

## Original Research Article

# Unusual medial tibial plateau fracture fixation using dual plating

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### ABSTRACT

**Background:** Medial tibial plateau fractures is a subtype of proximal tibial fractures that involve the articular surface and can present in several distinct patterns. Purpose of this study was to assess the clinical outcome of stabilizing these biplanar medial tibial plateau fractures using dual plating technique through a single incision.

**Methods:** Between 2017 to 2019, 12 men and 8 women with closed medial tibial plateau fracture who underwent reconstruction using two plates through a posteromedial approach were included in the study group. The fractures were classified using the three column concept of Lou.

**Results:** One patient had an articular step off that was unacceptable and two patients had an acceptable articular step off. Functional assessment was done using the objective scoring of Oxford knee score criteria and radiological assessment was done using the Rasmussen modified score.

**Conclusions:** Biplanar reconstruction using dual plates is a reliable and safe technique to reconstruct complex medial tibial plateau fractures.

**Keywords:** Medial tibial plateau fractures, Biplanar fixation, Clinical outcome

### INTRODUCTION

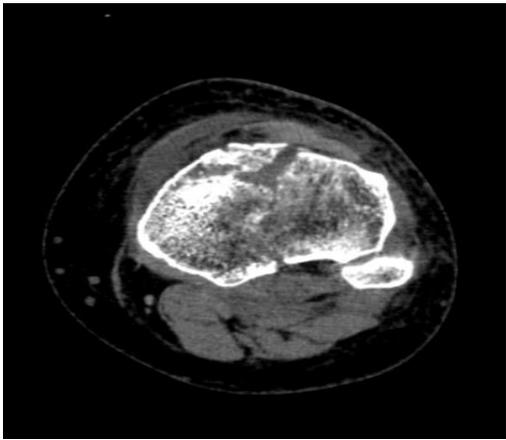
Tibial plateau fractures represent approximately 1% of fractures in adults.<sup>1</sup> Proximal tibial fractures occur mostly commonly due to motor vehicle accidents and fall from height. Trivial fall in osteopenic patients can also be a mode of injury. They occur as a result of either indirect trauma amounting to coronal pattern of fracture or direct trauma causing an axial compressive pattern.<sup>2</sup>

Each fracture pattern is different and requires individualised treatment protocol. The Schatzker classification describes a medial tibial plateau fracture as a single fragment split or one with a comminuted joint depression component. Complex tibial plateau may give rise to complications like compartment syndrome, peroneal nerve injury, vascular injury and subluxation or

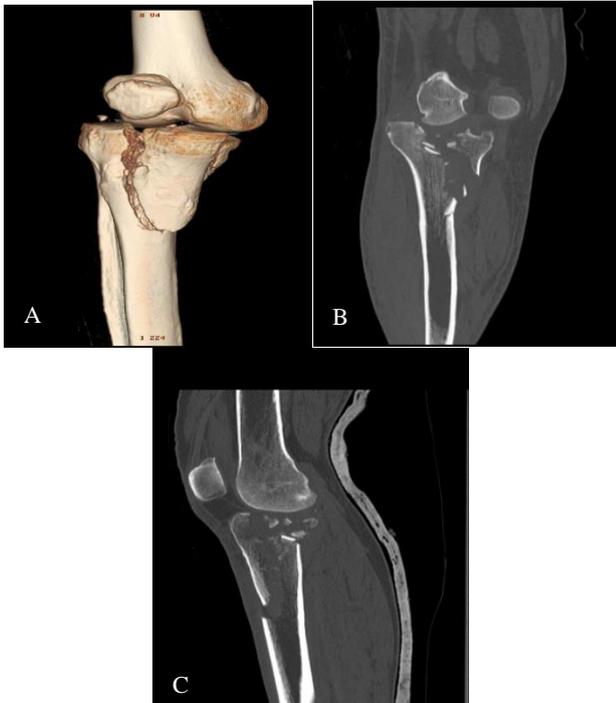
dislocation of the joint and ACL tear.<sup>3-5</sup> To distinguish a posteromedial split from a total medial condyle fracture the three column concept can be used. Management of medial tibial plateau fractures remains challenging due to its varied presentation. Most medial fractures have been described as difficult to treat and have been associated with high rates of soft tissue injury and complication.<sup>6</sup> It is well known that surgical management in the form of minimally invasive surgery or open reduction and stabilisation is the preferred treatment for most tibial plateau fractures.<sup>7,8</sup> Our purpose was to assess the clinical outcome of biplanar medial tibial plateau fractures treated by open reduction and internal fixation using a dual plating technique. Soft tissue complications can pose as a major concern while fixing medial plateau fractures but this can be minimised by proper handling of the soft tissue. This method provides good stability, adequate anatomical joint reduction and aids in early mobilisation.

