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ORIGINAL ARTICLE

Functional outcome of tibial plateau fractures treated by ORIF using three-column classification (TCC)

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ABSTRACT

BACKGROUND

Treatment of tibial plateau fractures remains challenging especially those caused by high energy trauma. Despite operative treatment, these fractures often result in complications like malalignment and secondary osteoarthritis (OA). A clearer understanding of the fracture pattern may help decrease these complications. As fracture configuration are better evaluated by CT scan, three column classification (TCC) seems to be useful in guiding the surgical management and planning surgical fixation of these fracture. The aim of this study is to evaluate the functional outcome of tibial plateau fractures treated by ORIF using TCC.

METHODS

All patients with proximal tibia fracture who were treated with open reduction and internal fixation (ORIF) between January 2019 - December 2022 were retrospectively identified and analysed using the hospital data base. A total of 30 patients were enrolled in this study. Preoperative radiographs, Preoperative CT scan, immediate post-operative and two year post-operative radiographs were analysed. Functional outcome was evaluated by Oxford knee score (OKS) and residual pain using Visual Analog Score (VAS).

RESULTS

All fractures were united in 4 months post op. The Functional outcomes measured by OKS was a mean of 43 (range: 23-48), which indicated good to excellent outcomes and patients had minimal residual pain of VAS score 1 (range: 0 to 5).

CONCLUSION

TCC seems to be a useful classification to plan the operative management of tibial plateau fractures.

KEYWORDS

Tibial plateau fractures; Three column classification

INTRODUCTION

Tibial plateau fractures account for 1% of all fractures and approximately 30% of all tibial fractures.[1-3] They are mainly due to high-energy trauma in the younger individual and low-energy trauma in the older person.[4] Treatment of tibial plateau fractures remains challenging, especially those caused by high-energy trauma due to extensive soft tissue injury and multi-fragmentary intra-articular fractures.[5,6] Open reduction and internal fixation (ORIF) is the preferred technique for managing displaced tibial plateau fractures.[7,8] Despite operative treatment, these fractures often result in complications like malalignment and secondary osteoarthritis (OA).[1,9,10] Schatzker, AO/OTA, and three-column classification (TCC) (Figure1) have been traditionally used to classify these fractures, which help the surgeon to understand the fracture personality and guide the treatment.[11-13] Schatzker and AO classifications are based on plain radiographs, whereas TCC is based on CT imaging. Schatzker and AO classification have been commonly used to classify these fractures, but these classification systems do not give adequate information regarding the integrity of the posterior articular surface, which can lead to inadequate fracture fixation and subsequent poor results.[14-16] A clearer understanding of the fracture pattern may help decrease these complications. As fracture configuration is better evaluated by CT scan, TCC seems to be more useful in guiding the surgical management and planning surgical fixation of this fracture[11,17] We classify the fractures using Schatzker classification for descriptive purposes. However, the surgical planning has been done utilising

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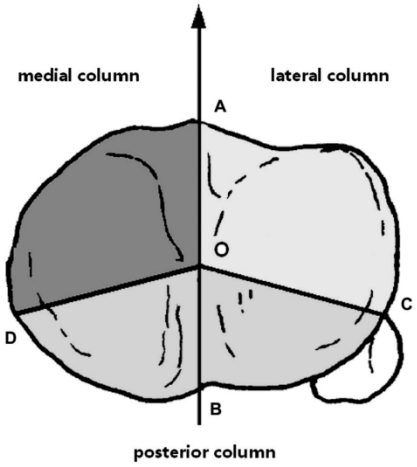
the TCC in all our cases.

This study aims to evaluate the Functional outcome of tibial plateau fractures treated by ORIF using TCC.



METHODS

All patients with proximal tibia fractures treated with open reduction and internal fixation (ORIF) between January 2019 - December 2022 were retrospectively identified and analysed using the hospital record database. Patients more than 18 years of age and a minimum of two years' post-op follow-up were included in this study. Pathological fractures, polytrauma patients and patients with cognitive impairment were excluded. A total of 30 patients were enrolled in this study. Patient characteristics, fracture types, and types of operative stabilisation were obtained by evaluating hospital charts, surgical notes, preoperative and postoperative radiographs, CT scans, and 3D views. X-rays were analysed to classify fractures using Schatzker classification, and CT scans were analysed to classify the fractures according to TCC. Pre-op planning of the case utilised the TCC classification. The first author performed all the surgeries. Preoperative X-rays, Preoperative CT scans, and immediate postoperative and two-year postoperative X-rays were analysed. Functional outcome was evaluated using Oxford Knee Score (OKS) and residual pain using Visual Analog Score (VAS).

