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Results of Open reduction and internal fixation of posteromedial tibial plateau fractures through posteromedial approach

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Abstract: Background: Fractures of the tibial plateau or tibial condyles can represent serious intraarticular injuries and constitute approximately 1% of all fractures. The spectrum of injury extends from less severe fractures of an isolated plateau that may be treated non surgically with excellent results to devastating involvement of the entire plateau (and often the proximal tibialmetaphysis) requiring extensive surgery. These severe injuries may result in posttraumatic premature arthritis, ligamentous injury, and lifelong pain and disability. **Materials and Methods:**21 patients with posteromedial tibial plateau fractures either alone or combined by other columns fractures underwent open reduction and internal fixation through posteromedial approach, assessment was done using Rasmussen scoring system.**Results:**17 patients achieved satisfactory results (twelve excellent - five good) representing 81% of all cases, three cases had fair outcome (14.2%) and one case had poor outcome (4.8%), one case had superficial wound infection and two cases had stiffness.**Conclusion:** The posteromedial approach involves smaller incision, safe and good exposure for reduction of the posteromedial fragment, and plate fixation allows rigid fixation withearly range of motion postoperatively.
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Key Words: Posteromedial, Tibial plateau fractures, posterior column buttress plate.

1. Introduction

Fractures of the tibial plateau or tibial condyles can represent serious intraarticular injuries and constitute approximately 1% of all fractures. These severe injuries may result in posttraumatic premature arthritis and lifelong pain and disability [(1)]. With varus and compressive injuring forces applied to the knee, medial tibial plateau fractures may be produced. Popliteal artery andtibial nerve are in danger during surgical fixation of this fracture with potential complications including significant motor or sensory deficit and vascular compromise [(2)]. Several classification schemes have been proposed on the basis of fracture morphology, the most common of which is the Schatzker classification [(3)]. This classification and others rely only on the plain radiographs [(4)], mainly the anteroposterior plane for designating the fracture type and may not account for the fracture pattern in sagittal plane [(5-7)]. The advent of computed tomography has added valuable information for futherdelination of tibial plateau fracture type [(8)] with development of the three-column classification [(9)]. Several approaches have been described by authors for reduction and fixation of posteromedial tibial plateau fractures and posteromedial approach was believed to be one of the best options for fixation of this type of fracture as It allows direct visualization of the fracture site which facilitates the reduction and provide less damage to soft tissues and neurovascular structures.

2. Materials and methods:

In this prospective study, 21 patients were presented with closed posteromedial tibial plateau fracture, 16 of which were males, 5 were females. Age ranged from 25 to 64 with mean of 42.42 years. Fractures treated in this study were classified according to three columns classification,10 of them had one column fracture, 10had two columns fracture while only one case had three columns fracture.14 cases had road traffic accident, 5 cases fell and 2 cases had twisting injury as the causative trauma. They were presented to our academically supervised hospital in the period between June 2018 and June 2019.

Inclusion criteria were closed posteromedial tibial plateau fractures occurring in skeletally mature patients. Exclusion criteria were open fractures, pathological fractures other than osteoporosis, skeletally immature patients (open physics). Neglected fractures more than 14 days old, patients with lower limb deformities and patients suffering other

musculoskeletal fractures in the same limb or were unable to walk prior to the injury.

Antero-posterior, lateral views and CT scan with 3-D reconstruction were obtained to delineate injury, Above knee posterior slap for the fractured limb was done to stabilize the fracture and reduce pain.

Approval for the study was obtained from the Faculty of Medicine Research Ethics Committee. Full counseling of participants in this research and informed consent was obtained from all patients prior to participation, with full privacy of participants and confidentiality of their data preserved.

Surgical procedure:

-Systemic broad spectrum antibiotic was given an hour before the operation.

- General or spinal anaesthesia was used according to patient general condition and anaestheiologist preference.

-The patient lie in prone or supine position on a radiolucent operating table.

-Visualization of the proximal tibia under fluoroscopy in both anteroposterior and lateral views was necessary.

-The leg prepared and the knee held in slight flexion by mild elevation of the ankle using a bump (in prone position).

Fig 1: Skin incision

-A 8-10 cm longitudinal incision was then made along medial head of gastrocnemius muscle ending at the level of the knee joint line (Fig 1).

-Blunt dissection was carried deep exposing the lateral border of semimembranosus and the medial border of gastrocnemius muscle (Fig 2).

-After blunt dissection semimembranosus muscle was retracted medially and the medial head of gastrocnemius was retracted laterally, exposing the posterior tibia.

-The neurovascular structures in the popliteal fossa were safely protected deep to the gastrocnemius muscle.

