

A midterm analysis of Tibial plateau fractures: functional outcome and incidence of osteoarthritis in 240 cases

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Abstract

Background: Tibial plateau fractures are a risk to the functional integrity of the knee. They are the result of axial compressive forces alone or combined with Varus or valgus stress on the knee joint. Post-traumatic osteoarthritis occurs after traumatic injury to the joint. The presence of residual incongruity at the time of fracture healing could lead to joint stiffness and long-term morbidity, studies have established the restoration of articular congruity as the key principle on the management of these injuries. Despite anatomical joint reconstruction, development of osteoarthritis may still take place secondary to the initial articular cartilage injury. This prospective study evaluates the functional and radiological outcome of surgically managed tibial plateau fractures and incidence of osteoarthritis.

Methods: In this prospective study 240 patients with tibial plateau fractures managed by different modalities were included. Patients were evaluated by Rasmussen criteria clinically and radiologically by Kellgren & Lawrence grading for development of osteoarthritis at 6 weeks, 3 months, 6 months, 1 year and then subsequent follow-ups.

Results: Rasmussen clinical scoring system showed excellent results in around 34% (82) of the patients, 53% (127) had good, 9% (22) fair and 4% (9) poor results. Out of 240 patients 78 (32.5%) developed OA knee (including Kellgren and Lawrence grade 1) which is a significant number of patients. With increase in schatzker type & amount of articular depression the number of patients developing Osteoarthritis increased, schatzker Type I -16 % vs schatzker Type VI - 54% and no articular depression 9.5% vs > 5mm articular depression 46 %.

Conclusion: With increase in schatzker type & amount of articular depression the chance of patient developing Osteoarthritis significantly increases and thus excellent anatomical reduction with restored articular congruity rigid fixation is required to facilitate early knee motion and reduces chances of post-traumatic osteoarthritis.

Keywords: Tibial Plateau fracture, post-traumatic arthritis, Proximal tibia Fracture.

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Introduction

When treating intra-articular fractures such as Tibial Plateau fractures, the goal is to obtain a stable joint permitting early range of motion for cartilage nourishment and preservation [1]. Various treatment

modalities have been used over the years, with mixed results. These include traction or closed treatment with cast bracing. Surgical procedures including circular frames [1], percutaneous screw fixation, open reduction/internal fixation (ORIF) and

arthroplasty have also been advocated. More recent techniques such as the use of fixed angle devices, arthroscopically-assisted reduction and the use of novel grafting methods to address articular depression, constantly gain popularity amongst orthopaedic surgeons. Post-traumatic osteoarthritis occurs after traumatic injury to the joint, most commonly following injuries that disrupt the articular surface, or injuries that lead to joint instability [2].

The clinical observation that the presence of residual incongruity at the time of fracture healing could lead to joint stiffness and long-term morbidity [3] has established the restoration of articular congruity as the key principle on the management of these injuries.[4]

Despite anatomical joint reconstruction, development of osteoarthritis may still occur secondary to the initial articular cartilage and meniscal injury [5,6]. In young patients this could be detrimental as it can lead to total knee replacement at an early age. In addition, these fractures may have significant socio-economic influence. In order to assess the effect of these injuries on functional outcome and development of OA, we started a prospective study in 2007 and reviewed its mid-term results of tibial plateau fractures treated in our institution.

Materials and Methods

From May 2007 to May 2017, 267 adult patients with tibial plateau fractures underwent surgical treatment at our center. 27 patients were lost to follow-up and were excluded from the final analysis. Thus, 240 patients (174 males, 66 females, mean age 48 [range 21–69 years) form the basis of this report.

Out of 240 patients 31 patients were treated with Percutaneous cancellous screw fixation method, 21with ORIF with cancellous

screws, 98 with ORIF with buttress plate, 90 with Locking compression plate.

Inclusion Criteria of our study were

- 1.All the fractures of the tibia plateau with intra articular extension.
- 2.Closed fractures, open grade I and open grade II fractures were included.

Exclusion Criteria of our study were

- 1.Pathological fractures
- 2.Fractures in children (< 18 years)
- 3.Old neglected fractures
- 4.All open grade III fractures
- 5.Previously operated Fractures
- 6.Fractures with neurovascular deficit

The patients were evaluated and were taken for surgery at the earliest possible time depending on their medical condition, skin condition and the amount of swelling. All surgeries were done under C-arm image intensifier control. Fractures were fixed either with percutaneous technique or by open reduction and internal fixation. The fixation devices consisted of T Buttress plate, L Buttress plates, Locking compression plate, 4.5 mm Cortical screws and 6.5 mm Cannulated. Bone grafts, Bone graft substitutes were used in depressed and comminuted fractures. The source of bone graft was ipsilateral iliac crest. Postoperatively patients were immobilized with an above knee posterior slab or a compression bandage for 3 weeks. The sutures were removed on the 12th postoperative day. Antibiotics were given till suture removal by 5 days of intravenous and 7 days of oral. The patients were advised static quadriceps exercises for initial 3 weeks followed by passive range of motion with protected knee brace and non-weight bearing crutch walking up to 6 weeks. After 6 weeks knee mobilization and weight bearing crutch walking was advocated. An immediate postoperative X-ray was also

done, later on repeated at 6 weeks, 3 months and 6 months and at latest follow-up. The patients were then followed up at 6 months and then last follow up (at mid term assessment), during which time the anatomic and functional evaluation was done using the modified Rasmussen clinical and radiological criteria.

