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Original article

FUNCTIONAL OUTCOMES OF MANAGEMENT OF TIBIAL PLATEAU FRACTURES (TYPE II) BY CLOSED REDUCTION AND PERCUTANEOUS SCREWS

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Abstract

To evaluate the outcomes of closed reduction and percutaneous screw fixation for tibial plateau fractures (Type II). 9 men and 3 women aged 21 to 64 (mean, 38.1) years underwent closed reduction and percutaneous screw fixation for closed tibial plateau fractures (type II) according to the Schatzker classification. Closed reduction was achieved using manual ligamentotaxis with traction in extension under image intensifier control. Reduction was fixed percutaneously with cancellous screws (6.5 mm) and washers. Functional outcome (pain, walking capacity, extension lag, range of motion, stability and return to daily activity) was evaluated using the Modified Hospital for Special Surgery Score. A total score of 55 to 60 was considered as excellent, 45 to 54 as good, 35 to 44 as fair, and <35 as poor. Patients were followed up for a mean of 8 (range, 6-12) months. The mean length of hospital stay was 2 (range, 1-3) days. All the fractures united radiographically after a mean of 3 (range, 2.5-3.5) months. The score was excellent in 4 patients, good in 6 patients, and fair in 2 patients. The mean Modified-HSS score was 53.3. No patient had infection or wound dehiscence. Closed reduction and percutaneous screw fixation for tibial plateau fractures (type II) is a minimally invasive method of fixation that reduces the length of hospital stay and costs, enables early mobilization with minimal instrumentation, and achieves satisfactory outcomes.

Keyword: *Tibial plateau, Knee fractures, Minimally invasive fixation, Percutaneous screws*

1. Introduction

The lateral side of the knee joint is most commonly injured during road traffic accidents, which results in torn ligaments, sprains, and fractures of one or both condyles [1]. Tibial plateau fractures are intra-articular fractures caused by high-velocity trauma. They are usually associated with neurovascular injury, compartment syndrome, compounding of fractures, and crushing of soft tissues. Associated injuries at and around the knee joint are more common and severe in patients with fracture-dislocation [1,2]. The treatment outcomes for tibial plateau fractures are inconsistent. [3]. Closed reduction (based on ligamentotaxis principles) and internal fixation (with percutaneous cancellous screws and washers) avoids the disadvantages of both operative and conservative treatments. However, it is not suitable for all types of tibial plateau fractures, particularly grossly comminuted and depressed fractures, Schatzker type-VI fractures, and open fractures [4,5]. We evaluated treatment outcomes of closed reduction and percutaneous screw fixation for tibial plateau fractures (type II) according to Schatzker classification.

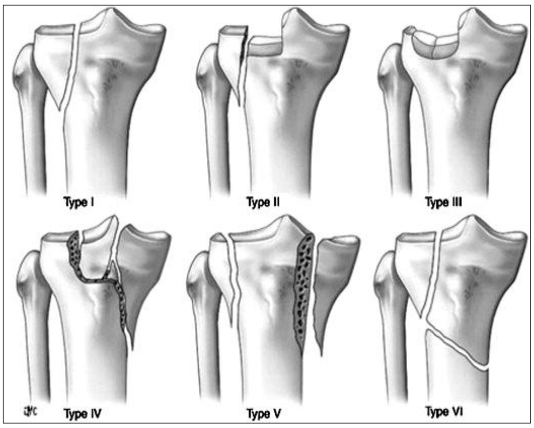

Figure (1) shows Schatzker classification, type I: pure cleavage, type II: cleavage combined with depression, type III: pure central depression, type IV: fracture of medial condyle, type V: bicondylar fracture, type VI: plateau fracture with dissociation of metaphysis and diaphysis

