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Treatment of Complex Proximal Tibial Fractures (Types V & VI of Schautzker Classification) by Double Plate Fixation with Single Anterior Incision

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ABSTRACT

Background: complex proximal tibial fractures (Types V & VI of Schautzker classification) are the major problems in orthopedic surgery and associated with high complication rates. There are many alternatives in treatment of these fractures. **Aim:** to evaluate the results of double plating with single anterior incision in complex proximal tibial fractures (Types V & VI of Schautzker classification). **Methods and Materials:** 22 patients (16 males and 6 females) with Types V and VI of Schautzker classification of proximal tibial fractures (14 cases were Type V and 8 cases were Type VI) were treated by double plating with single anterior incision method between May 2006 and May 2011. The bony and functional outcome was evaluated according to Knee Society Score. **Results:** According to Knee Society Score, the results were as follows: excellent in 19 patients (86.4%), good in 2 patients (9.1%), fair in 1 patient (4/5%), and poor in no patient (0%). **Conclusion:** the double plate fixation with single anterior incision is the best, effective and simple procedure in treatment of complex proximal tibial fractures (Types V and VI of Schautzker classification).

Keywords: Proximal Tibial Fractures; Types V & VI of Schautzker Classification; Double Plate Fixation; Single Anterior Incision

1. Background

Complex proximal tibial fractures (Types V & VI of Schautzker classification) are the major problems in orthopedic surgery and associated with high complication rates. These fractures include bicondylar injuries with significant articular depression; multiple, displaced condylar fracture lines; metadiaphyseal fracture extension and comminution; and open wounds or extensive, closed injuries [1-3]. Both the complexity and the soft-tissue disruption of this subgroup of fractures contribute to the high rate of unsatisfactory results which follow both nonsurgical and surgical management [4,5].

The goals of operative treatment of these fractures include anatomic reduction for restoration of articular congruity and alignment, and stable fixation to allow early motion.

Dual plating is preferred to other techniques in the setting of a significantly displaced fracture of the articular surface, especially in cases with significantly depressed fragments [6,7].

This technique, when performed through a single, midline extensile or double incision with wide stripping of the proximal tibia, has been associated with deep infection, wound dehiscence, and soft tissue complications in 23% to 100% of patients [8-11].

The two most common complications of double plating with two or single incision are; the compromised skin and soft tissue envelope, which invites a high rate of complications following attempted open reduction and internal fixation, and poor bone quality and comminuted fracture patterns creating difficulty in achieving stable fixation [3,7,9-11].

The purpose of this study was to evaluate the results of double plating with single anterior midline incision in complex proximal tibial fractures (Types V & VI of Schautzker classification) and compare this rate to other series in the literature.

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2. Methods and Materials

22 patients (16 males and 6 females) with Complex proximal tibial fractures were treated by double plating with single anterior midline incision between May 2006 and May 2011.

The fractures were classified using the Schautzker classification, and open fractures were classified according to the method of Gustilo and coworkers. 14 cases were Type V and 8 cases were Type VI of Schautzker classification. 5 patients had open fracture (3 cases were Type I and 2 cases were Type II of Gustilo classification). There were 16 males and 6 females with a mean age of 35 years (19 to 67).

5 patients suffered from additional injury (limb fractures, head, chest or abdominal injury).

20 patients were treated by one stage surgery and 2 patients were treated by two stage surgery (debridement and then plate fixation) due to open Type II Gustilo fracture.

All patients had anterior-posterior (AP) and lateral radiographs as well as CT scans to identify each of the bicondylar fractures.

Definitive fixation by double plating with single anterior midline incision technique was performed after the soft tissue injury had improved. The time from injury to definitive fixation varied widely (range: 2 to 15 days) as a result of variable degree of soft tissue compromise noted at initial presentation.

Closed fractures were treated with single anterior midline incision and double plate fixation.

Open fractures were managed by two stage surgery initially with irrigation and debridement and then by fixation.

The technique for fixation was as follow: With an anterior midline incision the proximal tibial fractures were exposed. A transverse submeniscal arthrotomy was performed to expose the articular surface at both sides. Depressed fragments were elevated and then supported with bone graft. L or T buttress or proximal metaphysial LCP plates were applied once anatomic reduction had been achieved. Plain radiographs were taken in the operating room to verify adequate articular reduction and plate's placement (**Figures 1** and **2**).

After surgery, the leg was supported and elevated with a posterior above-knee splint until soft tissue swelling resolved. Knee motion was started on the 3rd day with a CPM machine.

The patients were discharged with a posterior splint and were seen in an out-patient department after 15 days until the stitches and the posterior splint were removed. They were maintained on non-weight-bearing ambulation for 3 months. Serial radiographic examination of the knee and the tibia in AP and lateral planes was performed at 6 weeks, 3 months, 6 months, and 1 year post-operatively for follow-up of the fracture healing.

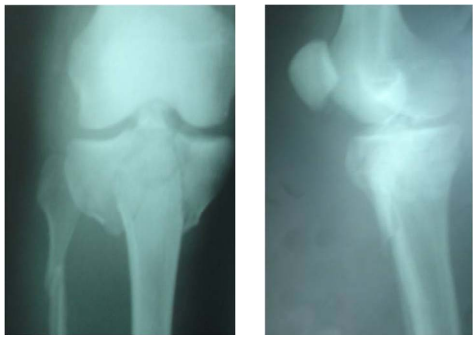

Figure 1. A 32-years-old man with Type V of Schautzker tibial platu fracture in motorcycle accident.

