

FUNCTIONAL AND RADIOLOGICAL OUTCOME OF BICONDYLARTIBIAL PLATEAU FRACTURES TREATED WITH SINGLE LATERAL 3.5MM PERIARTICULAR LOCKING PLATE: A RETROSPECTIVE STUDY

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Prasanna Baidoor¹, Santosh S Jeevanavar², Keshav Shenoy³, Vinod Makannavar¹, Abhishek Gumaste¹

¹ - Assistant Professor, Department of Orthopaedics, SDM College of Medical Sciences and Hospital, Sattur Dharwad, Karnataka, India.

² - Professor, Department of Orthopaedics, SDM College of Medical Sciences and Hospital, Sattur Dharwad, Karnataka, India

³ - Associate Professor, Department of Orthopaedics, SDM College of Medical Sciences and Hospital, Sattur Dharwad, Karnataka, India

Corresponding Author:

Dr. Santosh S Jeevanavar
Professor department of orthopaedics
SDM College of medical sciences and hospital
Manjushreenagar, sattur
Dharwad 580009
Karnataka
Email-drssj99@gmail.com

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Abstract:

Introduction: Bicondylartibial plateau fractures results from high energy injury and consists of 20% of all tibialplateau fractures. Treatment of bicondylartibial plateau fractures is challenging and still controversial. The standard approach which involves extensive dissection of medial and lateral column may lead to devascularisation of the fracture fragments, wound breakdown and infection. Locking plates acts as internal fixators with the locking screw creating a fixed angle construct and provide angular stability. With the use of lateral locking plate in selected bicondylar fractures medial plate can be avoided and reduce the medial soft tissue injury. Aim of this study is to determine the clinical, radiological and functional outcome of patients with bicondylartibial plateau fractures treated with single 3.5mm lateral locking plate.

Materials and methods: Between January 2009 to December 2015 all the patients operated for bicondylartibial plateau fractures in our tertiary care center were included in this study. Patients age less than 18 years, bicondylar fracture with displaced posteromedial fragment, Gustilo type 3 open fractures and patients with less than one year follow-up were excluded from the study. 24 patients with bicondylartibial plateau fractures who met all the criteria were included. All patients were operated in supine position through anterolateral approach for the proximal tibia and fracture fixed with

3.5mm periarticular proximal tibial lateral locking plate. Functional outcome was evaluated using new Oxford knee scoring system and the Hospital for Special Surgery knee score (HSS score).

Results: Average time of follow-up in our study is 19 months. In our study all patients achieved union in 14 to 42 weeks with an average time to union is 21.5 weeks. Two patients had intrarticular step-off more than 2mm in lateral condyle without any varus or valgus malalignment. 2 patients had varusmalalignment of 7 to 8 degree of MPTA on anteroposterior radiograph. One patient had loss of reduction and varus collapse at 3 months once he started weight bearing. As per the Oxford knee scoring system, 8 patients(33%) had excellent result and 16 patients had good result. The average HSS score was 82.6 (range 70 to 94).

Discussion: Effective management of bicondylartibial plateau fractures requires anatomical reduction and rigid fixation of articular segment and maintenance of limb alignment without causing much soft tissue

injury during the surgery. Moore TM et al. and Young MJ et al. have shown 23 to 88% of wound infection when dual plating was done through the single extensile approach. Gosling et al. reported immediate postoperative malreduction in 23% of cases using the LISS plating system. Barei et al. reported a 10% incidence of immediate malreduction after dual plating. In our study we have used single 3.5mm periarticular locking plate through which four locking screw can be placed in subchondral bone and may help to prevent loss of reduction. In our study one patient (4.2%) had loss of reduction. SaqibHasan et al. in their biomechanical study comparing 3.5mm plates with 4.5mm plate for bicondylartibial plateau fractures have shown no significant difference in both and advocated for low profile 3.5mm plates in these fractures

Conclusion: Present study shows bicondylartibial fractures without displaced posteromedial fragment can be treated with single 3.5mm periarticular lateral locking plate with minimal wound complication and acceptable result.

Key words: Tibial plateau, fractures, locking plates

Introduction:

Bicondylartibial plateau fractures results from high energy injury and consists of 20% of all tibial plateau fractures¹. Pattern of tibial plateau fractures depends on mode of injury, magnitude of the force, quality of the bone and age of the patient². Depending on the velocity of the injury there can be articular cartilage depression, metaphyseal comminution with or without subluxation of the joint. These fractures usually associated with high incidence of soft tissue contusion around the knee joint, fracture blisters and open fractures. Tibial plateau fractures are classified according to Schatzker's classification based on anteroposterior radiographs^{1,4}. With the use of computed tomography and three dimensional reconstruction coronal plane fractures, articular depression and fracture geometry can be identified⁵.

