SHORT ARTICLE

Evaluation of Results of Various Operative Method In The Management of Tibal Plateau Fracture In Adults

Neeraj Mahajan

Abstract

A series of 25 patients of tibial condylar fractures treated with various operative methods have been reviewed after surgery. The study has 6 Type I, 6 Type II, 1 Type III, 5 Type IV, 3 Type V and 4 Type VI fractures. 16 patients were treated with open reduction and internal fixation with buttress plate, 3 patients with closed reduction and internal fixation with cannulated screws, 5 patients with open reduction with cannulated screws, 1 patient with closed reduction internal fixation with cannulated screw with external fixator.Out of 25 patients, 19 had excellent results, 4 had good results and 2 patients had a fair result. Two patients had superficial wound infection, two patients had screw irritation on medial end and 1 patient had malreduction.The surgical goals in treating these fractures are anatomic reduction, stable fracture fixation and early post operative rehabilitation.

Key Words

Operative methods, tibial plateau fractures, cannulated screw, buttress plate

Introduction

The objective in the treatment of tibial plateau fractures is to obtain a stable, pain free knee joint with a functional range of motion. The optimal treatment of patients with tibial plateau fractures remains controversial, and a wide variety of treatment modalities have been proposed (1-3). Several authors advocate open reduction and internal fixation (4). Other authors have reported good results with limited internal fixation (5). Apley and others have advocated skeletal traction and early motion for most fractures (6-8).Schatzker *et al* (9) have recommended the use of open reduction and internal fixation utilizing AO techniques and implants with satisfactory results. Blokker et al reported that only 71% of their patients treated with open reduction and internal fixation had satisfactory results (10).

The purpose of this study was to evaluate the results of various operative methods in the management of tibial plateau fractures.

Material and Methods

Twenty five adult patients with tibial condylar fractures were treated with various operative techniques (between July 2004 and June 2006) in Department of Orthopaedics, Government Medical College, Jammu. Patients ages ranged from 20 to 54 years (average: 36 years). There were 22 males and 3 females. Seventeen fractures occurred in motor vehicle accidents, 6 in falls and 2 in direct blow.

For lateral condylar fractures, anterolateral incision was made starting 3cm above the patella and extending distally below the inferior margin of the fracture site. The intra-articular exposure was gained by incising the coronary or inframeniscotibial ligament and retracting the meniscus superiorly. To expose the longitudinal fracture of the lateral condyle, origin of extensor muscles was stripped from the anterolateral aspect of the condyle through an incision shaped like an inverted â•˜Lâ•™. Muscle origin was reflected laterally until the fracture

From the Post Graduate Department of Orthpaedics, Government Medical College, Jammu J&K-India.
Correspondence to : Dr. Neeraj Mahajan, Ward No. 14, Talab Sailan, Udhampur-182101 J&K-India

line was exposed. Access to the central part of the tibial condyle could be easily gained by retracting the lateral fragment.

In case of depression, the depressed articular fragment and compressed cancellous bone was elevated with small periosteal elevator after making cortical window below the depression (if needed). Cavity thus produced in the metaphysis was filled with bone graft harvested from iliac crest. The lateral condylar was then replaced snugly to lock the articular fragments together. At times it was temporarily fixed with K wires followed by definitive fixation by buttress plate. Once properly contoured, it was secured to the condyle with appropriate cannulated or cancellous screws of sufficient length to engage the opposite medial cortex (11).

If fracture consists of only single fragment with no comminution, with little or no depression, percutaneous fixation with appropriate sized AO cannulated or cancellous screws was done (12-13). In fractures of medial condyle, basic principle and technique of open reduction and internal fixation was same as described for lateral condyle fractures. Such fractures were approached by anteromedial approach.

When the condition of the soft tissues envelope was good in patients with type V and VI fractures they were managed by open reduction and internal fixation with buttress plate placed laterally as described for fractures of lateral condyle. When skin and soft tissue quality was not good, the fracture were managed by an external fixator with percutaneous fixation of the condyles using AO cannulated screws or cancellous screws, if the fragment were not extensively comminuted (14).

