International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2018; 4(2): 899-905

www.orthopaper.com
Received: 10-02-2018
Accepted: 11-03-2018

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Management of tibial condylar fractures in adults: A prospective study

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DOI: https://doi.org/10.22271/ortho.2018.v4.i2m.130

Abstract
Tibial condylar fractures are specially challenging to the Orthopaedic surgeons because of their variation, complexity, and injuries associated with it. Proximal tibia gives attachment to the various elements of knee stabilizers and is an integral part of the knee mechanism. So, alteration of its anatomy caused by injury result in functional impairment of knee. A study has been carried out to know the mode of injury, fracture pattern, outcome of various modalities of treatment, complications encountered and associated with management of tibial condylar fractures in adults. Study consists of 35 patients with tibial condylar fractures. Out of 35 patients, 12 patients were managed by conservative methods and remaining 23 Patients were managed by surgical methods. Conservative treatment included closed reduction and above knee cast application and surgical management included CRIF with CCS or ORIF with BP with or without bone grafts. Functional evaluation of the knee was done, based on the modified HohI and Luck evaluation methods. Incidence of osteoarthritis was assessed based on the most recent radiograph of tile patient's weight bearing. The management of tibial plateau fracture has always been a subject of debate because of their variety and complexity. It is concluded that surgery is the treatment of choice for displaced fractures belonging to Schatzker type I and II. Schatzker's type III fractures can be managed conservatively if the depression is less than 2 mm. Schatzker's type IV and V can be managed by open reduction and internal fixation with Buttress plate and bone grafting especially in young individuals who require perfect anatomical reconstruction of the articular surface, stable fixation and early mobilization. Conservative method is a valid and useful alternative for undisplaced Schatzker type I fractures.

Keywords: Tibia, Condylar fractures, undisplaced fractures, knee stabilizers, knee flexion, post traumatic osteoarthritis, Schatzker type I to type V fracture

Introduction
Tibial condylar fractures are specially challenging to the orthopaedic surgeons because of their number, variety, complexity, different concepts of management and injuries associated with it [1]. As proximal tibia gives attachment to the various elements of knee stabilizers and being an integral part of the knee mechanism, alteration of anatomy caused by injury, results in functional impairment [2, 3]. In India, more than anything, extreme flexion is very important as far as our living habits are concerned. Tibial plateau fracture whether treated conservatively or operatively is known to cause limitation of knee flexion of varying degrees. Earlier, most of tibial plateau fractures were treated conservatively which resulted in joint line incongruity, early osteoarthrosis and knee stiffness [4-6]. Now treatment of these fractures has changed radically over the years, as our ability to achieve near anatomic reduction and fixation has improved [7-9].
The aim of the study is evaluating the age group affected, mechanism of injury and type of fracture based on Schatzker's classification. To study the duration of union in different type of fractures and to compare the outcome of surgical and conservative management in tibial condyle fractures. Also to study the complications in both methods of treatment the functional outcome of knee post operatively.

Materials and Methods
This is a study of management of tibial condylar fractures in adults, conducted in the department of orthopedics at Karpaga Vinyaga Institute of Medical Sciences and Research Center, Madhurantagm, Tamilnadu during the period of September 2014 to March 2017.

During this period 35 patients were treated for tibial condylar fractures of which 12 patients were treated by conservative methods and 23 patients were treated by surgical methods. All the required data was collected from the patients during their stay in the hospital, during follow up at regular intervals and from the medical records.

Inclusion Criteria

Patients with tibial condylar fractures in the age group of 20-50 years seen during the period September 2015 to March 2018.

Exclusion criteria

People with less than 20 years of age and patients above 50 years and had fractures were excluded from the study. Patients who had compound fractures, associated with fracture of distal end of the femur and patellar fracture were also excluded from the study.