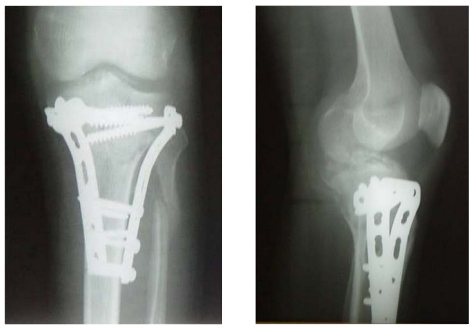

Figure 2. After surgical treatment by double plate fixation with single anterior incision technique.

In 8 patients autologous bone graft was needed at the time of surgery due to bone loss after elevation of depressed fragments. The bony and functional outcome was evaluated according to Knee Society Score.

3. Results (Table 1)

In all 22 patients the fracture had union with the average time up to 15 weeks (range12 - 23). None of the patients developed joint infection. 2 patients had superficial infection, which was suppressed with daily care and antibiotics.

None of the patients developed a varus or valgus deformity and leg-length discrepancy. None of the patients underwent a second operative procedure.

One patient had deep venous thrombosis (DVT) that required admission to the intensive care unit and anticoagulation therapy. 2 patients had significant pain requiring analgesics.

2 patients had noticeable limping. 16 patients achieved ability to perform previous activities of daily living (ADL) and returned to their previous work, 4 patients got ability to perform previous activities of daily living (ADL) and previous work with minimal difficulty, and 2

Table 1. Clinical data of 22 patients with complex proximal tibial fractures (Types V & VI of Schautzker classification) treated by double plate fixation with single anterior incision.

Data	Number of patients
Type of fracture (Schautzker)	
Type VI	8
Type V	14
Sex	
Female	6
Male	16
Side of fracture	
Left	12
Right	8
Left & Right	2
Complications	
Infection	2
Residual deformity	0
Shortening > 2/5 cm	0
Returned to previous work	20
Changed work	2
Unable work	0
Significant pain	2
Noticeable limp	2
Loss of knee motion > 15D	3

patients had significantly limited activities of daily living (ADL) and required a change from previous work.

According to Knee Society Score, the results were as follows: excellent in 19 patients (86.4%), good in 2 patients (9.1%), fair in 1 patient (4/5%), and poor in no patient (0%) (**Table 2**).

Table 2. The results of 22 patients with complex proximal tibial fractures (Types V & VI of Schautzker classification) treated by double plate fixation with single anterior incision according to Knee Society Score.

Grade	Results	
	Number of patients	percent
Excellent	19	86.4
Good	2	9.1
Fair	1	4/5
Poor	0	0
Total	22	100

4. Discussion

The most common difficulties are faced by the surgeon while dealing with intra-articular proximal tibial fractures are the compromised skin and soft tissue envelope, which invites a high rate of complications following attempted open reduction and internal fixation, and poor bone quality and comminuted fracture patterns creating difficulty in achieving stable fixation [3,7,9-12].

Treatment options include non-operative treatment using traction, casts or braces, hybrid, ring, or uniplanar external fixation; fixed angle implants utilizing percutaneous exposure and reduction; dual plating with one or two incision, arthroscopically assisted fixation and minimal percutaneous pinning, lateral plating and medial fixator, and minimally invasive techniques (LISS system) [1,2,5,11,13-17].

Regardless of treatment technique the reported complications include: wound breakdown; deep infection, deep vein thrombosis; compartment syndrome; non-union; myositis ossifican; peroneal palsies; hardware failure; and arthrofibrosis [7,18-20].

Non-operative treatment using traction, casts or braces has been reported to produce poor functional results, have prolonged hospital stays and complicated by the loss of reduction [12].

Arthroscopically assisted fixation and minimal percutaneous pinning have also been reported to give good results but these modalities are suitable for simple split depression and local compression fractures [17,21].

Open double plate fixation has been reported to be associated with the complication of wound dehiscence and infection [10,22,23].

Hybrid fixation systems have not good functional and bony results, and give increased risk of pin tract infection and prolonged courses of treatment [23-28].

Some studies have reported that open lateral plating and medial fixator in complex bicondylar fractures of the tibia give good functional results minimizing soft tissue complications [13].

Currently, minimally invasive techniques (LISS system) are used commonly by orthopaedic surgeons, and there have been reports of good results in tibia plateau fractures being treated exclusively by this technique. This system minimizes the surgical complications by decreasing the soft-tissue stripping, to provide a rigid fracture reduction and to respect the post-traumatic soft-tissue injury [15,29,30].

To minimize the surgical complication especially infection, staged treatment is necessary in open complex

proximal tibial fractures [31]. In this study 2 patients with open Type II Gustilo fractures were treated by two stage surgery (debridement and then plate fixation).

Anatomical knee joint reduction, the relative stability and alignment of the proximal tibia allowing the earliest knee mobilization, while keeping complications to a minimum rate, are the major goals in the treatment of complex proximal tibial fractures [27,32].

In order to obtain stability of bicondylar and complex proximal tibial fractures, reduction and fixation of both medial and lateral columns is necessary. Dual plating successfully gives a good stability by buttressing both columns; but high rate of complications associated with this open technique is reported [10,11].

Steven N., *et al*. reported wound dehiscence and infection in proximal tibial fractures treated with double plate fixation [33]. In our study superficial infection was observed in 2 cases and no soft tissue breakdown was noted. We also had good functional and bony results.

In this study, our results demonstrate a lower risk for deep infection and soft tissue complications, good functional and bony results in complex proximal tibial fractures when compared to earlier reports about other techniques.

5. Conclusion

The double plate fixation with single anterior incision is the best, effective and simple procedure in treatment of complex proximal tibial fractures (Types V and VI of Schautzker classification) with lower risk for deep infection and good results when compared to other reported techniques.

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