The postoperative regimen was individualized depending on the patientâ•™s age, quality of bone and stability of fixation. In general the policy was for early range of motion, exercise and non-weight bearing for 2 month period.Final evaluation was done at 9 months as per 100 point scale shown in table 1. 45 points were given to function, 30 points to subjective factors, and 25 point to anatomical restoration (15).

Results

Most of the patients were in age group of 20-40 years (68%) with mean age of 36.4 years. Male predominate the study (88%). Road traffic accidents were found to be the commonest mode of trauma (68%). Right limb was involved more often (60%) than the left. There were 6 Type I, 6 Type II, 1 Type III, 5 Type IV, 3 Type V and

Table -1: 100 Point Rating Scale For Froximal Tibial Fractures

A.	**Symptomatic (Max. of 30 points)**	
1.	Pain (max. of 20 points)	Points
	None	20
	Wet weather ache	18
	After hard use	16
	Limits use	14
	Painful walking	10
	Limits walking	05
	Continuous pain	00
2.	Activity level (max of 5 points)	Points
	Unlimited	5
	Limited in sports	4
	Limited in jogging	3
	Limited in walking	2
	Cane/Brace needed	0
3.	Patient Assessment (max. of 5 points)	Points
	Normal knee (100%)	5
	Near normal (90%)	4
	Good (>75%)	3
	Fair (50-75%)	1
	Poor (<50%)	0
B.	**Functional (Max. of 45 Points)**	
1.	Knee Flexion (max. of 30 points)	Points
	> 135 degrees	30
	120-134 degrees	26
	105 – 119 degrees	23
	90 – 104 degrees	20
	75 – 89 degrees	15
	60 – 74 degrees	10
	< 60 degrees	05
	Ankylosed	00
2.	Extension (Max. of 10 points)	Points
	Full extension	10
	Lacks 1 – 5 degrees	05
	Lacks 6 – 10 degrees	02
	Lacks more than 10 degrees	00
3.	Crepitus (Max. of 5 points)	Points
	No crepitus	05
	Clicking	04
	Occasional locking	03
	Constant crepitus	01
C.	**Anatomic (Max of 25 points)**	
1.	Angular deformity (max. of 10 points)	Points
	No deformity	10
	5 degrees	08
	10 degrees	05
	15 degrees	02
	20 degrees or more	00
2.	Instability (Max. of 10 points)	Points
	No instability	10
	5 degrees	08
	10 degrees	05
	15 degrees	02
	20 degrees or more	00
3.	Arthritis (Max. of 5 points)	Points
	None	05
	Mild	04
	Modeate	02
	Severe	00

RESULT	**POINTS**
Excellent	90-100 points
Good	80-89 points
Fair	70-79 points
Poor	Less than 70 points

Table 2: Characteristics of Evaluation of Results of Various Operative Methods In The Management of Tibial Plateau Fractures In Adults

S. No	Characteristics (n = 25)	No.	(%)
1.	Age (yrs)		
	Range	20-54	
	Mean age	36.4	
2.	Sex		
	Male	22	88%
	Female	3	12%
3.	Mode of trauma		
	Automobile accidents	17	68%
	Fall from stairs/height	6	24%
	Direct blow	2	8%
4.	Limb side injured		
	Right	15	60%
	Left	10	40%
5.	Case distribution		
	Type I	6	24%
	Type II	6	24%
	Type III	1	4%
	Type IV	5	20%
	Type V	3	12%
	Type VI	4	16%
6.	Mode of fixation		
	ORIF with buttress plate	16	64%
	CRIF with cannulated screws	3	12%
	ORIF with cannulated screws	5	20%
	CRIF with cannulated screws & EF	1	4%
7.	Mean time taken for weight bearing	(wks) Partial	Full
	Type I	6.5	10.5
	Type II	8.3	13.0
	Type III	10.0	15.0
	Type IV	8.4	16.0
	Type V	11.0	19.0
	Type VI	13.0	21.0
8.	Mean time for radiological union	(wks)	
	Type I	11.0	
	Type II	13.5	
	Type III	16.0	
	Type IV	16.4	
	Type V	19.3	
	Type VI	21.7	
9.	Range of motion at knee	(deg)	
	Flexion		
	More than 135	16	64%
	120- 134	5	20%
	105- 119	4	16%
	Extension		
	Full extension	21	84%
	Extensor lag of 5^0 or $<5^0$	4	16%
10.	Complications		
	Superficial wound infection	2	8%
	Screw irritation on medial side	2	8%
	Mal-reduction	1	4%
11.	Result grading		
	Excellent	19	76%
	Good	4	16%
	Fair	2	8%