Surgical Techniques:

Spinal anaesthesia (SA) or combined epidural and SA was given to the patients. Most cases were managed in the floppy lateral position except for one patient, who was kept prone. Depending on the columns involved, we use anterolateral, medial, posteromedial, and posterior approaches for the proximal tibia. We managed 11 cases with an anterolateral approach, 7 cases with a combined anterolateral and medial approach, 7 cases with combined anterolateral and posteromedial approaches, 2 cases with a posteromedial approach, 1 case with a medial approach, 1 case with a posterolateral approach and 1 case with posterior approach. Fixation was done with appropriate implants (screws, anatomical medial /lateral column and buttress plates) depending on the fracture pattern and columns involvement. The surgeon chose the implants that would best fix the fractures when seen during surgery. Fourteen cases were fixed with one plate, 7 cases with two plates, 6 cases with three plates and 3 cases with four plates, respectively. (Figure 2-4)

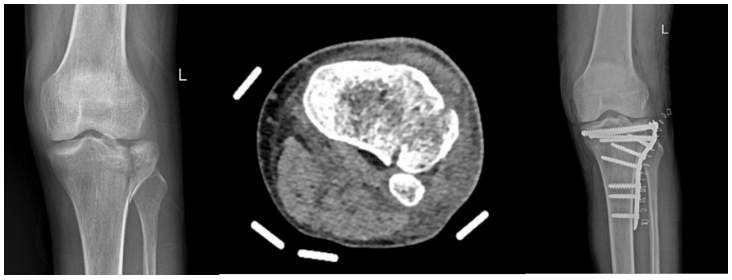


Figure 2: Schatzker type II, TTC - One column fracture

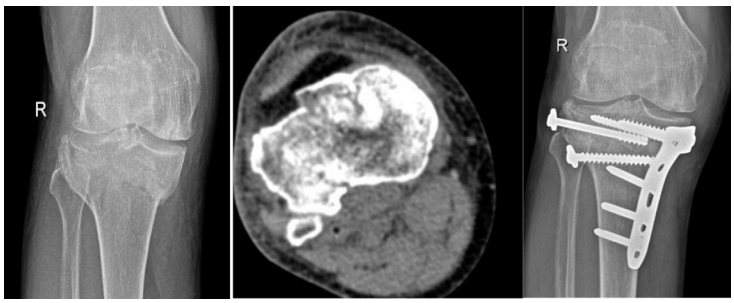


Figure 3: Schatzker type V, TTC - Two column fracture

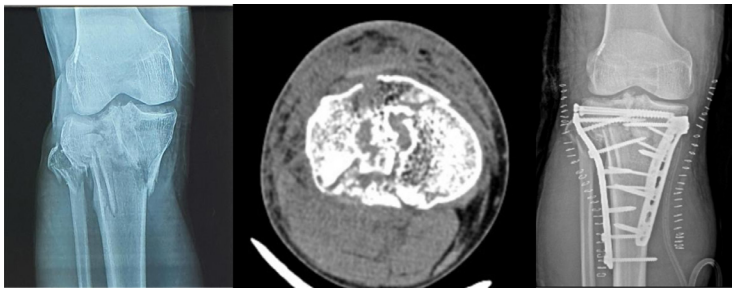


Figure 4: Schatzker type VI, TTC - three column fracture

Postoperative management:

Physiotherapy was started from the first postoperative day (POD) with knee range of movement (ROM) in a continuous passive motion machine. Active knee ROM and quads strengthening exercises were started once the patient could tolerate the pain. Injection Cefuroxime 1.5 gm IV twice daily was given to all patients for 24-48 hours, followed by Tab. Cefuroxime 500 mg twice a day for the next 7-10 days. For DVT prophylaxis, we have given Injections of Clexane 40mg s/c to all our patients for 1 to 2 days post-op, depending upon the postoperative ambulatory status, sequential compression device (SCD) for 4-5 days, early mobilisation, which Tab followed. Aspirin 75 mg once a day for the next 6 weeks.

Sutures were removed on 2 -3 weeks POD. Monthly x-rays were taken till fracture union was seen, and then patients were followed up every 3 months for one year and six monthly for the next year. Partial weight bearing (PWB) began at 6 - 8 weeks postoperatively, and full weight bearing (FWB) was delayed until the fracture was healed, usually 4 months post-surgery.

RESULTS

A total of 30 patients were enrolled in this study. There were 10 women and 20 men with an average of 44 years of age (range:

