Original Article

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Surgical Management of Tibial Plateau Fractures – A Clinical Study

Orthopaedics Section

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ABSTRACT

Background: Advance in mechanization and acceleration of travel have been accompanied by increase in number and severity of fractures and those of tibial plateau are no exception. Being one of the major weight bearing joints of the body, fractures around it are of paramount importance. The study was aimed to identify the role of surgical treatment of tibial plateau fractures, its functional outcome and complications.

Methods: Thirty-two cases of tibial plateau fractures treated by various modalities were studied from Jan 2004 to Dec 2005 at Bapuji Hospital and Chigateri General Hospital, Davangere and followed for minimum period of 6 months.

Results: The selected patients evaluated thoroughly: clinically and radiologically, were taken for surgery, after the relevant lab investigations. The indicated fractures were treated as per the SCHATZKER'S types accordingly with CRIF, with percutaneous cannulated cancellous screws, ORIF with buttress plate with or without bone grafting, external fixator. Early range of motion started soon after the surgery. No weight bearing upto 6-8 weeks. The full weight bearing deferred until 12 weeks or complete fracture union. Immobilization in insecurily fixed fractures continued for 3-6 weeks by POP cast. The knee range of motion was excellent to very good, gait and weight bearing after complete union was satisfactory. redepression in 1 case, malunion in 2 cases, knee stiffness in 3, wound dehiscence in 2 cases and non-union in none of our cases.

Conclusion: Surgical management of tibial plateau fractures will give excellent anatomical reduction and rigid fixation to restore articular congruity, fascilitate early motion and reducing post-traumatic OA and hence to achieve optimal knee function.

Keywords: Fracture, Tibial plateau, Buttress plate, Bone graft

INTRODUCTION

Tibial plateau fractures are one of the commonest intra-articular fractures resulting from indirect coronal or direct axial compressive forces. Fractures of tibial plateau constitute 1% of all fractures and 8% fractures in the elderly [1]. These fractures encompass many and varied fracture configurations that involve the medial condyle (10-23%), lateral condyle (55-70%) or both (11-30%) with differing degrees of articular depression and displacement. In case of improper restoration of the plateau surface and the axis of the leg, these fractures could lead to development of premature osteoarthritis, injury in ligaments, as well lifelong pain and disability [2]. Tibial plateau fractures may be accompanied by meniscal and ligamentous injuries to the knee too [3].

For assessment of the initial injury, planning management and prediction of prognosis, orthopedic surgeons widely use the Schatzker classification system, which divides tibial plateau fractures into six types. Each increasing numeric category specifies increased level of energy imparted to bone thereby increasing severity of fracture [3]. First four are unicondylar and type V and VI are bicondylar. Each fracture's pattern in Schatzker classification helps to direct orthopeadic surgeons to adopt appropriate treatment modality [4].

The aim was to study the surgical management of intra-articular fractures of proximal tibia to obtain a stable, pain-free, mobile joint, to prevent the development of osteoarthritis and to correlate the radiological findings with the type of fracture and the functional end result.

METHODOLOGY

The cases studied were included from inpatients of Bapuji Hospital and Chigateri General Hospital, Davangere, India during January 2004 to December 2005. Total 32 cases were studied. The average age of patient was 41 years with the oldest patient 60 years and youngest 24 years.

Inclusion Criteria

a) Age: Patients above 18 years of either sex.
b) Radiological diagnosis of fractures with classification based on Schatzker's classification.

Exclusion Criteria

a) Age: Less than 18 years.
b) Patients who are medically unfit for the surgery.
c) Compound tibial plateau fracture.

The consent of the patient for anaesthesia and surgery and Institutional ethical clearance was obtained [Table/Fig-1].

METHODS OF TREATMENT

Methods of treatment	No. of cases	Percentage
Percutaneous cancellous screw fixation	8	25
Cancellous screw and bone grafting	2	6.2
ORIF with buttress plate and screws	15	46.8
ORIF with buttress plate and bone graft	6	18.8
ORIF with buttress plate and external fixator	1	3.2

[Table/Fig-1]: Methods of treatment of 32 patients treated surgically

Whenever rigid internal fixation was achieved, the patient was mobilised 48 hours after removal of the drains, for 2-5 days the range of motion allowed was 0-20°, from the 5th day the range of motion was gradually allowed to be increased to 90° or more. After suture removal, full range of movement was allowed.

