Original Article
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Posteromedial tibial plateau fractures: Fixation with Antiglide Plate using posteromedial supine approach. Retrospective series of 21 patients Authors List

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Abstract:

Posteromedial tibia condyle fractures are not rare. In present series of 21 patients with posteromedial tibia condyle fragments (19 males, 2 females), there were 6 type IV, 10 type V and 5 type VI Schatzker fractures. The posteromedial fragment was exposed by supine posteromedial approach and fixed using antiglide plate. Six cases required additional medial plating. Lateral condyle fracture was fixed by percutaneous screws in 5 cases and open reduction and plating in 5 cases. Anatomic reduction was achieved in 8 patients, good in 9 patients and fair reduction in 4 patients which was maintained at the end of mean follow-up of 23.1±5.31 months (range, 14-32 months). The mean union time was 12.19±1.4 (10 -16) weeks with no wound complications. Final knee range of motion was mean 127.85±7.17° (range 100° to 135) with no extension lag or fixed deformity. The mean oxford knee score was 45.52 (range 40 to 52). The final oxford knee score was significantly affected by the Schatzker class of fracture and quality of reduction achieved. Thus supine posteromedial approach has acceptable results with advantage of ability to fix the associated lateral condyle fracture without compromising on exposure of posteromedial fragment.

Keywords:-Posteromedial tibia plateau fracture, posteromedial supine approach, antiglide plate, oxford knee score.

Introduction

Coronal fractures of the medial condyle of tibia were not included in the initial classifications of tibial plateau fractures, however they have been recognized to pose unique challenge in both surgical approach and fixation method [1,2]. Rombold in 1960 was first to report such case that was incidentally detailed due to failed fixation [3] However credit to first include the posteromedial split fractures in classification system of proximal tibia fractures goes to Hohl who described it in 1967 [4]. Moore next described these fracture as most common of the fracture dislocation patterns involving proximal tibia [5] Since then a number of authors have described these fractures [6-17] and recently Barei et al [18] and Higgins et al [19] have presented data on incidence, morphology and results of these fractures. These are generally secondary to high energy trauma and represent an unstable fracture dislocation category[4,5,7,17,20,21]. Although thought be rare, recent studies have shown that posteromedial fragment is present in 59% to74% of bicondylar fracture cases with involvement of more than half of condyle in most cases.18,19 Due to inherent instability, open reduction and internal fixation is advised for displaced posteromedial condyle fractures. A common reason for inadequate fixation is inadequate exposure. Various approaches like anterior midline [12,22] anteromedial [17], medial [23,24],double medial [21], posterior [7,8,16,25,26] and prone posteromedial approach [14,27,28] have been described for these fractures. A direct supine posteromedial approach was described by only two authors, Barei et al [29] and Weil et al [1]. We here describe our experience with direct posteromedial approach and antiglide plating for treating a retrospective cohort of Tibial Plateau fractures with Postero Medial Fragment.

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Material and methods

Between November 2008 and April 2010, 21 consecutive cases of proximal tibia fracture associated with displaced posteromedial tibial condyle fracture were treated with posteromedial approach and antiglide plate. There were 19 males and 2 females with mean age of 39.52 years (range, 19 to 66 yrs). There were 19 road traffic accidents and 2 fall from height. All cases were of closed fractures. Standard anteroposterior, oblique and lateral radiographs were taken to confirm the diagnosis. Fractures were classified based on Schatzker classification30 with 6 type IV, 10 type V and 5 type VI fractures. The AO classification30 showed 1 41-B1 fracture, 2 41-B3 fracture, 9 41-C1 fracture, 6 41-C2 fracture and 3 41-C3 fracture. Eleven cases were bicondylar fractures, 5 cases had associated anterior cruciate ligament avulsion while all had a separate posteromedial fragment (Table 1). Soft tissues were allowed to heal in all cases and injury surgery interval varied from 7 days to 25 days (mean 9.61 days).