Figure 1 & 2 : X-ray Showing Fixation if Tibial Plateau Fracture with Cannulated Screws

4 Type VI fractures. 16 patients were treated with open reduction and internal fixation with buttress plate *(Fig-1)*, 3 patients with closed reduction and internal fixation with cannulated screws *(Fig-2)*, 5 patients with open reduction with cannulated screws, 1 patient with closed reduction internal fixation with cannulated screw with external fixator. The mean time taken for partial weight bearing, for full weight bearing and for radiological union is shown in *table 2*. Range of motion at knee in degrees of flexion and extension is shown in table 2. Worst complication was malreduction which latter lead to fair results. There were 2 cases of superficial wound infection and 2 cases of screw irritation at the far end. Overall there were 19 excellent, 4 good and 2 fair results. There were 6,6,1,5,3 and 2 excellent or good results in Types I, II, III, IV, V and Type VI respectively. Both the fair results were seen in Type VI fractures.

Discussion

Open reduction and internal fixation continues to be the method of choice for the management of unicondylar fractures as evident from this study in which 16 patients were treated with this method using buttress plating. Recent study has also shown that the long-term results after open reduction and internal fixation for tibial plateau fractures are excellent (16). But opinion varies as far as management of high energy tibial plateau fractures (Type V and Type VI) is concerned. Conventional forms of open reduction and internal fixation in such cases is often

associated with complications like skin necrosis, wound infection, decreased range of motion etc. resulting in poor functional outcome as evident from 2 fair results seen only in high energy tibial plateau type VI fractures. Such complications can be minimized by careful selection of cases for open reduction and internal fixation keeping in mind the status of the soft tissue envelope (17).High-energy tibial plateau fractures present a therapeutic challenge to the orthopaedic trauma surgeon, both in terms of the osseous injury as well as the concomitant soft-tissue insult. This is supported by recent study which also states that type VI fractures are difficult to manage and the treatment of such fractures, need specific attention to the soft tissue envelope around the knee (18). Surgical treatment has evolved to address these fractures in a more biologically favourable manner without further compromising the soft tissues (19). Recently 3.5-mm medial distal tibia plate, originally designed for distal tibial shaft or pilon fractures, is used in osteosynthesis of certain bicondylar tibial plateau fractures as it reduces soft-tissue dissection and thereby decreases risk for soft-tissue infection or slough while preventing medial column collapse and varus deformity of the knee(20). An alternative method of management of high energy tibial plateau fractures is the use of conventional or ring external fixators after performing a closed reduction. Conventional ring fixator can span the fracture gap in case of comminution or minimal bone loss (21, 22). While the open reduction & internal fixation continues to be the method of choice for unicondylar fractures, conventional or ring external fixators after performing a closed reduction may be more safe and effective for management of high energy fractures with open wounds and severe contusions of the soft tissue envelope.