Treatment of bicondylartibial plateau fractures is challenging and still controversial³. Treatment goals include preservation of soft tissues, restoration of articular congruity, rigid articular fixation and correction of anatomic alignment in the lower extremities. Many authors have advocated dual plating⁶, buttressing the medial and lateral condyles. The standard approach which involves extensive

dissection of medial and lateral column may lead to devascularisation of the fracture fragments, wound breakdown and infection^{7,8}. Locking plate's acts as internal fixators with the locking screw creating a fixed angle construct and provide angular stability^{9,10}. With the use of lateral locking plate in selected bicondylar fractures medial plate can be avoided and reduce the medial soft tissue injury. However chances of medial collapse, loss of reduction and varus deformity are expected complication when lateral plating alone was used.

Aim of this study is to determine the clinical, radiological and functional outcome of patients with bicondylartibial plateau fractures treated with single 3.5mm lateral locking plate.

Materials and methods:

Between January 2009 to December 2015 all the patients operated for bicondylartibial plateau fractures in our tertiary care center were included in this study. Patients age less than 18 years, bicondylar fracture with displaced posteromedial fragment, Gustilo type 3 open fractures and patients with less than one year follow-up were excluded from the study. 24 patients with bicondylartibial plateau fractures who met all the

criteria were included out of which 19(79%) were male and 5 (21%) were female patients. Road traffic accident was the most common mode of injury consisting 14 patients(58%), injury due to fall from height seen in 8 patients(34%) and sports related injury occurred in 2 patients(8%). Right leg was involved in 15 patients(62.5%). 4 patients had Gustilo type 1 open injury and 2 patients had Gustilo type 2 open fracture.

After admission all patients underwent pre operative radiographs and CT scan with three dimensional reconstructions. Fractures were classified according to Schatzker's classification, 15 patients had type V and 9 patients had type VI fracture pattern. Limb was immobilized in posterior slab and elevated over Bohler Braun splint till the initial edema and fracture blisters subsides. All patients were operated in supine position through anterolateral approach for the proximal tibia. In patients who had articular surface depression of the lateral condyle, sub meniscal arthrotomy was done, entrapped lateral meniscus is lifted. Fractured lateral condyle is opened as a book and depressed articular fragment elevated and initially stabilized with multiple k-wires. Metaphyseal bone void after elevation of articular

fragment were filled with cancellous bone graft taken from ipsilateral iliac crest. Displaced medial condyle is reduced using k-wire as a joystick and compressed to lateral condyle with pointed clamp. Varus or valgus mal alignment corrected and fracture fixed with 3.5mmperiarticular proximal tibial lateral locking plate. Additional fixation of medial condyle done in few patients with percutaneously placed 4.0mm cannulated cancellous screw.

Active and passive knee and ankle range of movements and non weight bearing walking with walker started from third post operative day. Patients were followed at 6 weeks, 3,6,9 and 12 months and analyzed radiologically for progress of union, loss of reduction and any mal alignment. Full weight bearing walking allowed after radiological union. Bony union was defined radiologically when at least three cortices united in anteroposterior and lateral radiographs. Anteroposterior radiographs were used to measure the medial proximal tibial angle (MPTA) and in lateral radiographs we measured the posterior proximal tibial angle (PPTA) according to Freedman and Johnson¹¹. Mal reduction was defined as an intraarticular step-off more than 2mm and malalignment in the frontal or sagittal plane of more than 5 degree according to Paley¹². Secondary loss of reduction was defined as a change of alignment of 5 or more degrees into either varus or valgus at union as compared to initial radiographs¹². Functional outcome was evaluated using new Oxford knee scoring system¹³and the Hospital for Special Surgery knee score (HSS score)¹⁴.

Results:

All patients were operated within 10 days of injury with average delay in surgery being 4.5 days. All

patients were treated with 3-5mm periarticular lateral locking plate and in 5 patients (21%) additional medial fixation with 4.0mm cannulated screw is used. In 9 patients (37.5%) iliac crest cancellous bone graft is used to fill the metaphyseal void created after elevation of depressed articular fragment. One patient had superficial wound infection which was treated with regular dressing and intravenous antibiotics for one week. One patient who had type 2 open fracture developed delayed wound infection at 5 months and on radiological examination showed union of the fracture and treated with implant removal and wound debridement.