Operative technique: Posteromedial fragment was approached first through a posteromedial approach with

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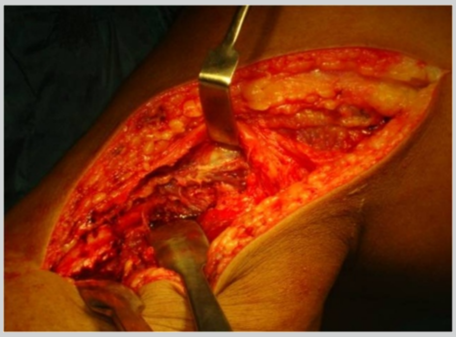

Figure 1a – Posteromedial Exposure with anterior retraction of the pes anserinus tendons and subperiosteal diseection of the fracture

Figure 1b – Reduction achieved by repositioning of the apex of the posteromedial fragment

patient in supine position. Skin incision is taken with knee in 30^0 flexion and hip in external rotation. After skin and subcutaneous dissection the pes anserinus is dissected. The pes tendons can be retracted either anterior or posterior depending upon the demands of fracture reduction [Figure 1-a]. The semi membranous muscle is retracted posteriorly to visualize joint from the posterior aspect. Fractures fragments and geometry is delineated by further subperiosteal dissection [Figure 1-a]. Reduction is achieved by repositioning of the apex of the fracture [Figure 1-b]. This indirectly achieves the intraarticular reduction. In 2 cases, where the medial fragment was comminuted a submeniscal arthrotomy was needed to assess the intra-articular reduction. An undercontoured plate was then slided over the reduced fragment. T plates were used in 7 cases and 3.5mm reconstruction plate in 14 patients. In 6 cases, in addition to posterior plate, a hockey plate was used to support the medial condyle. The reduction was confirmed under image intensifier. Further lateral fragment was fixed either with percutaneous cancellous screws (n=5) or open reduction with plate fixation in cases with significant displaced lateral fragment (n=5). 5 cases with associated ACL avulsion fractures were treated with open reduction and internal fixation using wire loop. Intraoperatively reduction was checked by moving the knee through range of motion and joint stability tests. The mean operative time was 1.31±0.2 (1 to 2.1 hours) and mean blood loss was 151.2± 40.6 ml (range 100 to 250 ml). Postoperatively an Above knee slab/brace was given to the patient for 1 week and full weight bearing was not allowed till radiological bone healing. Fracture reduction was described as - Anatomic (0 mm step–off or depression), Good (< or = 2mm), or fair (2-5 mm),according to the methods of DeCoster et al.31 Patients were followed up every 2 weeks after surgery till fracture united when full weight bearing walking was allowed. We called all patients for a final follow up where the union status and alignment were noted on standardized radiographs. Clinically knee ranges of motion, stability, pain and oxford knee score32 were checked. A subgroup analysis was planned to study the effect of age, Schatzker type and intraoperative reduction on the union time, knee range of motion and Oxford knee score. Varus angle was measured by calculating angle between the medial joint line and the shaft of the tibia and angle of 87±5° was taken as normal.33 Tibia shaft line was drawn by joining the midpoint of two transverse lines (at least 3 cms apart) on the tibial shaft. Sample was divided into two groups based of age (<40 years,>40 years) and comparison was done using Mann Whitney U test. The sample was divided into three groups based on Schatzker type (Type IV,V and VI) and quality of reduction (Excellent, good, fair). Comparison between the variables of these groups was done using non parametric Kruskal Wallis test.

Results

Figure 2 a – 22 year old male with Medial condyle fracture and ACL avulsion fracture

Figure 2 b – Lateral Radiograph showing the displaced posteromedial fragment

Figure 2c – post operative radiograph with fixation of posteromedial fragment using reconstruction plate as antiglide plate and fixation of the ACL avulsion fracture

Figure 2d- Twenty Month follow up radiograph showing fracture union

Figure 2 a – AP radiograph of 115 kgs obese man with fall from motorcycle showing medial condyle fracture

Figure 3 b – Lateral radiograph showing the posteromedial fragment

Figure 3 c – Posteromedial fragment was fixed with an antiglide plate and an additional medial plating was done to stabilise the medial condyle