Acknowledgement

Author wish to acknowledge Dr M N Gupta, Dr OP Bhagat, Dr Dara Singh & Dr AQ Salaria for the help support rendered in the present research work

References

1. Bhan S,Marya SKS, Dave PK,Chandra P. Place of conservative treatment in the management of tibial plateau fractures. *Ind J Ortho* 1989; 23(2):160-64.
2. Mason H. Tibial condylar fractures. *JBJS* 1967; 49:1455-67.
3. Moore TM, Patzakis MJ, Harvey JP. Tibial plateau fractures: definition, demographics, treatment rationale, and long term results of closed traction management or operative reduction. *J Orthop Trauma* 1987; 1(2): 97-119.
4. Steven DG, Beharry R, Mckee MD, Waddell JP, Schemitsch EH. The long term functional outcome of operatively treated tibial plateau fractures. *J Orthop Trauma* 2001; 15 (5):312-20.
5. Duwelius PJ, Rangitsch MR, Colville MR, Woll TS. Treatment of tibial plateau fracture by limited internal fixation. *Clin Orthop* 1997; 339:47-57.
6. Apley AG. Fractures of the tibial condyle treated by skeletal traction and early mobilization. *JBJS* 1956; 38 (3): 699-708.
7. Sankhala SS, Gupta SP, Sharma JC, Agarwal S. Tibial condylar fractures treated with traction and early mobilization. *J Ind Med Asso* 1990; 88(11):309-11.
8. Marwah V, Gardegone WM, Margarkar DS. The treatment of fractures of tibial plateau by skeletal traction and early mobilization. *Int Orthop* 1985; 9(4):217-21.
9. Schatzker J, McBroom R, Bruce D. Tibial plateau fractures. The toronto experience 1968 -1975. *Clin Orthop* 1979; 138:94-104.
10. Blockker CP, Rorabeck CH, Bourne RB. Tibial plateau fractures. An analysis of results of treatment in 60 patients. *Clin Orthop* 1985; 182: 193-99.
11. Gossling HR, Peterson CA. A new surgical approach in the treatment of the depressed lateral condylar fractures of tibia. *Clin Orthop Relat Res* 1979; 140: 96-102.
12. Harper MC, Henstorf JE, Versely MB *et al*. Closed reduction and percutaneous reduction of tibial plateau fracture. *Orthopaedics* 1995; 18: 623-26.
13. Collinge C, Sanders R, DiPasquale T. Treatment of complex tibial periarticular fractures using percutaneous technique. *Clin Orthop Relat Res* 2000; 375: 69-77.
14. Marsh JL, Smith ST, TT Do. External fixation and limited internal fixation for complex fractures of tibial plateau. *JBJS* 1995; 77(5), 661-73.
15. Delamarter RB, Hohl M, Hopp E Jr. Ligament injuries associated with tibial plateau fractures. *Clin Orthop Relat Res* 1990; 250: 226-33.
16. Rademakers MV, Kerkhoffs GM, Sierevelt IN *et al*. Operative treatment of 109 tibial plateau fractures: five- to 27-year follow-up results. *J Orthop Trauma* 2007; 21(1):5-10.
17. Lachiewicz PF, Funcik T. Factors influencing the results of open reduction and internal fixation of tibial plateau fractures. *Clin Orthop Relat Res* 1990; 259:210-15.
18. Mahadeva D, Costa ML, Gaffey A. Open reduction and internal fixation versus hybrid fixation for bicondylar/severe tibial plateau fractures: a systematic review of the literature. *Arch Orthop Trauma Surg* 2008; 128 (10):1169-75.
19. Robert D. Zura, James A. Browne, Molly D. Black , Steven A. Olson.Current management of high-energy tibial plateau fractures. *Current Orthopaedics* 2007; 21(3):229-35.
20. Mashru RP, Jahangir AA, Parrella MS, Harding SP. Percutaneous fixation of the medial condyle in bicondylar tibial plateau fractures: novel use of the 3.5-mm medial distal tibia plate. *Am J Orthop* 2008; 37(1):14-17.
21. Gaudinez RF, Mallik AR , Szporn M. Hybrid external fixation of comminuted tibial plateau fractures. *Clin Orthop Relat Res* 1996; 328: 203-10.
22. Mikulak SA, Gold SM, Zinar DM. Small wire external fixation of high energy tibial plateau fractures. *Clin Orthop Relat Res* 1998; 356:230-38.