2. Patients and Methods

Between June 2016 and June 2017, 9 men and 3 women aged 21 to 64 (mean, 38.1) years underwent closed reduction and percutaneous screw fixation for closed tibial plateau fractures (type II). Seven of them involved the right side and 5 was the left. The causes of injury included motor cycle accidents (n=5), motor car accident (n=4), fall from a height (n=2), and fall on the ground (n=1). Associated injuries included ankle fracture (n=1), tibial spine (n=2). Patients with other types of tibial plateau, open fractures, compartment syndrome, or vascular injury were excluded. This study was approved by the ethics committee of our hospital. Informed consent was obtained from each patient. Appropriate emergency treatment was given for associated head, chest, and/ or abdominal injuries after haemodynamic stabilization. Antero-posterior and lateral radiographs of the knee joint were obtained. Computed tomography was performed to assess articular depression. The lower limb was rested in above-knee posterior splint and anti-edematous medications were given to the patients. Patient characteristics, injury mechanism, injury pattern, distal neurovascular status, and associated injuries were recorded using a predesigned proforma. Patients were operated on as soon as they were medically fit. Surgery was delayed for 4 to 7 days in 2 patients with blisters or persistent tense swelling. Excluding these 2 patients, the mean delay in surgery was 2 (range, 1-3) days. Closed reduction was achieved using manual ligamentotaxis with traction in extension under image intensifier control. Both sides of the proximal tibia were thumped to dislodge the depressed articular fragment. Reduction was held temporarily with one- or 2-pointed reduction forceps, and then fixed percutaneously with cancellous screws (6.5 mm) and washers. The direction and the number of screws (≥2) used were based on the fracture pattern and orientation. Articular congruency was checked under a C-arm in antero-posterior and lateral views. The limb was then immobilized in above-knee cast. The rehabilitation protocol was standard for all patients. Patients were encouraged to perform isometric quadriceps exercises, ankle pump, and toe movements. Analgesia and antibiotics were given. The cast was removed after 4 weeks, and the knee joint was examined for tenderness, swelling, and instability. Gradual knee flexion and extension exercises were advised with non–weight-bearing crutch walking for further 4 weeks. Partial and full weight bearing was allowed at week 8 and week 12, respectively. Patients were followed up at 6 and 12 months. At the final follow up, functional outcome (pain, walking capacity, extension lag, range of motion, stability and return to daily activity) was evaluated using the Modified Hospital for Special Surgery Score [6], tab. (1). A total score of 55 to 60 was considered as excellent, 45 to 54 as good, 35 to 44 as fair, and <35 as poor.

Table (1) the Modified Hospital for Special Surgery Knee Score (HSSKS)

Pain	Constant, unbearable	0	**Walking (Gait)**	Bedridden	0
	Constant, bearable	2		Uses a wheelchair	2
	Pain with activities	4		Markedly restricted, uses bilateral support	4
	Pain at start of activities	6		Moderately restricted, uses one support	6
	Occasional and slight pain	8		Mildly restricted, limping without support	8
	None	10		Unrestricted, no limp, no support	10
Motion-Muscle power	Ankylosis with deformity	0	**Radiographic evaluation**	Non-union, metal failure, secondary arthritis	0
	Ankylosis with good functional position	2		Delayed union	2
	Poor to fair muscle power, flexion ≤ 60°	4		Varus > 10°, shortening > 2.5 cm	4
	Fair to good muscle power, flexion up to 90°	6		Varus 5° - 10°, shortening 1 - 2.5 cm	6
	Good to normal muscle power, flexion ≥ 90°	8		Varus < 5°, shortening < 1 cm	8
	Muscle power normal, motion normal	10		Anatomic reduction	10
Function	**Retired pre-injury**		**Employed pre-injury**		
	Completely dependent		Retired		0
	Partially dependent		Part-time/ light duty		2
	Independent, limited housework		Changed jobs		4
	Do most housework, shops freely		Altered job description		6
	Little restriction, walk on feet		Returned to work		8
	Normal activities		Returned to full work		10
Daily activity	**Shoes & socks:**		**Stairs:**		
	Unable	0	Unable		0
	With difficulty	3	One at a time		2
	With ease	5	Normal		4

3. Results

Patients were followed up for a mean of 8 (range, 6-12) months. The mean length of hospital stay was 2 (range, 1-3) days. All the fracture united radiographically after a mean of 3 (range, 2.5-3.5) months. The score was excellent in 4 patients, good in 6 patients, and good in 2 patients. The mean Modified-HSS score was 53.3. No patient had infection or wound dehiscence.