Management

The Schatzkers classification was used to classify these fractures. The patients were followed up for an average period of 12 months. The patients were first seen in the casualty. The history was taken followed by general and local examination of the patient. Concerned specialists undertook appropriate management of the associated injuries. Intensive care was given to those patients who presented with shock and immediate resuscitative measures were taken. Once the patient's general condition was fit, relevant X-rays were taken. The treatment method was based on the type of fracture, the amount of displacement and the amount of depression of the tibial plateau. Minimally displaced fractures were reduced by traction and compression methods followed by an above knee cast with the knee in 10° of flexion. Patients who presented with, extensively comminuted fractures, patients who were not fit for surgery and those patients with extensive skin problems were initially treated with skeletal traction followed by cast application. During the period of traction patients were advised isometric quadriceps exercises and active ankle and foot movements. At 6 weeks an X-ray was repeated and if showed signs of union, the cast were removed and the patients were advised non-weight bearing crutch ambulation with active knee movements. At 3 months a repeat X-ray was done and based on clinical and radiological evidence of union partial weight bearing was allowed which was gradually progressed to full weight bearing.

Surgical method of treatment was mainly based on the type of fracture and amount of displacement or depression and the degree of instability. The patients were taken for surgery at the earliest possible time depending on their medical condition, skin condition and the amount of swelling. All surgeries were done under C-arm image intensifier control. Fractures were fixed either with percutaneous technique or by open reduction and internal fixation. The fixation devices consisted of T Buttress plate, L Buttress plates, spoon plate's 4.5 mm cortical screws and 6.5 mm and 7.0 mm cannulated and non-cannulated cancellous screws. Bone grafts were used in depressed and comminuted fractures. The source of bone graft was ipsilateral iliac crest or femoral condyles [6-8]. Postoperatively patients were immobilized with an above knee posterior slab or a compression bandage. The sutures were removed on the 10th postoperative day. Antibiotics were given till suture removal [9]. The patients were advised quadriceps exercises, knee mobilization and non-weight bearing crutch walking, on discharge [10-14]. An immediate postoperative X-ray was also done.

Follow up

The first follow up was done at 2 weeks, during which the surgical scar was inspected and range of movements noted. The second follow up done at 6 weeks during which an X-ray was taken to look for signs of fracture union and loss of reduction if any [13, 15-18]. The third follow-up was done at 3 months (luring which one more X-ray was done and a clinical evaluation of union done. Based on the clinical and radiological signs of union patients were allowed partial weight bearing and gradually progressed to full weight bearing [7, 9, 12, 15- 18]. The patients were then followed up at 6 months, 1 year and 2 years respectively during which time the anatomic and functional evaluation was done using the modified HohI and Luck evaluation method. The posttraumatic osteoarthrosis was assessed on the most recent radiographs taken with the patients standing.

Statistical analysis

Following statistical methods were employed in the present study. All the statistical operations were done through SPSS version 16.0. Data was expressed in mean, standard deviation and percentage and applied appropriately where ever applicable. The statistical inference test used for analysis was Contingency coefficient analysis (CC) and Chi-square test with Yate's correction.

Results

The following observations were made from the data collected during the study of management of tibial condylar fractures.

Age incidence and Sex incidence

In the current study, the average age group was 41 years, 62.5% were between 21-60 years of age group, youngest being 21 years and eldest being 60 years. In this study male preponderance is observed. Out of 35 patients, 19 patients sustained injury to the right and 16 patients to the left. Table 1 shows the age wise distribution of the study population. It is seen from the table that majority of the patients were in the age group of 31-40 years (40%). The gender wise distribution of the study population shows majority (80%) of male patients, only 20% were female patients. Road traffic accident was the commonest mode of injury (74.2%) and produced different types of fractures, followed by fall from level surface and fall from a height (25.8%).

Table 2 shows the distribution of the patients based on the type of fracture. 21 patients had low velocity type of injury. The low velocity type of injury includes type I, II and III fractures. 14 patients had fractures due to high velocity type of injury. Type IV, V and VI fractures are fractures due to high velocity injury.