Average time of follow-up in our study is 19 months. In our study all patients achieved union in 14 to 42 weeks with an average time to union is 21.5 weeks. Two patients had intrarticular step-off more than 2mm in lateral condyle without any varus or valgus malalignment. 2 patients had varusmalalignment of 7 to 8 degree of MPTA on anteroposterior radiograph. One patient had loss of reduction and varus collapse at 3 months once he started weight bearing.

At one year follow up 18 patients (75%) had no pain in the knee joint and 6 patients had occasional pain while walking for long distance. Mean range of movement of knee joint is 102 degree (75 to 135 degree). 4 patients had restriction of knee joint movement less than 90 degree. 16 patients had returned to their initial work. As per the Oxford knee scoring system, 8 patients(33%) had excellent result and 16 patients had good result. The average HSS score was 82.6 (range 70 to 94).

Table 1: Distribution of Study Participants according to Mode of Injury

Mode of Injury	Frequency	Percent
Road traffic accident	18	58%
Fall from height	8	34%
Sports related injury	2	8%

Table 2: Type of Fracture according to Schatzker classification

Type of fracture	No of patients	Percent
Type V	15	62.5%
Type VI	9	37.5%
Total	24	100%

Table 3: Complications

Complications	No of patients	Percent
Superficial infection	1	4.2%
Deep infection	1	4.2%
Articular mal reduction	2	8.3%
Varus mal alignment	2	8.3%
Loss of reduction	1	4.2%
Knee stiffness	4	16.7%

Figure 1- a: Schatzker type V tibial plateau fracture pre-op x-ray



Fig. 1-b: Pre-op 3D CT scan



Fig. 1-c : Immediate post-op x-ray



Fig. 2-c : Immediate post-op x-ray



Fig. 2-d : 1 year follow-up X-ray



Fig. 1-d: 1 year follow-up X-ray



Fig. 2-a: Schatzker type VI tibial plateau fracture pre-op x-ray



Fig. 2-b: Pre-op 3D CT scan



MJ et al.¹⁵ have shown 23 to 88% of wound infection when dual plating was done through the single extensile approach. Bareiet al.¹⁶ have shown 5 to 8% of infection rate when dual plating done through two incision technique. Many factors contribute to wound infection which includes high velocity injury, fracture blisters, open fracture, extensile dissection and operative time. Operative time and soft tissue dissection can be minimized in single lateral locking plate and we have seen deep wound infection in 1 patient (4.2%).

Because of metaphyseal comminution and fractures in multiple planes in tibial plateau fractures incidence of malreduction is also high. Gosling et al.⁹ reported immediate postoperative malreduction in 23% of cases using the LISS plating system. Bareiet al.¹⁶ reported a 10% incidence of immediate malreduction after dual plating. Many authors have advocated that in presence of displaced posteromedial fragment, single lateral locked plating may not be as effective as dual plating. In our study tibial plateau fractures with displaced posteromedial fragment was excluded which require posteromedial plating. We had immediate malreduction in 4 patients (16.7%). Loss of reduction and varus collapse is also significant problem while treating bicondylartibial plateau fractures and it is attributed to inadequate fixation of all the fractured fragments. Gosling et al.⁹ has studied 69 bicondylartibial plateau fractures treated with LISS and has reported loss of reduction in 13% of cases. In our study we have used single 3.5mm periarticular locking plate through which four locking screw can be placed in subchondral bone and may help to prevent loss of reduction. In our study one patient (4.2%) had loss

Discussion

Effective management of bicondylartibial plateau fractures requires anatomical reduction and rigid fixation of articular segment and maintenance of limb alignment without causing much soft tissue injury during the surgery. Soft tissue complication is a major concern while treating bicondylartibial plateau fracture. Moore TM et al.⁸ and Young

of reduction. SaqibHasan et al.¹⁹ in their biomechanical study comparing 3.5mm plates with 4.5mm plate for bicondylartibial plateau fractures have shown no significant difference in both and advocated for low profile 3.5mm plates in these fractures.

In our study all patients achieved union with average of 21.5 weeks. No patient had implant failure in our series and only one patient had loss of reduction. In our study 33% had excellent result and 67% had good result with average HSS score 82.6. However this study had some limitations in the form of small no of cases and less duration of follow-up. Late collapse and post traumatic arthritis could not be evaluated.

Conclusion

Bicondylartibial plateau fractures occur as a result of high energy injury and treatment require balance of anatomical reduction, rigid fixation and soft tissue dissection. Present study shows bicondylartibial fractures without displaced posteromedial fragment can be treated with single 3.5mm periarticular lateral locking plate with minimal wound complication and acceptable result.

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