**METHODS**

Over a period of 2 years from 2017 to 2019, 20 patients who sustained closed tibial plateau fractures involving the medial plateau were identified and included. Our study was a prospective study conducted at a single tertiary care centre Sri Ramachandra College of Medical Science and Research. Our selection criteria included selecting patients above the age of 18 years of both sexes with isolated proximal tibial fractures that involved both columns of the medial tibial plateau. Patients with pathological fractures, open injuries, vascular injuries, paediatric injuries and systemic illness that would interfere with rehabilitation were excluded (Figure 1 and 2).



**Figure 1: Pre-operative CT scans of a 42 years old female with complex medial tibial plateau fracture.**



**Figure 2 (A-C): Pre-operative CT scans of a 50 years old male with complex medial tibial plateau fracture.**

**Management**

All fractures were classified using the three column concept of Lou. A computed tomography scan was obtained to assess the fracture pattern based on which operative planning was done. Patients in whom gross swelling and poor skin condition around fracture site was noted underwent temporary external fixator application and definitive surgery was done after a 2 weeks interval.

**Operative management and procedure**

All surgeries were done under regional- spinal anaesthesia with C-arm image intensifier control. Procedure was done in supine position with a bolster placed under the knee joint. Posteromedial approach was utilized to adequately visualise both the medial and posterior fracture fragments and all the fractures were reduced and stabilised using two plates placed on dual planes including the medial and the posterior plane. The medial or posteromedial fragments were exposed by elevating the Pes anserinus subperiosteally. The saphenous vein and nerve were retracted anteriorly and the medial head of gastrocnemius was retracted laterally. The posterior fragment was stabilised first followed by the medial fragment. Fractures fragments were fixed to each other and to the lateral condyle and then elevated using K wires. Locking plates, T buttress plates and distal radius locking plates were used for the fixation. Ligamentous injuries were ruled out while testing for stability. Soft tissue injuries if any were addressed to during the procedure and intraoperative and in hospital post-operative complications if any were recorded prior to discharge (Figure 3).



**Figure 3 (A-D): Post-operative X-ray of the above mentioned cases in the study.**

**Post-operative rehabilitation and follow up**

Mobilisation in the form of full range of knee motions were allowed as tolerated by the patient on post-operative day 1. All patients were advised non weight bearing protocol for minimum of 6 weeks. Follow up for all patients in the study group was done. The functional results were analysed using the Oxford knee score criteria graded as excellent (80-100), good (70-79), fair (60-69) and poor (<60) and radiological outcome was assessed using Rasmussen assessment criteria and graded as excellent (28-30), good (24-27), fair (20-23) and poor (<20).

**RESULTS**

The study group included 12 men and 8 women with age group ranging from 27 years to 50 years of age and road traffic accident being the most common mode of injury.

In our study the most common mode of injury for medial tibial plateau fracture was found to be road traffic accident more commonly occurring in men. All the medial tibial plateau fractures had fractures involving two planes with right sided predominance. Out of the 20 patients included in the study satisfactory anatomical reduction was achieved in 17 patients. Two patients had an acceptable articular step off and one patient had an unacceptable articular step off that needed revision surgery. Knee flexion at an average was around 100 degrees (Figure 5). Out of the 20 patients 3 patients had knee stiffness.