Table 3 shows the distribution of various types of treatment for the patients based on the type of fracture. Out of 35 patients 12 (34.2%) patients were treated conservatively and 23 (65.7%) patients had undergone surgery. The various types of surgeries done were cannulated cancellous screw fixation, buttress plate fixation and bone grafting. Type 1 and type II undisplaced fractures were treated conservatively and the displaced fractures of both these types were treated surgically. Most of the patients with type IV, V and VI fractures were treated surgically.

Table 4 shows the early complications of the patients based on their type of fracture. The early complications reported among the patients were infection and loss of reduction. The rate of complications were more in fracture types IV, V and VI when compared to fracture types I, II and III and this difference was found to be statistically significant (*P*<.005).

Table 5 shows the early complications of the patients based on the type of interventions. Among the conservatively treated patients loss of reduction was the commonest early complication and that is found to be statistically significant. Whereas among surgically treated patients infection was found to be the commonest complication. 74.2% of patients had not experienced any of the early complication

Table 6 shows the late complications of the patients based on their type of fracture. Knee stiffness, Post Traumatic Osteoarthritis, malunion and knee instability are the various late complications experienced by the patients. The late complications were reported more among the patients with high velocity injuries (Type IV, V and VI fracture) when compared to low velocity injuries (Type I, II and III fracture) and this difference was found to be statistically significant (*p*<.05).

Table 7 shows the late complications of the patients based on the type of treatment given. Among the conservatively treated patients knee stiffness was the commonest late complication when compared to other complications and this difference was statistically significant (*P*<.0001). The late complications were comparatively less among the surgically treated patients. Only 5 patients out of 23 patients who had undergone surgery had experienced late complications.

Table 8 shows the mean time of fracture union based on the type and treatment for the fracture. The mean time for type I, II and III fractures and conservatively treated fractures was 3 months and for surgically treated patients and fracture type IV, V and VI the mean time for fracture union was ranging between 4-6 months and this difference was found to be statistically significant.

Table 9 indicates the result of final outcome based on the type of fracture. The final outcome was measured based on modified Hohl and Luck evaluation method where the outcome was graded as excellent, good, fair and poor. It is inferred from the table that the final outcome was excellent in more number of patients in the fracture type I, II and III when compared with fracture type IV, V and VI and this difference was statistically significant (*P*<.005). Similarly 4 patients with fracture type IV, V and VI had poor outcome whereas none of the patients with fracture type I, II and III had a poor outcome and this difference was also found to be statistically significant (*P*<.005).

Table 10 shows the result of final outcome based on the type of treatment given to the patient. In conservative type of management 9 patients had an outcome of good to excellent when compared with fair to poor and the difference was statistically significant. Similar result was also seen with patients who got operated with cannulated cancellous screws alone and with bone graft. Whereas 9 patients was operated with buttress plate alone in that 6 had results ranging from good to excellent and for 3 patients it was between fair to poor. Only one patient was operated with buttress plate with bone graft and the outcome was excellent.

Table 11 indicates the result of final outcome based on low and high velocity injury and the conservative and surgical treatment given for it. It can be inferred from the table that among the low velocity injury type of fractures both the conservative and surgical type of intervention based on displaced or undisplaced fractures had given good to excellent outcome results and there is no statistical significant difference between conservative or surgical type of intervention. Whereas among the high velocity type of injuries the surgical intervention had shown excellent outcome rather than conservative type of management and this difference was found to be statistically significant.

Table 1: Age wise distribution of the study population

Age in years	Number	Percentage
21-30 yrs	9	17.1
31-40 yrs	15	34.2
41-50 yrs	6	22.8
51-60 yrs	5	14.2
Total	35	100

Table 2: Distribution of study population based on the type of Fracture

Type of fracture	Number	Percentage
Type 1-Displaced	3	8.5
Type 1-Undisplaced	5	14.2
Type 2-Displaced	9	25.7
Type 2-Undisplaced	2	5.7
Type 3	2	5.7
Type 4	6	17.1
Type 5	7	20
Type 6	1	2.8
Total	35	100