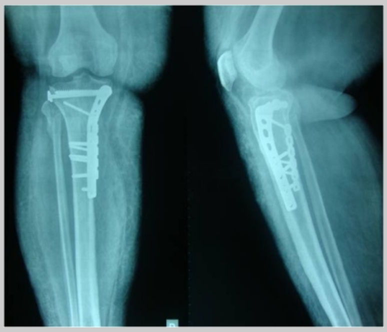

Figure 3 d – 14 months follow up of the patient showing united fracture

The mean follow up duration was 23.1±5.31 months (range from 14 to 32 months). On immediate post operative radiograph reduction was anatomic in 8 patients, good in 9 patients and fair in 4 patients, and there was no case with articular step of >5mm. The mean union time was 12.19±1.4 (10 -16) weeks and mean weight bearing time was 11.23±2.23 weeks. There were no wound complications or any other perioperative complication. At final follow up all patients were available for data collection with no drop outs. The intraarticular reduction did not change significantly and the proportion of anatomic, good and fair reduction remained same as post surgery. Knee range of motion was mean 127.85±7.17° (range 100° to 135^{0}). There was no extension lag or Fixed flexion deformity. Two patients had medial knee joint laxity but with good knee range and good functional outcome. No pain was reported by any patients and there was no evidence of loss of reduction or osteoarthrosis in any case. The mean oxford knee score was 45.52 (range 40 to 52). The mean varus angle was 88.19±2.11 (range 90 to 83°) with no patients having deformity beyond the normal limit of 87±5° [table 2]. Figures 2 and 3 show serial radiographs of two of patients in this series.

Results of subgroup analysis are given in Table 3. Although the union time and knee range were not affected by any of the variables the patient perception [Oxford score] was statistically affected by the Schatzker type and quality of reduction.

Discussion

Postero-medial condyle fractures are distinct entity and require open reduction and internal fixation. Our series shows that supine posteromedial approach can be used for open reduction of this fragment and fixation using an antiglide buttress plate can be performed. Clinical and functional outcome at more than one year follow show good results.

Various exposures for postero-medial fragments have been described for exposure of posteromedial fragment. Espinoza-Ervin et al22 suggested anterior approach for these fractures in cases with isolated posteromedial fragment and in cases where indirect reduction may be problematic. They suggested that the scar will be more functional and surgeons are more familiar with the approach. However as seen in other series and in present series too, most of the time a lateral condyle fractures is present and in majority of cases with single piece posteromedial fragment indirect reduction can be achieved easily, thus limiting the indication for anterior approach. Also the anterior approach involved lifting the insertion of deep medial collateral ligament for adequate exposure, the long term effect of which is not reported. Fernandez et al34 recommened extensile anterior approach with tibial tubercle osteotomy in bicondylar fracture, however wound complications and inadequeate fixation of posteromedial fragment were an issue. Hsieh et al12 and Tscherne and Lobenhofer17 recommended an anteromedial approach for fixation of posteromedial fracture. Hsieh et al12 agreed that it is difficult to achieve reduction by this exposure but preffered it to prevent neurovascular injuries associated with posterior approaches. Millis and Barei23 used a medial approach with good result but commented that plate needs to be placed posteriorly which may be a difficult task. Potocnik et al24 used an extended medial approach but again reaching the apex of the posteromedial fragment was an issue and they did not comment on post operative wound complications in their series. Lou et al reported successful use of double medial incision with miminal complications.21 Posterior approach has been used by few authors, with main advantage being simultaneous fixation of the lateral condyle fractures through the same incision.7,25 Direct handling of the neurovascular structures is required in this approach and may cause complication. A direct prone posterolateral approach is used by many authors8,14,27,28 with good results for fixation of posteromedial fractures. The issue with this approach is difficulty in fixation of association lateral or anterolateral fragments. A supine posteromedial approach offers direct visualization of the fragment with