Whenever there was doubt about the rigidity of fixation, external splinting in the form of plaster of paris slab was given for support. Range of motion exercises (CPM) were done daily under careful supervision and splint reapplied. All the patients were taught and advised to do static quadriceps exercises and dynamic exercises

with a quadriceps board as much as possible and throughout the day. Partial weight bearing was delayed until 6–8 weeks and full weight bearing allowed after 12-16 weeks. The best time for open reduction and internal fixation was within 4 hours of injury or 1 week after the injury, when the swelling and the inflammatory reactions have subsided.

Pre-operative instructions: Consent of the patient for anaesthesia and surgery was obtained. nil by mouth (NBM) 8 hours prior to surgery. Injection TT 0.5cc IM stat was injected. Preoperative antibiotic was given.

Post-operative instructions: Blood pressure temperature, pulse and respiration were monitored hourly. Post-operative analgesia was given and antibiotics were prescribed for 7-10 days. Patients were watched-out for bleeding. Foot end elevation was done (as the surgeries are performed under spinal anaesthesia). Postoperative X-ray was taken, preferably the next day.

RESULTS

Observation and analysis of results was done in relationship to age, type of fracture, method of treatment, duration of immobilization, complications and the remarks of different age groups in details as shown in [Table/Fig-2].

Age in years	No.of cases	Percentage
21-30	3	12.25
31-40	17	50.25
41-50	8	25.0
51-60	4	12.5
Sex		
Male	29	90.63
Female	3	9.37

[Table/Fig-2]: Shows patient age groups and sex Vs number of cases

Period of immobilization	No.of cases
< 10 days	24
Upto 3 weeks	5
Upto 6 weeks	3

[Table/Fig-3]: Period of immobilisation

None of the patients were immobilized when secure, rigid fixation was done. In case of doubt about rigidity of fixation, associated ligament injury or osteoporosis, the immobilization was extended preferably in above knee cast upto 3 weeks. Two cases of infection and another case of severe metaphyseal comminution had to be immobilized for 6-8 weeks [Table/Fig-3]. Most of the cases had good range of painless knee motion (0-130°), except for the last group where one patient developed knee stiffness [Table/Fig-4].

Complications	No.of cases
Knee stiffness	3
Malunion	2
Infection and wound dehiscences	3
Extensor lag	1
Redepression	1

[Table/Fig-4]: Shows numbers of patients with different complications

All fractures united within expected time. Not a single case of non-union was noted in given series. Average time for union was 14 weeks (range 10-22 weeks).

Out of 32 cases treated with surgical procedure, 14 cases gave excellent result and 2 cases of poor result were seen, mainly due to the severity of the injury and infections [Table/Fig-5]. Retrospectively it was found that high velocity injuries (Type IV – VI) have poorer outcome than low velocity injuries (Type I-III) [5].

Clinical results	No.of cases	Percentage
Excellent	14	44
Good	14	44
Fair	2	6
Poor	2	6

[Table/Fig-5]: Clinical results of surgery

DISCUSSION

Tibial plateau fractures, one of the commonest intra-articular fractures, are major traumatic injury occuring as a result of RTA, fall from height, violence etc. It is sometimes associated with other bony or soft tissue injuries. Any fracture around the joint (especially weight bearing knee joint in the lower limb) is of paramount importance as it results in significant moribidity and adversely affects quality of life. Hence, the treatment of upper tibial fractures with intra-articular extension is a challenge for the orthopedic surgeons.

In present study, the majority of fractures occured between the age of 20 and 60 years with maximum incidence in the productive age group of 31-40 years (50.25%). Honkonen SE [6] also showed age incidence 20-60 years with an average of 39.8 years which correlates with the present study. Lee et al., [7] too showed that the average age of tibial plateau fractures in patients was 42 years. Albuquerque et al., observed that 71% of injuries occurred in those aged 30-60 years, with maximum frequency between 40-49 years[8]. High energy injuries are more common in youngsters and low energy fractures in elderly patients [4].

The tibial plateau fractures are commonly seen in the active and productive age group especially in male patients as they engage in more activities and travels. In given study males were more affected than females which was also reported by Lee et al., (65.71%) [7], Albuquerque et al., (70.3%) [8], Manidakis et al.,(58.4%) [9] and Mehin et al.,(56%) [10].