Table 3: Distribution of type of treatment for the various types of fractures

Type of fractures	Types of treatment					Total
	CCS	CCS/BG	Conservative	BP	BP/BG	
Type 1-DISPLACED	3 (100%)	0	0	0	0	3 (100%)
Type 1-Undisplaced	0	0	5 (100%)	0	0	5 (100%)
Type 2-Displaced	6 (66.6%)	0	0	2 (22.2%)	1 (11.1%)	9 (100%)
Type 2-Undisplaced	0	0	2 (100%)	0	0	2 (100%)
Type 3	0	2 (100%)	0	0	0	2 (100%)
Type 4	2 (33.3%)	0	2 (33.3%)	2 (33.3%)	0	6 (100%)
Type 5	0	0	2 (28.5%)	5 (71.4%)	0	7 (100%)
Type 6	0	0	1 (100%)	0	0	1 (100%)
Total	11 (31.4%)	2 (5.7%)	12 (34.2%)	9 (25.7%)	1 (2.8%)	35 (100%)

Table 4: Fracture wise early complication among the study subjects

Type of fractures	Early complications			Total	P value
	INF	LOR	Nil		
Type 1-DISPLACED	0	0	3 (11.5%)	3 (8.5%)	<.005*
Type 1-Undisplaced	0	1 (25%)	4 (15.3%)	5 (14.2%)	
Type 2-Displaced	1 (20%)	0	8 (30.7%)	9 (25.7%)	
Type 2-Undisplaced	0	0	2 (7.6%)	2 (5.7%)	
Type 3	1 (20%)	0	1 (3.8%)	2 (5.7%)	
Type 4	1 (20%)	1 (25%)	4 (15.3%)	6 (17.1%)	
Type 5	2 (40%)	1 (25%)	4 (15.3%)	7 (20%)	
Type 6	0	1 (25%)	0	1 (2.8%)	
Total	5 (100%)	4 (100%)	26 (100%)	35 (100%)	

Table 5: Treatment wise early complication among the study subjects

Type of treatment	Early complications			Total	P value
	INF	LOR	Nil		
Conservative	0	4 (100%)	8 (30.7%)	12 (34.2%)	<.05
CCS	0	0	11 (42.3%)	11 (31.4%)	<.0001
CCS/BG	1 (20%)	0	1 (3.8%)	2 (5.7%)	0.523
BP	4 (80%)	0	5 (19.2%)	9 (25.7%)	0.416
BP/BG	0	0	1 (3.8%)	1 (2.8%)	0.248
Total	5 (100%)	4 (100%)	26 (100%)	35 (100%)	

Table 6: Fracture wise late complication among the study subjects

Type of fractures	Late Complications					Total	P value
	KS	PTOA	Malunion	KI	Nil		
Type 1-DISPLACED	0	0	0	0	3 (14.2%)	3 (8.5%)	<.055
Type 1-Undisplaced	2 (33.3%)	0	1 (50%)	0	2 (9.5%)	5 (14.2%)	
Type 2-Displaced	0	0	0	1 (33.3%)	8 (38%)	9 (25.7%)	
Type 2-Undisplaced	2 (33.3%)	0	0	0	0	2 (5.7%)	
Type 3	0	1 (20%)	0	0	1 (4.7%)	2 (5.7%)	
Type 4	1 (16.6%)	1 (20%)	0	1 (33.3%)	3 (14.2%)	6 (17.1%)	
Type 5	1 (16.6%)	2 (40%)	1 (50%)	1 (33.3%)	2 (9.5%)	7 (20%)	
Type 6	0	1 (20%)	0	0	0	1 (2.8%)	
Total	6 (100%)	5 (100%)	2 (100%)	3 (100%)	21 (100%)	35 (100%)	