-If more exposure was needed, the medial gastrocnemius tendon can be released near its insertion, leaving a small cuff for later repair. The soleus and popliteus muscles were then elevated from the medial edge of the tibia by sharp dissection, exposing the fracture site.

-If a coronal split was present, dissection was carried anteriorly and medially while retracting the pes anserinus tendons and the medial ligament.

-Once the fracture site was clearly exposed, a good reduction achieved by hyperextension with axial traction and pushing the fragment with assistance of periosteal elevator.

-Kirschner wires were used as temporary fixation and intraoperative C-arm fluoroscopy was used to assess the reduction (Fig 3).

Fig 2: Deep dissection

Fig 3: Temporary fixation of fracture using k-wires

-Buttress plate was used for fixation. Proper plate fixation required 3-4 screws distal to the fracture line (Fig 4).

Fig 4: Plate fixation with 3 distal screws

Fig 5: Post-operative X-rays

Fig 6: Follow-up X-rays

-With the fracture reduced and fixed, the wound was closed. The medial gastrocnemius tendon (if release was done) was repaired. The subcutaneous tissues and skin were closed, leaving the fascia open.

-A drain was inserted in all cases and removed after 24 hours.

-Above knee posterior slap was applied.

Post-operative follow up:

-Post-operative x-rays were performed after the patient has recovered from anesthesia (Fig 5).

-The patients were allowed intermittent knee mobilization once the skin sutures and posterior splint were removed, usually after 14-21 days.

-Partial weight bearing was delayed until at least 6 weeks and full weight bearing was not allowed until evidence of union was seen on x-rays (after 12-20 weeks) (Fig 6).

-Clinical and radiological assessments were done for all patients at 2 weeks, 1 month, 3 months and 6 months (Fig 7).

Fig 7: Functional outcome

Methods for assessment of the results:

1- Radiologically

The quality of reduction based on AP and lateral radiographs was evaluated on the basis of articular step off, and catergorized as good, acceptable, or poor.

Good reduction meant noarticular step (anatomical reduction), acceptable reduction if the articular step was less than 3 mm, and poor reduction if the articular step was more than 3 mm.

2- Clinically:

Data collection and analysis of outcome was completed based on Rasmussen scoring system [10] (Table 1).

3. Results:

According to Rasmussen scoring system [10]. the clinical results were graded with the excellent score being: 27-30, Good: 20-26, Fair: 10-19, and Poor 6-9 points. Excellent and good results were considered satisfactory, while fair and poor results were considered unsatisfactory. Seventeen patients achieved satisfactory results (twelve excellent and five good) representing 81% of the cases, three cases (14.2%) had fair, and one (4.8%) had poor outcome based on the before-mentioned Rasmussen scoring system.

Nineteen patients had good postoperative radiological reduction; fifteen of them scored satisfactory end result while four achieved fair results. One patient had acceptable postoperative reduction and one had poor postoperative reduction and both patients ended with poor clinical results. Side and sex had no influence on the final clinical outcome, nor did smoking. However, Age, diabetes, fracture pattern and mode of trauma was found to have a significant influence on the final outcome P values (0.02), (0.009), (.01) and (0.03) respectively.

Three patients suffered from post-operative complications. One patient had superficial infection that improved by daily dressing and switching antibiotics, while two patients had stiffness with partial improvement after physiotheraby.

Table 1: Rasmussen scoring system [10]

		Acceptable		Unacceptable	
	Points	Excellent	Good	Fair	Poor
A. Subjective complaints					
a. Pain					
No pain	6				
Occasional ache, bad weather pain	5				
Stabbing pain in certain positions	4	5	4	2	0
Afternoon pain, intense, constant pain around the knee after activity	2				
Night pain at rest	0				
b. Walking capacity					
Normal walking capacity (in relation to age)	6				
Walking outdoors at least 1 hour	4	6	4	2	1
Short walks outdoors > 15 minutes	2				
Walking indoors only	1				
Wheel-chair/bedridden	0				
B. Clinical signs					
a. Extension					
Normal	6				
Lack of extension (0–10 degrees)	4	6	4	2	2
Lack of extension > 10 degrees	2				
b. Total range of motion					
At least 140	6				
At least 120	5	5	4	2	2
At least 90	4				
At least 60	2				
At least 30	1				
0	0				
c. Stability					
Normal stability in extension and 20 degrees of flexion	6				
Abnormal instability 20 degrees of flexion	5				
Instability in extension < 10 degrees	4				
Instability in extension > 10 degrees	2				
Sum (minimum)		27	20	10	6

