Original Article

Closed Reduction and Percutaneous Fixation of Non-Osteoporotic Tibial Plateau Fractures

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ABSTRACT

Objective: To highlight the advangages and disadvantages of closed reduction and percutanous fixation technique in patients with tibial plateau fractures type I and II according to the Schatzker classification.

Venue: Al-Razi Orthopedic Hospital, Kuwait.

Material and methods: A prospective study included 23 patients with different types of tibial plateau fractures classified according to Schatzker classification. They were treated with closed reduction and percutaneous cannulated screw fixation to minimize surgical trauma. Our patients were followed up for a minimum of 18 months.

Results: We had 74% excellent results in type I fractures and 50% excellent results in type II with no statistical difference between these two types (p = 0.735). The results were comparable to other publications using the same technique. Our results were also compared to those using arthroscopically assisted technique.

KEYWORDS: percutaneous fixation, tibial plateau fractures

INTRODUCTION

The optimal treatment of a displaced tibial plateau fractures should provide stable painless knees with a functional range of mobility. These injuries may be treated by closed, traditional open or minimally invasive techniques. Which technique to use is still controversial. Closed reduction and percutaneous fixation technique under fluoroscopic guidance is widely used nowadays, as it does not require extensive exposure or long operative time and it is also more simple technically. Another type of minimal invasive surgery is the arthroscopically assisted reduction and fixation technique, which is more demanding and requires fluoroscopic control[1]. Because these two techniques differ significantly in the necessary resources and training of the surgical team, we performed a study to assess the benefits and disadvantages of fluoroscopic reduction and fixation. We studied the technique and the quality of reduction and finally the early end results.

MATERIAL AND METHODS

Twenty-three non-consequetive cases of tibial plateau fractures were treated by closed reduction and percutanous screw fixation from December 1997 to December 1999. Eighteen were males and five, females. The age ranged from 23-55 years (mean: 34 years). Our criteria of operative treatment were displacement of more than four millimeters, radiographic angular displacement of fracture fragments of more than four degrees or fracture related instability, in addition to open fractures or fractures in multiple skeletal injury or polytraumatised patients. The fracture was due to road traffic accident in 15 cases, direct trauma in six cases and a fall from height in two cases. Three cases were open grade II fractures.

Using Schatzker classification[3] there were: nineteen type I cases and four type II cases. The fracture was isolated in 20 cases while it was accompanied by ipsilateral open femoral fracture, and ipsilateral os-calsis fracture in one case. Another case was a patient with multiple fractures. Ipsilateral lateral popliteal nerve palsy was seen in one case. Satisfactory intra-operative reduction was achieved in all but two patients (cases 9 and 20). A limited incision was done to allow a distal port through which a depressed fracture is reduced and grafted. All patients had pre- and post-operative standard radiographs (Fig. 1a, 1b, 2a, 2b). No tomography or CT-scan was done.

Clinical follow-up for a period of at least 18 months (range: 18-30 months) was performed. X-rays were obtained at the first and the fourth weeks and after weight bearing, then every three months for 18 months. The patients were evaluated according to Rasmussen's functional scoring system[2] (Table 1), giving the final grade according to: pain level, walking capacity, degree of extention, total range of motion, and stability (six points for each).

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Fig. 1a: Type I split fracture

Fig. 1b: Post-operative X-ray

Fig. 2a: Type II split compression fracture

Fig. 2b: Post-operative X-ray

Surgical Technique

The anaesthetised patient is positioned in supine position on the orthopedic table, with a posterior knee post allowing ligamentotaxis and mediolateral push for indirect reduction. This also allowed complete freedom of fluoroscopic control. A bone clamp was applied to compress a split fracture. Depressed fracture was elevated through a more distal window through which a buttress graft was applied. After fluoroscopic assessment of the reduction, fixation was carried out using 7.3 millimeters lag cannulated screws with washers sliding on k-wires. These screws were parallel to the joint line and of different lengths and thread length. Early passive and active motion with non-weight bearing and without external support were allowed. Gradual weight bearing was permitted starting from the ninth weeks post-operatively.

RESULTS

The hospital stay was short, two to five days; with the exception of open fractures and those associated with other fractures. We encountered no cases of sepsis, deep vein thrombosis or compartmental syndrome. All patients were allowed free range of motion excercises with no external support and non-weight bearing, then partial to full weight bearing from week nine.

Among the 23 patients, two type II fractures had delayed displacement of more than four millimeters (noted on conventional X-rays during the first post-operative month). No cases required arthroscopic examination later. Removal of the metal was performed in five cases because of occasional localized pain.

In type I fracture, 14 cases (74%) resulted in excellent results while five had good results (26%). In type II fracture, two cases were classified as excellent (50%) and two cases as good (50%) (Table 2). There was no statistical difference between the results in type I and type II fractures.