Table 7: Treatment wise late complications among the study subjects

Type of treatment	Late complications					Total	P value
	KS	PTOA	Malunion	KI	Nil		
Conservative	6 (100%)	3 (60%)	1 (50%)	1 (33.3%)	1 (5.2%)	12 (34.2%)	0.0001
CCS	0	1 (20%)	1 (50%)	2 (66.6%)	7 (36.8%)	11 (31.4%)	0.156
CCS/BG	0	0	0	0	2 (10.5%)	2 (5.7%)	0.146
BP	0	1 (20%)	0	0	8 (42.1%)	9 (25.7%)	0.028
BP/BG	0	0	0	0	1 (5.2%)	1 (2.8%)	0.216
Total	6 (100%)	5 (100%)	2 (100%)	3 (100%)	19 (100%)	35 (100%)	

Table 8: Mean time for fracture union in months based on the type of fracture and treatment

Type of fractures	Types of treatment					P value
	CCS Mean (SD)	CCS/BG Mean (SD)	Conservative Mean (SD)	BP Mean (SD)	BP/BG Mean (SD)	
Type 1-Displaced	3 (0.02)	0	0	0	0	<.005
Type 1-Undisplaced	0	0	3(0.01)	0	0	
Type 2-Displaced	3 (0.04)	0	0	3(0.24)	4	
Type 2-Undisplaced	0	0	3(0.02)	0	0	
Type 3	0	3 (0.12)	0	0	0	
Type 4	4(0.16)	0	3(0.12)	4 (0.18)	0	
Type 5	0	0	4 (0.21)	5 (0.24)	0	
Type 6	0	0	6	0	0	

Table 9: Results of the final outcome based on type of fracture

Type of fracture	Result of final outcome				Total	P value
	Excellent	Good	Fair	Poor		
Type 1-Displaced	2 (13.3%)	0	1 (16.6%)	0	3 (8.5%)	<.005
Type 1-Undisplaced	3 (20%)	1 (10%)	1 (16.6%)	0	5 (14.2%)	
Type 2-Displaced	5 (33.3%)	4 (40%)	0	0	9 (25.7%)	
Type 2-Undisplaced	0	1 (10%)	1 (16.6%)	0	2 (5.7%)	
Type 3	2 (13.3%)	0	0	0	2 (5.7%)	
Type 4	2 (13.3%)	2 (20%)	1 (16.6%)	1 (25%)	6 (17.1%)	
Type 5	1 (6.6%)	2 (20%)	2 (33.3%)	2 (50%)	7 (20%)	
Type 6	0	0	0	1 (25%)	1 (2.8%)	
Total	15 (100%)	10 (100%)	6 (100%)	4 (100%)	35 (100%)	

Table 10: Results of the final outcome based on type of treatment

Type of treatment	Results of final outcome				Total	P value
	Excellent	Good	Fair	Poor		
Conservative	3 (21.4%)	6 (50%)	2 (33.3%)	1 (33.3%)	12 (34.2%)	0.023
CCS	5 (35.7%)	3 (25%)	2 (33.3%)	1 (33.3%)	11 (31.4%)	0.05
CCS/BG	2 (14.2%)	0	0	0	2 (5.7%)	0.01
BP	3 (21.4%)	3 (25%)	2 (33.3%)	1 (33.3%)	9 (25.7%)	0.174
BP/BG	1 (7.1%)	0	0	0	1 (2.8%)	0.312
Total	14 (100%)	12 (100%)	6 (100%)	3 (100%)	35 (100%)	

Table 11: Results of final outcome based on high and low velocity injuries with conservative and surgical treatment

Type of injury	Type of treatment	Results of final outcome				Total	P value
		Excellent	Good	Fair	Poor		
Low velocity type injury Type I, II, III fractures	Conservative	3 (25%)	3 (50%)	1 (33.3%)	0	7 (33.3%)	0.328
	Surgery	9 (75%)	3 (50%)	2 (66.6%)	0	14 (66.6%)	
	Total	12 (100%)	6 (100%)	3 (100%)	0	21 (100%)	
High velocity type injury Type IV, V, VI fractures	Conservative	0	3 (50%)	1 (33.3%)	1 (33.3%)	5 (35.7%)	<.05
	Surgery	2 (100%)	3 (50%)	2 (66.6%)	2 (66.6%)	9 (64.2%)	
	Total	2 (100%)	6 (100%)	3 (100%)	3 (100%)	14 (100%)	

Discussion

The management of tibial plateau fracture has always been a subject of debate because of their variety and complexity. When reviewing previous studies, it is apparent that results are reported collectively without regard to the severity of the fracture type [7-9]. A review of literature suggested that the current series has some similarities with other published series which is discussed below.