Results

Average time for union was 12 weeks (9-20 weeks) We had no case of non-union in our series. Mean duration of follow up was 8.4 years (6.2-9.7 years). 67 patients under went fixation with bone grafting after elevation of articular depression. Out of 240 patients 78 (32.5%) developed OA knee.

Table 1: Type of fracture

SCHATZKER TYPE OF FRACTURE	NO. OF CASES	PERCENTAGE
TYPE I	12	5
TYPE II	27	11
TYPE III	82	34
TYPE I	62	26
TYPE V	33	14
TYPE VI	24	10

Table 2: Age In year

Age In year	Number of cases	Percentage
21-30	44	18
31-40	94	39
41-50	62	26
51-60	29	12
61-70	11	5

Table 3: Amount of Articular Depression

Articular Depression	Patients	Percentage (%)
None	42	18
<2mm	115	48
2-5mm	51	21
>5mm	32	13
Total	240	100

Table 4: Frequency of method of treatment

Type of Fixation	No. of Cases
Percutaneous cancellous screw fixation	31
ORIF with cancellous screws	21
ORIF with buttress plate	98
ORIF with locking compression plate	90
Total	240

Table 5 : Rasmussen Clinical Assessment at final follow-up

CLINICAL RESULT	NO. OF CASES	PERCENTAGE
EXCELLENT	82	34
GOOD	127	53
FAIR	22	9
POOR	9	4

Table 6 : Rasmussen Radiological Assessment at final follow-up

RADIOLOGICAL EVALUATION	NO. OF CASES	PERCENTAGE
EXCELLENT	48	20
GOOD	141	59
FAIR	39	16
POOR	10	4

Table 7: Distribution of patients developing OA knee according to Schatzker classification at final follow-up

Schatzker classification Type	Total no. Of Cases	Kellgren & Lawrence grade 1	Kellgren & Lawrence grade >1	No. Of Cases who developed OA knee	%
I	12	2	-	2	16
II	27	5	2	7	26
III	82	19	3	22	27
IV	62	14	4	18	29
V	33	10	6	16	48
VI	24	9	4	13	54
Total	240	59	19	78	

Table 8: Distribution of patients developing OA knee according to amount of articular depression at final follow-up

Amount of articular depression	Total No. Of Cases	Kellgren and Lawrence grade 1	Kellgren and Lawrence grade >1	No. Of Cases who developed OA knee	%
None	42	4	Nil	4	9.5
<2mm	115	26	11	37	32
2-5mm	51	15	7	22	43
>5mm	32	7	8	15	46
Total	240	52	26	78	

Table 9: Distribution of patients developing OA knee according to type of fixation method

Type of Fixation	Kellgren and Lawrence grade 1	Kellgren and Lawrence grade >1
Percutaneous cancellous screw fixation	8	3
ORIF with cancellous screws	6	2
ORIF with buttress plate	21	14
ORIF with locking compression plate	13	11
Total	48	30

Table 10: Complications

Complication	Patients	Percentage (%)
Infection (Superficial)	21	9
Infection (deep)	8	3
Knee joint stiffness	27	11
Implant Failure	None	0
Varus deformity	11	5
None	173	72
Total	240	100

Discussion

The management of tibial plateau fractures is a challenging task for the surgeon, as they are often associated with a number of complications [7]. It has been well documented that instability due to articular incongruity predisposes to uneven loading and early Osteoarthritis [1,8]. It is not surprising therefore that minimally displaced tibial plateau fractures had the best results when open or closed methods of reduction were used, followed by early range of knee motion.

Rademakers and colleagues evaluated 109 patients with tibia plateau fractures who had an average follow-up period of 14 years to determine the long-term functional outcome of operatively treated tibia plateau fractures [9]. The authors also reported complications, one of which was secondary osteoarthritis. They reported a 5% incidence of secondary osteoarthritis that necessitated reconstructive surgery (total knee arthroplasty, realignment osteotomy, knee arthrodesis).

our study consisted of 240 patients (174 males & 66 females). Mean age was 48 years (21-69 years). Mean duration of follow up was 8.4 years (6.2-9.7 years). Out of 240 patients 31 patients were treated with Percutaneous cancellous screw fixation

method, 21 with ORIF with cancellous screws, 98 with ORIF with buttress plate & 90 with ORIF with Locking compression plate. 67 patients under went fixation with bone grafting after elevation of articular depression. 182 patients (76%) had right sided tibial plateau fracture whereas 58 patients (24%) had left side affected.

Average time for union was 12 weeks (9-20 weeks).

In our study Rasmussen clinical scoring system showed excellent results in around 34% (82) of the patients, 53% (127) had good, 9% (22) fair and 4% (9) poor results. Out of 240 patients 78 (32.5%) developed OA knee (including Kellgren and Lawrence grade 1) which is a significant number of patients.

36% of patients treated with Cannulated Cancellous Screw developed OA knee, 35.7% of patients treated with buttress plate developed OA knee and 26.6% of patients treated with Locking compression plate developed OA knee. This difference may be due to superiority of LCP in maintaining reduction till osteosynthesis because of its angular locking capability.

With increase in schatzker type & amount of articular depression the number of patients developing Osteoarthritis increased, schatzker Type I 16 % vs schatzker Type VI 54% and no articular depression 9.5% vs > 5mm articular depression 46 %.

The limitations of this study is that we did not compare the x-ray of normal knee with the operated knee to confirm if the osteoarthritis is post traumatic or senile.

Conclusion

With increase in schatzker type & amount of articular depression the chance of patient developing Osteoarthritis significantly increases and thus excellent anatomical reduction with restored articular congruity rigid fixation is required to facilitate early knee motion and reduces chances of post-traumatic osteoarthritis.

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