Figure (2) shows Schatzker type-II tibial plateau fractures fixed with percutaneous cancellous screws

4. Discussion

Tibial plateau fractures are difficult to treat because of their intra-articular nature, cancellous bone involvement, and proximity to a major weight bearing joint. The aim of the surgical treatment of tibial plateau fractures is to restore normal knee function. This is accomplished by anatomically restoring the articular surfaces of the tibial condyles, maintaining the mechanical axis, restoring ligamentous stability. The limitations of conservative treatment are inadequate reduction of the articular surface, ineffective limb alignment control, and prolonged hospitalization and recumbency, which causes quadriceps atrophy and range of movement restriction. Operative treatment restores articular congruity, axial alignment, and joint stability, and enables early mobilization while decreasing the risk of post-traumatic arthritis. Nonetheless, operative treatment compromises soft tissues, devascularises bone fragments, and may be complicated by infection, implant failure, and wound dehiscence. Thus, it is not indicated for all types of tibialplateau fractures. Closed reduction and percutaneous screw fixation is minimally invasive and thus reduces the length of hospital stay and costs [5]. It is highly indicated in patients with a large peripheral fragment (i.e. Schatzker type-II). In our study, patients with Schatzker type-II fractures were indirectly reduced with manual ligamentotaxis. The articular condyle was then reduced to the shaft and fixed with screws. Irrespective of treatment modality, early mobilization (no later than 4 weeks) is essential to prevent knee stiffness [2]. Impacted articular fragments cannot be dislodged by traction or manipulation alone as there is no soft-tissue attachment [2]. In our study, patients with depressed fractures (type II) were excluded, as it is difficult to achieve articular congruency by traction or manipulation. [7,8]. In 12 patients with closed tibial plateau fractures type-II treated with percutaneous cancellous screws and washers, The mean Modified-HSS score was 53.3 for all patients (range, 59-30) after a mean follow up of 8 months; out-come was excellent in 33%, good in 50%, and fair in 17% of patients; unacceptable outcomes were likely due to comminuted or depressed fractures. In addition, a few patients had loss of knee range of motion owing to delayed knee mobilization [9,10]. Outcome was satisfactory (good-to-excellent) in 83%. The mean Modified-HSS score was 53.3 for all patients with closed tibial plateau fractures type-II (range, 59-30). In our study, manual ligamentotaxis successfully reduced fractures with a peripheral fragment, whereas a femoral distractor successfully reduced fractures with comminution using an indirect technique [11,12]. Guarded thumping on both sides of proximal tibia helped dislodge the depressed fragment. The depressed fragment can be elevated using an arthroscopy, which also enables direct visualization of the articular congruency. Arthroscopic reduction is superior to closed reduction and broadens the indications of minimally invasive percutaneous fixation. Nonetheless, it needs expertise and infrastructure. Percutaneous cancellous screw fixation with arthroscopic elevation of the depressed articular fragment is a favorable treatment modality for tibial plateau fractures [13].

5. Conclusion

Tibial plateau fractures are one of the most challenging intra-articular fractures that affecting range of motion, congruity of the joint and life style of the patients. Surgical techniques vary between ORIF and minimally invasive techniques that are either arthroscopically assisted or intraoperative fluoroscopic control. We conclude that minimal invasive surgical techniques for fixation of the tibial plateau fractures (Schatzker type II) reduces time of hospitalization and rate of complications, decreases time of rehabilitation, increases rate of union and early weight bearing in compare with ORIF.

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