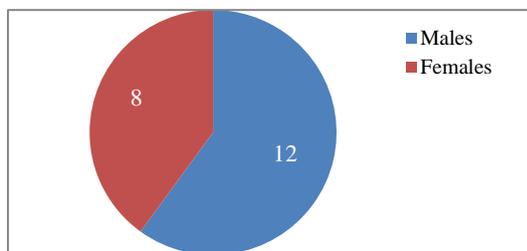
**Figure 5: Clinical picture of 3 months post-operative analysis of functional result.**

**DISCUSSION**

Management of complex tibial fractures involving more than one plane remains difficult owing to intra articular extension, gross comminution and associated soft tissue injury.<sup>9</sup> An uncommon variant of this fracture involves a fracture line extending in the coronal plane that can lead to formation of posteromedial fragment. When this fragment is stabilised using a laterally applied plate the reduction may be unsatisfactory.<sup>10</sup> Lou et al in their study described the three column concept to emphasize on the importance of the posterior column and the complication like secondary osteoarthritis, disability and pain that can be produced if the posterior fragment is not well stabilised.<sup>11</sup> In our study we aimed as assessing the clinical outcome of such complex medial tibial plateau fractures that were fixed using dual plates through a single incision.

Various surgical approaches are available that can be used to expose the medial and posterior column using either a single or double incision. Krausen et al in their study of specific surgical approaches talks about availability of posteromedial approach, extended medial approach and an inverted L-shaped approach for fractures involving the medial and posterior plane.<sup>12</sup> Mark et al in their study described the Loben Hoffer approach for isolated posteromedial fractures. A fracture specific approach can lead to good visualisation of the fragments and aid in reduction and stabilisation. In our study we used a single posteromedial approach to access the fracture.<sup>13</sup>

Barei et al reported in his study about increased rate of wound complications with dual plating via single or dual incision with an incidence of infection ranging from 3% to 32%.<sup>14</sup> He described that 7 out of 83 patients (8.4%) developed deep infection and 3.3% required secondary procedures in the form of debridement and implant removal. Although increased rate of wound complications with dual plating have been reported. In our study we found the incidence of such complications to be low. Dual incisions on the same side leave behind inadequate soft tissue cover thereby leading to poor soft tissue healing. Using a single incision with careful soft



**Figure 4: Demographic data.**

**Table 1: Oxford knee score.**

Objective knee score	No. of patients
Excellent	14
Good	5
Fair	1
Poor	0
<b>Total</b>	<b>20</b>

**Table 2: Rasmussen modified score.**

Rasmussen modified score	No. of patients
Excellent	13
Good	4
Fair	3
Poor	0

tissue handling and appropriate timing of surgery can help reduce the risk of these complications.

Raza et al in his study demonstrated that the use of modern implants with locking screws and plates increased the stability of the construct and helped maintain reduction.<sup>15</sup> Yoo et al also described in his study of stabilisation of posteromedial fragment in bicondylar tibial fractures that a laterally placed conventional implant and a posteromedial buttress was a good option that provided stability.<sup>16</sup> In our study according to the size of the fracture fragment precontoured posteromedial plates, T plates and distal radius plates were used to achieve satisfactory reduction and stabilisation of the posteromedial fragment. Medial component was fixed using 3.5 system buttress plate.

Post traumatic arthritis remains a cause of concern in all intra articular fractures and restoration of articular congruity is of prime important. Blokker et al in his study described that an articular step off >5 mm was associated with unsatisfactory results.<sup>17</sup> Trumble et al also suggested in his study that an articular step of <2 mm is critical for good outcome.<sup>18</sup> Rademaker et al in his retrospective study described that an articular step off <2 mm did not significantly differ from that of upto 4mm in causing secondary arthritis.<sup>19</sup> In our study two patients had an acceptable step off <2 mm and one patients had a step off up to 4 mm which was unacceptable and required revision. Since articular step off was noted in our patients we revised our surgical technique and included submeniscal arthrotomy as a part of our procedure for better visualisation of the joint and to minimise the risk of an articular step off.

There has been a strong association between increasing age of the patients and chances of failure of fixation.<sup>20</sup> In our study no such correlation could be assessed owing to the limitation of not having older patients in our study group.

Most of our patients on follow up had a good clinical and radiological outcome assessed using the Oxford knee score and Rasmussen radiological score.

## CONCLUSION

Medial tibial plateau fractures involving two planes are usually high velocity complex injuries and management though challenging needs to be fracture specific. Dual plating of such fractures using a single posteromedial incision and careful soft tissue dissection can be a useful technique to approach these fracture patterns but needs further evaluation and research. Newer implants might be required to attain absolute anatomical reduction and joint congruity in these unusual fracture patterns.

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