Age incidence

In the current series, the average age group was 41 years, 62.5% were between 31-50 years of age group, youngest being 21 years and eldest being 60 years. The present study had male preponderance. In this study, 17 patients sustained injury to the right and 15 patients to the left. Road traffic accident was the commonest mode of injury (56.3%) and produced different types of fractures, followed by fall from level surface (34.4%) and fall from a height (9.4%).

In this study 59.4% affected the lateral tibial condyle, isolated medial tibial condyle occurred in 15.6% where as involvement of bicondylar lesions were 25%. This is comparable to studies done by Hohi M [20] in 1991 reported 50-70% injuries affecting lateral condyle, isolated medial condyle lesions in 10-23% and bi condylar, lesions found in 10-30% [20].

Conservative treatment and results

12 (37.5%) patients treated by conservative treatment methods showed good to excellent results in 58.4% of the patients, 25% fair andl6.7% poor results.

These results were comparable to the study done to Dendrinos GK *et al*. [10] where they got good to excellent results in 62% of the patients. In 1988 De coster *et al*. [4] reported 61% of good to excellent results following conservative management. Their method of management was mainly by functional cast bracing. Some investigators have revealed a higher rate of good to excellent results.

Knee joint stiffhess was seen in 2 conservatively managed patients, which accounted to 16.7% of the conservatively managed group. Posttraumatic osteoarthritic changes were seen in 16.66% of the conservatively managed patients. These changes were more commonly seen among the high velocity trauma in type IV V and VI fractures [19-23]. Average time of union of those fractures management conservatively was 4.08 months. The average time of hospitalization in conservatively managed patients was 14.58 days. Most of the patients managed conservatively were discharged in a week time after the application of above knee cast [24- 26].

Surgical treatment and results

The results of functional evaluation of the knees treated by surgical means showed 80% good to excellent results and 20% fair to poor results. Keogh P [21] reported, out of 13 patients treated for displaced tibial plateau fractures with percutaneous screw fixation 11 had satisfactory results, one had fair and one had poor results. Koval KJ [22] reported 33% excellent, 56% good and 11% fair-results with 20 displaced fractures treated by indirect reduction and percutaneous screw fixation. Stokel EA [26] reported 65% had good to excellent results after being treated-by surgical means with operative treatment. Barei DP *et al*. [12] reported 89% acceptable results of fractures treated by experienced surgeons with accurate reconstruction of articular surface, rigid external fixation and early mobilization. They advocated that meniscectomy at the

time of surgery and postoperative immobilization was responsible for poorer functional results.

One of the common complications encountered in surgical group of patients was infection. The rate of infection was 10%. All the infections were superficial infection and healed with time. There were no incidences of deep infection or delayed infection in this study. Minimal to moderate posttraumatic osteoarthritis was seen in 15% of the 20 patients manage surgically. The earlier authors attributed this high percentage to meniscectomy done at the time of surgery. They observed that arthritis was more frequent with bicondylar fractures, varus deformity and unstable knees in extension. In this study the incidence of secondary arthritis was more common in type IV and V injuries [19, 24, 27, 29].

Malunion was seen only in 1 patient managed by surgical ORIF with BP, which was type V fracture, displaced. The average time of union in patients managed with CRIF with PCCS was with a mean of 3.58 months. ORIF with BP. was 3.75 months. The average period of hospitalization with CRIF with PCCS was with a mean of 16.33 days, ORIF with BP mean of 18 days [2, 5, 9, 21, 25]. De Coster TA *et al*. [4] reported an average stay in the hospital of 15 days after operative treatment of displaced tibial plateau fractures.