Table 1: Showing Demography and surgical details of patients

Sr No	Age	Schat-zker type	AO Class	Associated injury	Postero-Medial Fragment	Surgery done
1	47	V	41-C1	Lateral condyle	Multifragment	ORIF postero-medial condyle with buttress plate. percutaneous cannulated screw fixation of lateral condyle
2	66	VI	41-C2	Lateral condyle	Single	ORIF postero-medial condyle with buttress plate. percutaneous cannulated screw fixation of lateral condyle
3	37	V	41-C2	Lateral condyle	Single	ORIF postero-medial condyle with buttress plate. T plate for Lateral condyle
4	60	V	41-C1	Lateral condyle, MCL injury	Single	ORIF postero-medial condyle with buttress plate., LCP for Lateral condyle
5	45	V	41-B3	None	Single	ORIF postero-medial condyle, fixation with Hockey stick plate.
6	46	V	41-C1	Lat tibial condyle, opposite fracture shaft Tibia	Single	ORIF postero-medial condyle with buttress plate. percutaneous cannulated screw fixation of lateral condyle
7	30	V	41-C1	Lateral tibial condyle, ipsilateral pilon and opposite shaft tibia fracture	Single	ORIF post condyle with recon plate & medial hockey plate
8	46	V	41-C2	Lateral condyle	Single	ORIF postero-medial condyle with buttress plate. percutaneous cannulated screw fixation of lateral condyle
9	38	VI	41-C3	Lateral condyle, fracture extending to shaft tibia	Multifragment	ORIF postero-medial condyle with buttress plate and medial Hockey plate
10	26	IV	41-B1	None	Single	ORIF postero-medial condyle with buttress plate.
11	24	V	41-C1	ACL with lateral condyle fracture	Single	ORIF postero-medial condyle with buttress plate. Percutaneous cannulated screw fixation of lateral condyle. ACL avulsion fixation
12	39	VI)	41-C3	ACL with lateral condyle fracture	Multifragment	ORIF post medial condyle with interfragmetary screw and plate, Percutaneous cannulated screw fixation of lateral condyle. ACL avulsion fixation
13	24	IV	41-C1	ACL, MCL- Gr-2	Single	ORIF postero-medial condyle with buttress plate. ACL avulsion fixation
14	33	V	41-C1	None	Single	ORIF postero-medial condyle with buttress plate.
15	54	VI	41-C3	ACL	Multifragment	ORIF postero-medial condyle with buttress plate. lateral condyle with plate. ACL avulsion fixation
16	19	IV	41-B3	None	Single	ORIF postero-medial condyle with buttress plate.
17	38	VI	41-C2	Lateral condyle	Single	ORIF postero-medial condyle with buttress plate. lateral condyle with plate, medial condyle with hockey plate.
18	26	IV	41-C1	None	Single	ORIF postero-medial condyle with buttress plate.
19	42	IV	41-C1	None	Single	ORIF postero-medial condyle with buttress plate.
20	38	V	41-C2	ACL	Multifragment	ORIF postero-medial condyle with buttress plate., hockey plate- medial, ACL avulsion fixation
21	52	IV	41-C2	None	Single	ORIF postero-medial condyle with buttress plate.

Table 2: Showing Results in all patients in series

Sr No	Reduction Quality	Union Time	Follow Up time	Varus Angle	Knee Range	Oxford Knee Sc
1	good	14	26	89	120	42
2	good	12	28	88	130	44
3	good	12	28	90	130	42
4	good	16	18	89	130	40
5	anatomic	14	24	90	100	48
6	anatomic	14	18	89	120	46
7	anatomic	12	22	90	135	48
8	Good	12	30	89	130	46
9	Good	12	32	90	130	48
10	anatomic	10	30	90	130	52
11	Good	12	16	90	130	46
12	good	10	20	87	130	42
13	good	12	19	86	130	48
14	fair	12	28	85	130	44
15	fair	12	26	84	130	40
16	anatomic	12	18	89	130	48
17	fair	12	26	87	130	44
18	anatomic	12	24	88	130	48
19	anatomic	10	24	89	130	48
20	fair	12	14	83	130	42
21	anatomic	12	14	90	130	50

