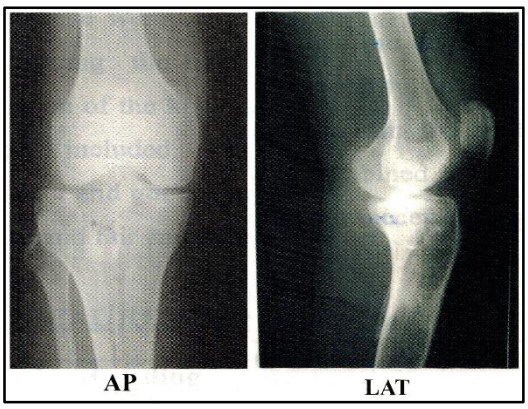
Case I (Schatzker Type II)

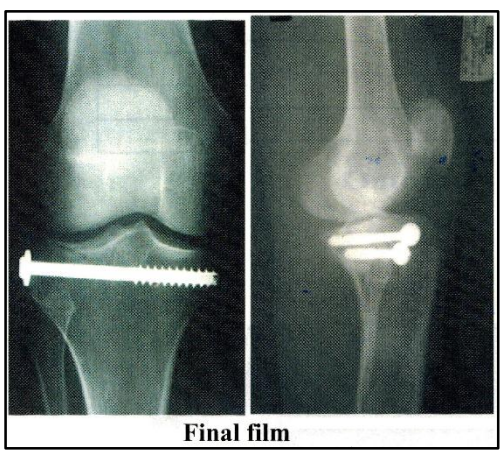


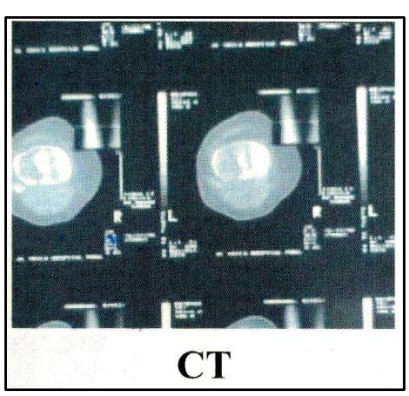


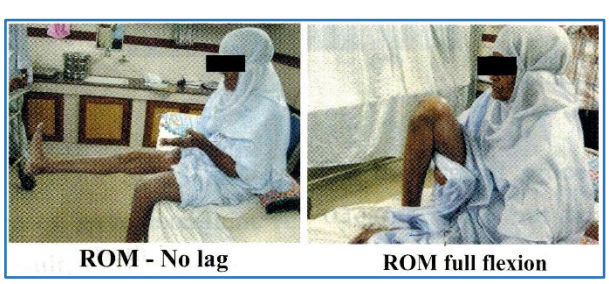


Case II (Schatzker Type III):









DISCUSSION: Tibial plateau fractures are one of the major traumatic Injuries. The results of the functional outcome of management of 25 cases of Type II and Type III Schatzker tibial plateau fracture treated with indirect elevation; percutaneous fixation and bone grafting are in keeping with those reported by others.

In our study majority of fractures occurred between the age of 20 and 60years with the maximum incidence of fractures in the age group of 31-40years (32%). Brown et al also found that the majority of the patients are aged between 15-55yrs with an average of 38.5years.[15] The tibial plateau fractures are commonly seen in the active age group in our setup as they engage in more activities and travels. Osteogenesis is better in younger patients than in older patients. The strength of the muscles, bones and ligaments also decreases with age.

In our series, majority of the patients were males 76% males and 24% females. Burri et al in their study on 278 cases reported tibial plateau fractures in 67% of men and 33% women.[16] This incidence of sex versus upper tibial fractures can be attributed to an over-whelming large proportion of male patients indulging in traveling and outdoor activities and the female population largely working indoors.

Occupation wise tibial plateau fractures were seen in people with high level of activity, movement, and travel. In our series, the commonest mode of injury being the road traffic accidents about (84%). The next very common mode of injury being the, fall from height (12%) each followed by the trivial traumatic injury (4%). Paul j duwelius et al in their study of 75 cases, the cause of injury was RTA in 35 cases (46%) and 11 cases was due to fall from height (14%) and 9 cases were due to other causes.[17]

The incidences of tibial plateau fractures in our series have more right tibial fractures (64%) than the Left tibial fractures (36%). 08 cases (32%) were Schatzker Type II and 17cases (68%) were Schatzker Type III respectively.

Different authors use different criteria for the surgical management of tibial plateau fractures. Honkonen et al conducted a study of treatment of upper tibial injuries with 130 patients with the main indications being fracture of the Lateral tibial condyle with the step off of more than 3mm, Condylar widening more than 5mm.[11] Other authors Rasmussen et al, Hohl et al, Waddell et al have taken mean articular depression of 10mm,5mm,10mm as cut off for surgical intervention.[18,14,4] In our series we have taken more than 3mm of depression as the indication for surgery, and the mean depression was11mm, In a study by Schatzker et al the mean depression was 11.4 mm.[13]

All cases united well, two patients had screw back out and persistent locking which was later treated arthroscopically for LSC Tear.

The range of motion of the knee joint is critical for the clinical result. The final range of motion was flexion was more than 120 degrees and no extensor lag. In study by Burri etal loss of extension was less than 5 degrees in 84.7 % more than 5 degrees in 15.3 % of cases, flexion of more than 100 degrees was present in 83.1% and less than 100 deg in 16.9%.[16]

We were able to achieve 21(84%) of excellent results with this surgical method, 3(12%) good result (the acceptable group), 1(4%) fair result (non-acceptable group). Schatzker et al in their study obtained 75% acceptable results in their surgical group.[19]

CONCLUSION: From our study we were able to conclude that indirect elevation, percutaneous fixation and bone grafting gives a good satisfactory outcome in Schatzker type II and type III fractures. However long term results with arthritis could not be evaluated due to short follow up. Also internal de arrangement especially the lateral meniscus tear may be missed due to non-visualization and may have to be tackled later.

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