DISCUSSION

Indirect reduction and percutaneous fixation of tibial plateau fractures would be an attractive method because of the known soft-tissue complications associated with standard open techniques[4]. There is no definite agreement about whether to use only fluoroscopy or the assistance of arthroscopy to reduce and fix these fractures[1]. We tried to highlight the advantages and disadvantages of the technique used in our patients in relation to those using other modalities.

Fluoroscopic-controled closed reduction and fixation carries the advantages of minor operative trauma due to the minimal soft tissue stripping and

Table 1
Rasmussen's Functional Score System

	Points	Satisfactory Excellent	Good	Unsatisfactory Fair	Poor
Subjective Complaints	6				
Pain	5	5	4	2	
No pain	4	(minim)	(minim)	(minim)	1
Occasional ache	2				
Stabbing pain in certain positions	0				
Afternoon pain, intense, constant pain					
Night pain at rest					
Walking Capacity					
Normal walking capacity (in relation to age)	6				
Walking outdoor at least one hour	4	6	4	2	
Walking outdoor 15 minutes	2	(minim)	(minim)	(minim)	1
Walking indoors only	1				
Wheel chair / bedridden	0				
Clinical Signs					
Extension normal	6				
Lack of extension 0 - 10º	4	6	4	2	
Lack of extension > 10º	2	(minim)	(minim)	(minim)	1
Total Range of Motion					
At least 140º	6				
At least 120º	5				
At least 90º	4				
At least 60º	2	5	4	2	
At least 30º	1	(minim)	(minim)	(minim)	2
0º	0				
Stability					
Normal stability in extension and 20º flexion	6				
Instability in 20º flexion	5	5	4	5	
Instability in extension < 10º	4	(minim)	(minim)	(minim)	
Instability in extension > 10º	2				
Sum (minimun)		27	20	10	6

Total score is 30 points
Excellent 27-30. Good 20-26. Fair 10-19. Poor 6-9
minim = minimum

Table 2
The final functional results

	Excellent n (%)	Good n (%)
Type I	14 (74)	5 (26)
Type II	2 (50)	2 (50)
Total (n = 23)	16 (70)	7 (30)

the low incidence of infection in addition to a short surgical time. It also has a similar advantage as open surgery as regards stable fixation allowing early mobilization and weight bearing. Arthroscopic assisted closed technique allows, more accurate reduction of the fracture, the assessment of ligamentous or meniscal concomittant injuries, the lavage of the joint and the removal of small intra-articular fragments[5]. The question is whether these advantages justify the routine use of arthroscopic assistance.

In our series we adopted the fluoroscopic controlled closed technique in 23 cases of different types of tibial plateau fractures. We had 74% excellent results in type I fracture and 50% in type II fractures. Even if there were no statistical difference between the two fracture types, the number of patients is too small, especially type II fractures, to draw any definite conclusions.

Our results were comparable to these provided by Holzach *et al*, who in 1994 used arthroscopic assisted techniques[6]. They were also comparable to those of Harper *et al*, 1995[7]. Our results were better than those of Keogh *et al*, who in 1992 used the same technique[8]. This could be explained because our series included only type I and II fractures, and we had also no fractures in osteoporotic bone.

One case (case 16) necessitated later reconstruction of the anterior cruciate ligament and another case (case 24), due to a lateral meniscal tear and entrapment of its anterior horn in the fracture preventing accurate reduction. In this last case surgery was shifted to formal open surgery and it was excluded from the final results. Meniscal and ligamentous injuries associated with tibial condyle fractures may reach up to 20-47%[2,9,20]. But most of these soft tissue injuries occur in the red-red or red-white zones[1] with high potential for healing. The incidence of such injuries is higher in type III fracture. However surgical intervention was found necessary in a much lower number of cases[11]. In addition, the healing of meniscal tears is claimed better in bloody enviroment[12]. So, Loben Hoffer *et al*, in 1999, reserved arthroscopic assisted closed technique to cases with significant ligamentous injuries and children with median eminence fractures[1].

We had late fracture displacement in three cases (cases 4, 16, 21). Such a displacement can occur with arthroscopic assisted closed technique[13] but probably in a relatively lower incidence because it is easier to assess depressed fractures through direct visualization with arthroscopic assistance[4].

Belanger and Fadale in 1997, stated that complications of arthroscopic assisted reduction and fixation are infrequent but potentially severe and there is a possibility of compartemental syndrome unless a low pressure flow is used[14]. In addition, there is a question about sterility with arthroscopic assissted technique[11,14]. We had no cases of infection or compartmental syndrome. We agree with Scheerlinck *et al*, that dealing with meniscal and ligamentous injury could be performed later in symptomatic cases[13].

Arthroscopic assisted reduction is a more demanding operative technique and is costly. It is

not advisable in polytrauma or in cases with multiple fractures or peripheral plateau fractures[1]. It is a good, but not always a necessary option, if performed by an arthroscopically well-trained orthopedic surgeon. It is the optimal technique in type III fractures[5]. A well-designed study is necessary to further compare the two techniques.

CONCLUSION

Closed reduction and percutaneous fixation under fluoroscopic control is a good method for treating tibial plateau type I and type II fractures.

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