Variable	N	Union time Weeks	Knee Range Degrees	Oxford Score
Age				
<40	12	19.16±6.11	130±6.75	46±3.19
>40	9	19.88±5.39	124±10.13	44.8±3.62
p-value		0.10	0.14	0.52
Schatzker type				
IV	6	11.23±1.03	130	49±1.67
V	10	12±1.41	125.5±10.12	44±2.79
VI	5	11.6±0.89	130	43±2.96
p-value		0.08	1.0	0.009
Reduction Quality				
Excellent	8	12±1.5	125.6±11.1	48.5±1.77
Good	9	12.44±1.6	128.9±3.3	44.2±2.99
Fair	4	12	130	42.5±1.91
p-value		0.91	0.93	0.004

Table 3: Subgroup analysis of effect of age, Schatzker class and quality of reduction on final outcome

minimal soft tissue dissection.1 Also in cases where a lateral stabilization is needed an anterolateral incision can be safely taken with minimum risk of infection. In our series two patients required dual plating of both posteromedial fragment and the lateral fragment with no post operative complication. Weil et al too commented that rate of complication in cases with these dual incision are acceptable.1

Another advantage of the posteromedial approach is that it facilitates the placement of the antiglide plate. The posteromedial fragment is most often a single shear fragment with apex posteromedially. Hohl et al considered these fractures as fracture-dislocations in view of instability and tendency to displace.4 Unstable fixation can cause malalignment and poor prognosis.7,8,21 Supine Posteromedial approach allows easy exposure and reduction of the apex of the posteromedial fragment. In our series 16 out of 21 cases the postero medial fragment was a single shear piece and could be easily reduced through the posteromedial approach. Follow up alignment was well maintained in these cases. Even for multifragment posteromedial fragment, only in 2 out of 5 the varus angulation was more than 5°. In series by Weil et al1 the varus alignment was >6° in 5 out of 27 cases, however they did not comment on the fragments of postero-medial piece.

Many a times the posteromedial fragment is a part of bicondylar fracture, where dual plating is recommended.35,36 A solitary lateral plate with screw fixation of the medial fracture has been used and popularized by few authors.37,38,39 Biomechanical analysis of fixation methods used for posteromedial fractures has been recently reported by Zeng et al.2 They compared 4 different fixation methods, anterior posterior screws, anteriomedial low contanct dynamic compression plate, lateral locked plate and a posterior butresss plate. They found posterior buttress plating to be most biomechanically stable construct. In our series too, 14 out of 21 cases were stabilized by using simple reconstruction plate as a buttress and a T buttress plate was used in remaining cases with good results. Primary application of the buttress plate also stabilizes the medial condyle and medial metadiaphysis, thus mostly requiring minimal invasive treatment for the associated lateral condyle fractures. In this series 11 out of 21 cases had a lateral condyle fracture and 9 of these lateral condyle fractures were treated successfully with percutaneous screw fixation. In two cases were lateral condyle was severely displaced and required open reduction, a plate fixation was used. There were no wound complications in this series and no cases of infection or loss of reduction. Thus in cases of bicondylar fracture with a posteromedial fragment, a medial buttress plate and a lateral screw fixation may be an option. However this requires further study, both clinical and biomechanical.

We assessed the effect of age, Schatzker class and quality of reduction on the outcome. None of the factors had any effect on the union time and knee range of motion however Schatzker type and quality of reduction both affected the functional outcome with outcome better in type IV Schatzker class and in cases with excellent reduction. Wei et al1 reported no correlation between outcome and above factors, however other have found similar correlation between functional outcome and quality of reduction and severity of injury.40 Further studies in subgroup analysis will be required to establish the role of these prognostic indicators.

Our series had few shortcomings in terms of small sample size and lack of comparative group, however our result indicate the effectiveness of a supine posteromedial approach in exposure, reduction and fixation of posteromedial tibial condyle fragments.

Thus in conclusion, a supine posteromedial approach adequately exposes the posteromedial tibia fractures and allows for fixation with antiglide plate with good result and minimal complications.

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