Table 1. Patient characteristics, treatment details and outcomes

A/S	Schatzker (Type)	Luo's (TCC) (Column)	Approach	Fixation	OKS	VAS
42/M	V	3	M + AL	3 Plates: L + M + PM	48	0
42/M	VI	3	AL + M	2 Plates: L + M	45	3
30/F	II	3	M + AL	3 plates: L + M + PM	45	2
40/M	IV	2 (M + P)	PM	2 Plates: M + PM	48	0
65/M	V	2 (L+M)	AL + M	1 Plate: (M) + 2 CCS L	48	0
60/M	VI	3	AL + PM	3 Plates: L + M + PM	42	1
40/M	IV	1 (M)	M	1 Plate: M	47	1
30/M	VI	3	M + AL	2 Plates: L + M	48	0
35/F	II	1 (L)	PL	2 Plates: L + PL + ACLR	27	3
61/F	II	1 (L)	AL	1 Plate: L	48	0
23/M	IV	1 (M)	PM	1 Plate: PM + 2 CCS	48	0
48/M	II	1 (L)	AL	1 Plate: L	48	0
42/M		1 (P)	P	1 Plate: P	48	0
40/M	VI	3	AL + M	3 Plates: AL + M + PM + 2 CCS	42	5
53/M	II	2 (L+P)	AL	1 Plate: L	37	2
45/M	II	1 (L)	AL	1 Plate: L + 2 CCS	46	1
79/F	II	1 (L)	AL	1 Plate: L	48	0
43/M	V	3 (P+L+M)	AL + PM	3 Plates: L + M + PM	42	3
62/M	II	1 (L)	AL	1 Plate: L + 2 CCS	35	2
73/M	II	2 (L + P)	AL + PM	3 Plates: L + M + PM	48	0
39/M	VI	3 (L + P + M)	AL + PM	3 Plates: L + M + PM	46	1
20/F	V	3	AL+ PM	3 Plates: L +M + PM + 2 CCS	37	0
30/F	I	1 (L)	AL	1 Plate: L	34	3
49/F	II	1 (L)	AL	1 Plate: L	48	0
40/M	III	0 (L)	AL	1 plate: L	48	0
31/F	V	3	AL + M	2 Plates: M + PL + 2 CCS L	46	1
51/F	II	1 (L)	AL	1 Plate: L + 2 CCS	23	3
46/F	VI	3	AL + PM	3 Plates: L + M + PM	40	0
44/M	II	1 (L)	AL	1 Plate: L	48	0
37/M	VI	3 (L+M+P)	AL + PM	3 Plates: L + M +PM	42	0

20 - 79 years). According to TCC, among 30 cases, 1 case was classified as zero column, 13 as single column, four as two columns and 12 as three column fractures. All single-column fracture cases were managed with one plate 2 column fractures with two plates. Among the 3 column fractures, six cases were fixed with three plates, whereas the other three cases were fixed with four plates and the remaining three were fixed with two plates. All patients were followed up for at least two years with x-rays of the Knee.

All fractures were seen to be united in 4 months post-op. Radiological signs of arthritis were seen in three cases. OKS and VAS evaluated functional outcomes. The average patient scores for OKS were 43 (range, 23-48) and VAS were 1 (range, 0-5), respectively. (Table 1)

There were superficial infections in two cases managed by dressings and antibiotics.

DISCUSSION

Complex tibial plateau fractures can be challenging to treat despite contemporary fracture reduction and fixation techniques, modern implants for fracture fixation and better soft tissue handling.[18,19] ORIF is the preferred treatment for these fractures, although some studies have shown poor results even after ORIF.[7,8,20] Operative treatment has been associated with complications such as infection, delayed union, nonunion and revision surgery.[21] In the current study, all fractures united in 4 months. There were superficial infections only in two cases, which were managed by dressings and antibiotics.

10-58% incidence of osteoarthritis is seen after tibial plateau fracture.[22-26] 0- 21.9% of operated cases may need total knee arthroplasty (TKA).[27,28] In this study, early radiological signs of arthritis were seen in three cases that were not symptomatic, and none of them required TKA during the follow-up period of our study.

Anatomical reduction of all articular fragments seems mandatory to decrease the Incidence of secondary arthritis.[29] Several classification systems were described for proximal tibia fracture to assess the fracture fragments, which help guide the treatment plan. Schatzker classification, AO, and TCC were commonly used.[11,12] Schatzker and AO classification are based on X-rays, whereas TCC is based on CT imaging. Historically, Schatzker [4] and AO classification have been commonly used to classify these fractures, but these classification systems do not give adequate information

regarding the integrity of the posterior articular surface, which can lead to inadequate fixation.[13,15] As fracture configurations are better evaluated by CT scan, TCC seems to be logical and useful in guiding surgical management.[16,17]

Wicky et al. reported a cohort of 42 cases with tibial plateau fractures, which were assessed by plain radiographs and CT scans. They concluded that 43% of the fractures were under-evaluated by plain radiographs.[30] Macarini et al. studied 25 cases of tibial plateau fractures, and operative plans were changed in 60% of their cases after a CT scan.[31] In this study also, among 30 cases, 16 had involvement of posterior articular surface, which could not be adequately evaluated by x-rays alone. One of our cases had only posterior articular involvement, which the Schatzker classification could not even classify. This study

has limitations: its small sample size, short follow-up period and retrospective study design.

CONCLUSION

TCC seems to be a useful classification for planning the operative management of tibial plateau fractures as it helps us understand the fracture characteristics more clearly. In our case series of proximal tibial fractures operated using TCC, the mean OKS score was 43 (range: 23-48), which showed good to excellent outcomes, and patients had minimal residual pain of a mean VAS score of 1 (range: 0 to 5). Further prospective studies with a larger number of participants and a longer follow-up period can ascertain the importance of TCC in evaluating and managing proximal tibial fractures.

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