4. Discussion:

Tibial plateau fractures are one of the commonest intra articular fractures, incidence of these fractures are increasing regularly due to road traffic accidents (RTA), and at the same time, surgical treatment options are being modified continuously. Any fractures around weight bearing joint like the knee is especially important as it would result in significant morbidity and obvious affect upon quality of life. Hence the treatment of tibial plateau fractures has become challenging for orthopedic surgeons. [11, 12, 13]

Posteromedial approach was found to be most appropriate if the articular surface of the medial plateau has a split component in the coronal plane or the posterior articular surface is significantly displaced as it provide direct access to the fracture site and more protection to the neurovascular structures as well as the soft tissue. [14, 15, 16]

In this study, 21 patients with posteromedial tibial plateau fractures either alone or with other columns fractures underwent open reduction and internal fixation through posteromedial approach. The functional outcome of these cases was assessed by the Rasmussen score after a minimum of 6 months post-operative follow up.

According to Rasmussen scoring system, there were twelve patients with excellent results (57.1%), five patients were good (23.9%), three patients were fair (14.2%) and one patient with poor result (4.8). This is inferior to those reported by (**Hong-wei Chen et al**) [17] who reported 21 patient with excellent results out of 36 patient (58.3%), thirteen patients with good results (36.1%) and two patients with fair results (5.5%). On the other hand, as regarding the quality of reduction our study reported nine out of 21 patients with anatomic reduction (42.9%), ten patients with accepted reduction (47.6%) and two patients with poor reduction (9.5%) and was superior to those reported by**(Yoram A. Weil et al)** [18]. who reported eleven out of 27 patients with anatomic reduction (41%), nine patients with accepted reduction (33%) and seven patients with poor reduction (26%).

The age of the patients in this study ranged from 25 to 64 with a mean of 42.42 years, which conforms with the mean age reported by **(Yoram A. Weil et al)** [18] who reported mean age of 43and (**Hong-wei Chen et al**) [17] who reported mean age of 40.1.

Age was a significant factor in determining the final outcome in our study as 100 % of patients below the age of 45 had satisfactory results, while only 55.5 % of patients above the age of 45 had satisfactory results. Although we did not find evidence of that in the study reported by (**Yoram A. Weil et al)** [18], on the other hand, (**Hong-wei Chen et al**) [17] didn't comment on the impact of the age on clinical outcome.

Males were sixteen cases, and females were five cases, with a ratio of (3.2**:**1), showing male predominance. This was the case in most of the studies [17-21, 22, 23]. There was no difference in results in relation to sex.

In this study, fourteen cases suffered the fracture as a result of road traffic accident with a percentage of 66.6% while seven patients suffered a relatively lower energy trauma presenting in falling down and twisting with a percentage of 33.4%, this conforms to other studies such as (**Yoram A. Weil et al**) [18] reporting 52% from RTA, (**Hong-wei Chen et al**) [17] showing predominance of RTA by 52.7% and **(Boldin C et al)** [24]. There was significant influence on the results in relation to mechanism of trauma as it was found that patients suffered from RTA had better results, we hypothesize that this is related to the age of the patient as it was noticed that the lower the age of the patient the higher the energy required to cause the fracture, on the other hand, the patient suffered from lower energy trauma were of older age suggesting osteoprotic bone that resulted in worse results.

There was significancecorrelation between fracture pattern and clinical results (**P. value =0.01),** unlike **(Reshid Berber et al)** [20] and (**Yoram A. Weil et al)** [18] who reported that there is no significance between fracture pattern and clinical results.

Comparing clinical results with diabetics and non-diabetics, we found that there was significant correlation between clinical results and diabetic patients. P. value=0.009, this may be due to the effect of diabetes on fracture healing and vasculopathy caused by diabetes that can have harmful effect to the blood supply of bone [25-30].

Three patients developed complications. One of them had superficial wound infection that improved with daily dressing and antibiotics that was also reported by **(Reshid Berber et al)** [20] who reported two cases with superficial wound infection whom also improved with antibiotics. Two patients developed limitation of kneeflexion that partially improved after physiotherapy that was also reported by **(Reshid Berber et al)** [20] who reported that two patients required manipulation under anesthesia for knee stiffness. Three patients suffered a persistent fixed flexion deformity of five degrees. We didn't have any cases with compartment syndrome nor nerve injury, however it was reported in the literature as complications of this approach [18,19,20].

Limitation of the study:

- Small sample size.
- Noncompliance of the patients with follow up appointments.
- Short time of the patients follow up which didn't cover any possible future complications as osteoarthritis.

Conclusion:

The posteromedial approach involves smaller incision, safe and good exposure for reduction of the posteromedial fragment, and plate fixation allows rigid fixation with early range of motion postoperatively.

Conflict of interest

The authors declare no conflict of interest.

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