Comparative Results of Conservative and Surgical Methods of Treatment

Functional evaluation of the knee joint revealed 16.7% excellent results, 41.7% good results by conservative treatment and 45% excellent results, 35% good results by surgical treatment. After stratification of fractures into low velocity injuries (Type I, II, III) and high velocity injuries (Type IV, V, VI). 68.4% of low velocity injuries are treated by surgical methods and 31.6% treated with conservative methods. Among the high velocity injuries 53.8% are treated by surgical methods and 46.2% by conservative methods. The results showed that surgical treatment produced better results in low velocity injuries as compared to conservative methods. In high velocity injuries results of both surgical and conservative methods were similar [11, 17, 22, 24].

Among the early complication infection was a common problem with surgical methods with 10% incidence in this study. There was a significant difference in the incidence of loss of reduction between the two methods which was significantly higher in conservative method (33.33%) of treatment. One case of compartment syndrome was seen in which was treated with fasciotomy after being treated with ORIF with BP and one more case of peroneal nerve injury was seen which was treated conservatively [20, 27-29]. Study also revealed that the duration of hospital stay was much shorter after conservative management as compared to surgical method.

Conclusion

From this study it can be concluded that males are more prone for tibial condylar fractures than females being road traffic accident was commonest mode of injury. Further, lateral plateau fractures were more common compared to medial plateau. Displaced intra-articular fractures those belonging to Schatzker's type I, II and Ill should be treated by surgical methods. Schatzker's type III can be managed conservatively if the depression is less than 2 mm. ORIF with Buttress plate and bone grafting treatment give good to fair results in Schatzker's type IV fractures. In the present study high velocity injuries belonging to Schatzker's type V and VI the number of good to fair results were better with conservative group in elderly patients. Conservative treatment is a reliable inexpensive and alternative modality of management in high velocity bicondylar fractures of Schatzker's type V and VI especially in the elderly age group with osteoporotic bones. Conservative treatment yielded good results in type I undisplaced fractures. Incidence of minimal to moderate posttraumatic osteoarthritis was higher in the conservatively managed patients and in patients with high velocity injuries as compared to the surgical group and low velocity injuries indicating the importance of accurate articular surface reconstruction by surgical methods.

Conflict of interest: None declared

Financial support

We did not receive any external funding for this project

Acknowledgements

We would like to thank Dr Regupathy Annamalai. M.S Orhto, MCh, Managing director of Karpaga Vinyaga Institute of Medical Sciences and Research Center, Mahurantagam, Tamilnadu, India for his support and encouragement in accomplishing this project.

References

1. Bucholz RW, Canton A, Holmes R. Interporous hydroxyapatite as a bone graft substitute in tibial plateau fractures. Clin Orthop. 1989; 240: 53-62.
2. Honkonen SE, Jarvinen MJ. Classification of fracture of the tibial condyle. JBJS. 1992; 74B:840.
3. Horilconen SE. Indications for surgical treatment of condyle fractures. Clin Orthop. 1994; 320: 199-205.
4. De Coster TA, Nepola JV, El Khoury GY. Cast brace treatment of proximal tibia fracture: a ten-year follow-up. Clin Orthop. 1988; 231:196-204.
5. Reid JS, Van Slyke MA, Moulton MJ. Safe placement of proximal tibial transfixation wires with respect to intracapsular penetration. J Orthop Trauma. 2001; 15:10e17.
6. Saleh KJ, Sherman P, Katkin P. Total knee arthroplasty after open reduction and internal fixation of fractures of the tibial plateau: a minimum five-year follow-up study. J Bone Jt Surg Am. 2001; 83-A:1144e-1148.
7. Segal D, Arati Mallik R. Early weight bearing of lateral tibial plateau fractures. Clin Orthop. 1993; 294:232-237.
8. Zahid M, MKA S, Siddiqui YS. The role of the JESS (Joshi's external stabilization system) fixator in the management of tibial plateau fractures which are associated with severe soft tissue injuries. J Clin Diagn Res. 2010; 4:3356-3361.
9. Thomas G, Padanilam Nabil A. Meniscal detachment to approach lateral plateau fractures by the ilizarov circular external fixator. J Bone and Joint Surg. 1996; 78(B):710-717.
10. Dendrinos GK, Kontos Katsenis D, Daias K. Treatment of high-energy tibial plateau fracture by the llizarov circular external tibial plateau fixator. JBJS 1996; 78(B):710-717.
11. William J. High energy tibial plateau fractures: staged management. Operative techniques In Orthopaedics. 2003; 13(2):96-103.
12. Bal G, Kuo RS, Chapman JR. The anterior T-frame external fixator for high energy proximal tibial fractures. Clin Orthop. 2000; 380:234-240.
13. Barei DP, Nork SE, Mills WJ. Functional outcomes of