In given series, Schatzkar Type I and Type II dominated the total fractures making 50% [Table/Fig-6]. Similarly Rademakers et al., reported that 64% patients sustained a fracture of the lateral condyle (Schatzker 1/2/3) [11]. Mehin and coworkers reported about 30% of the injuries were high-grade Type-VI tibia plateau fractures, whereas 35% were lower-grade Type-III fractures [10]. In MRI analysis of 103 patients, Gardner et al., reported that the most frequent fracture pattern was a lateral plateau split-depression (Schatzker II) [12].

Number and percentage of cases, with various Schatzkar type of fracture, reported in various studies has been tabulated in [Table/Fig-6].

Type of fracture (Schatzkar classification) [3]	Schatzkar et al., [13]	Albuquerque et al., [8]	Manidakis et al.,[9]	Present study
lateral plateau fracture without depression (I)	4 (6)	20(8.4)	31(24.8)	10 (31.2)
lateral plateau fracture with depression (II)	18 (25)	84(35.1)	42(33.6)	6 (18.8)
compression fracture of the lateral/ central plateau (III)	25 (36)	21(8.8)	21(16.8)	2 (6.3)
medial plateau fracture (IV)	7 (10)	28(11.7)	9(7.2)	4 (12.5)
bicondylar plateau fracture (V)	2 (3)	38(15.9)	6(4.8)	6 (18.8)
plateau fracture with diaphyseal discontinuity (VI)	14 (20)	48(20.1)	16(12.8)	4 (12.5)
total	70	239	125	32

[Table/Fig-6]: Schatzkar type of fracture reported in various studies

In this series we studied 32 cases of simple tibial plateau fractures treated only by surgical methods. Different authors use different critiera for the surgical management of these fractures. In present study, 3mm depression was considered as an indication for surgery. Schatzkar [13], reported 70 cases of tibial plateau fractures of all

types treated by conservative (56%) and surgical (44%) with average follow-up of 28 months. Acceptable results were obtained in 58% of cases of conservative group and 78% by open methods. In the early half of the 20th century an author reported two studies having satisfactory percentage of good to excellent short and long term results with surgical method of treatment [14,15]. Another published study of 159 cases of tibial plateau fracture of all types reported better "good-excellent" results in surgery (84%) than conservative (62%) methods [16]. Mehin and coworkers reported that "of 286 patients with tibial plateau fractures, of whom 77% were treated operatively"[10]. Similarly Pasa et al., too reported that 30 % were treated conservatively and 70% by a surgical procedure [17].

We have not formulated the stringent criteria as to particular method of fixation for particular type of fracture. So each case was individualized and treated accordingly as it needs. Most of the type I, some Type II and a case of Type V were treated with percutaneous cancellous screw fixation. The split fracture, of >3mm displacement was 79 treated by ORIF. Bone grafting was included along with ORIF with Buttress plate and screws in Type II, III, V and VI wherever necessary. Of 114 patients with proximal tibial fractures, Pasa et al., used fixation with a cancellous screw and washer in 25, and a buttress plate in 27 patients. They also reported that better results were achieved in treatment of Intra-articular fractures of the proximal tibia by minimally invasive fixation with cancellous screws [17].

The benefits of early knee motion include - reduce knee stiffness and improved cartilage healing (regeneration). However, these benefits are to be cautiously balanced by risks, including loss of fracture reduction, failure of internal fixation and compromised ligament and soft tissue healing. Schatzker et al., stated that the prognosis is given by the degree of displacement, type of fracture, method of treatment and quality of postoperative care [13]. we achieved 44% excellent result 44% good results (overall 88% acceptable results) with our standard surgical care using various standard fixation 80 methods. In addition we had 6% fair and 6% poor results in terms of functional outcome. These results are comparable and on par with other documented standard studies [Table/Fig-7].

Authors	result
Joseph Schatzkar [13]	86%
Honkonen SE [6]	86%
Rademakers et al.,[10]	94%
Manidakis [9]	69%
Urruela AM [18]	76%
present study	88%

[Table/Fig-7]: Studies showing acceptable result of surgical treatment

CONCLUSION

Tibial plateau fractures are increasing (especially the high velocity injuries) with the increase in automobile accidents. Surgical treatment when indicated (particularly in depressed and displaced fractures) is advantageous to get a stable knee. The surgical management of tibial plateau fractures is challenging and gives excellent anatomical reduction & rigid fixation to restore articular congruity, facilitate early knee motion by reducing post-traumatic osteoarthritis and thus achieving optimal knee function.

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