severe bicondylar tibial plateau fractures treated with dual incisions and medial and lateral plates. J Bone Joint Surg (Am). 2006; 88-A:1713-21.
14. Duwelius PJ, Rangitsh MR. Treatment of tibial plateau fractures by limited internal fixation. Clin Orthop. 1997; 339:47-57.
15. Hassankhani EG. Treatment of Complex Proximal Tibial fractures (Type 5 & 6 Scatzker Classification) by Double Plate fixation with Single Anterior Incision, Open Journal of Orthopaedics. 2013; 3:208-212.
16. Grahan B, Loomer RL. Anterior compartment syndrome in a patient with fracture of the tibial plateau, treated by continuous passive motion and anticoagulants. Clin Ortho. 1989; 195:197-199.
17. Jennifer Ratcliff R. Medial buttress versus lateral locked plating in a cadaver medial tibial plateau fracture model. J Orthop Trauma. 2007; 21:444-448.
18. Papagelopoulos P, Partsinevelos A, Themistocleus G. *et al*. Complications after tibial plateau fracture surgery. Injury. 2006; 37:475-484.
19. Rademakers MV. Operative treatment of 109 tibial plateau fractures five-to 27-year follow-up results. J Ortho Trauma. 2007; 21:5-10.
20. Hohi M. Part-I: Fractures of proximal tibia and fibula. In: Rockwood C, Green D, Bucholz R, Eds. Fractures In Adults, 3' Ed. Philadelphia: JB Lippincott, 1991, 1725-1761.
21. Keogh P, Kelly C, Cashman WF. Percutaneous screw fixation of tibial plateau fractures Injury. 1992; 23:387-393.
22. Koval KJ, Sanders R, Borelli J. Indirect reduction and percutaneous screw fixation of displaced tibial plateau fractures. J Orthop Trauma. 1992; 6:340-351.
23. Stevens DG, Beharry R, McKee MD, Waddell JP, Schemitsch EH. The long term functional outcome of operatively treated tibial plateau fractures. J Orthop Trauma. 2001; 15:312-320.
24. MJ Weigel DP. High energy fractureof tibial plateau: knee function after longer follow-up, J Bone and Joint Surg. 2002; 84A:1541-1551.
25. Musahl V, Tarkin I, Kobbe P. New trends and techniques in open reduction and internal fixation of fractures of the tibial plateau. J Bone Jt Surg Br. 2009; 91-B:426-33.
26. Stokel EA, Sadasivan KK. Tibial plateau fractures: standardized evaluation of operative results. Orthopaedics. 1991; 14:263-270.
27. Jong-keun O, Chang-wug O, In-Ho J, Sung-Jung K, HeeSoo K, Il-Hyung P *et al*. Percutaneous plate stabilisation of prximal tibial fractures. J Trauma. 2005; 5:431-7
28. Sirkin MS, Bono CM, Reilly MC. Percutaneous methods of tibial plateau fixation. Clin Orthop. 2000; 375:60-66.
29. Mills WJ, Nork SE. Open reduction and internal fixation of High energy tibial plateau fractures. Orthop Clin North Am. 2002; 33:177-94.