



Orthopaedics

A LONG TERM COMPARATIVE STUDY OF FUNCTIONAL OUTCOME OF TIBIAL CONDYLAR FRACTURE MANAGED SURGICALLY BY SINGLE COLUMN PLATING VERSUS BICOLUMN PLATING IN YOUNG ADULTS: 24 MONTHS FOLLOW UP

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ABSTRACT **Introduction:** Fractures of tibial plateau involve the articular surface of proximal tibia. The injuries span a wide spectrum, ranging from low energy unicondylar fractures to high energy bicondylar and comminuted fractures. The surrounding soft tissues are severely damaged in high energy injuries and this complicates management of these challenging lower limb fractures. **Aim and Objectives:** The aim of this study was to compare the clinical, functional, and radiological outcomes of the DLP and SLLP procedures, in subjects with Bicondylar tibial plateau fractures (BTPFs), which are type V/VI. **Materials and Methods:** This prospective study conducted in Rama Medical College, Mandhna, Kanpur from January 2017 to September 2018. We included the patients presenting themselves in casualty and OPD of Department of orthopaedics and newly diagnosed as tibial bicondylar fractures. Maximum Follow up period was 24 months after operative management. **Results:** In Group 1 out of 23 patients 16 were males and 7 were females, the mean and SD of age in years was 40.9 ± 7.89 . In Group 2, out of 23 patients 18 were males and 5 were females, the mean and SD of age in years was 38.9 ± 6.89 . Mechanism of injury: Out of 56 patients 29 (51.7%) had 4-wheeler road traffic accident, 8 (14.2%) had bicycle accident, 9 (16.07%) had history of fall from height, 6 (10.7%) had history of simple fall and 4 (7.14%) had crush injury. The most common mode of injury was road traffic accident. We assessed the surgical details of the patients between the two groups, the average time to surgery (days), mean operation time (minutes), mean reduction time (minutes) and bone grafting (number of patients) in Group 1 were 9 days, 132 minutes, 39 minutes, 20 bone grafting and 8.9 days, 108 minutes, 38 minutes and 18 bone grafting respectively. The p value was statistically significant only for mean operation time ($p = 0.028$). The mean operative time was significantly decreased in Group 2 compared to Group 1. We compared the complications between the two groups, we did not find statistically significant differences in post-operative malalignment, postoperative mal reduction, radiographic healing time, loss of reduction, loss of alignment, implant irritation, knee range of motion and HSS score at 24 months follow up between the two groups. In group 1, four patients developed deep infection and in group 2 one patient developed superficial infection, which was statistically significant. **Discussion and Conclusion:** The results of this study demonstrate that DP through two incisions resulted in a better limb alignment and joint reduction with an acceptable soft tissue complication rate.

KEYWORDS : tibial bicondylar fractures, post-operative malalignment, postoperative malreduction, radiographic healing time & loss of reduction.

INTRODUCTION

Fractures of tibial plateau involve the articular surface of proximal tibia. The injuries span a wide spectrum, ranging from low energy unicondylar fractures to high energy bicondylar and comminuted fractures. The surrounding soft tissues are severely damaged in high energy injuries and this complicates management of these challenging lower limb fractures [1,2].

The treatment of bicondylar tibial plateau fractures remains a highly demanding surgical procedure with a wide variety of perioperative complications. The goal of treatment of high energy tibial plateau fractures are to restore joint line congruity, joint stability and alignment with minimal soft tissue dissection to allow for early mobilization and establishment of good function.

The optimal treatment for these fractures has always been mired in controversy. There have been proponents for both operative and non-operative methods. Good functional results were reported with either modality in low energy fractures but the ideal treatment for high energy injuries is still being debated. Various options like conservative management, hybrid external fixation, open reduction internal fixation, etc., have been put forth [1,2].

Tibial plateau fractures can be categorized as per the Schatzker or AO-Müller/Orthopaedic Trauma Association (AO/OTA) classifications, and they constitute approximately 30% of all tibial fractures. Bicondylar tibial plateau fractures (BTPFs), which are type V/VI and type 41-C, respectively, as per the Schatzker and AO/OTA classifications, constitute approximately 18% to 39% of all tibial plateau fractures, and are complex and serious injuries [3,4].

In recent years, with the increase in traffic accidents, which cause high-energy injuries, the number of BTPFs has increased in correlation. BTPF treatment is a big challenge for orthopaedic surgeons due to

problems such as excessive comminution on the articular surface, and severe soft tissue injury and its vulnerability to complications. The main purpose of surgery is the anatomical restoration of the joint surface, avoidance of soft tissue damage, and early mobilization of the patient by ensuring the alignment of the lower extremities [5,6,7,8].

Many different methods, such as external fixators, Ilizarov circular frame, and open reduction internal fixation (ORIF) are performed in the surgical treatment of BTPFs. The open reduction and dual locked plate (DLP) method is one of the ideal surgical procedures, with proven biomechanical stability, since it supports both lateral and medial fragments stably [9,10]. However, the biggest handicap of this method is that wide soft tissue dissection at the fracture site increases the possibility of wound complications, especially in patients with severe soft tissue injury [9]. With the development of modern locking plating systems and the use of the minimally invasive percutaneous osteosynthesis (MIPO) technique, a good alternative to BTPF treatment with a single lateral locked plate (SLLP) has emerged in patients with severe soft tissue injury. In this technique, the possibility of secondary reduction loss, especially in the medial fragments, appears to be a disadvantage [11,12].

OBJECTIVES

The aim of this study was to compare the clinical, functional, and radiological outcomes of the DLP and SLLP procedures, in subjects with Bicondylar tibial plateau fractures (BTPFs), which are type V/VI.

METHODOLOGY

This is a prospective study conducted in 56 patients treated at RAMA MEDICAL COLLEGE, Mandhna, Kanpur from January 2017 to September 2018. We included the patients presenting themselves in casualty and OPD of Department of orthopaedics and newly diagnosed as tibial bicondylar fractures. Maximum Follow up period was 24 months after operative management.

When the patients were seen for the first time after injury, a thorough history was taken concerning about the time of injury, mechanism of injury, any significant past or personal history. Patients were examined giving special importance to whether the fracture was open or closed, presence of gross swelling, fracture blisters and presence of other associated injuries. Routine investigations were done as were necessary.

Inclusion Criteria:

Age > 18 years, Schatzker type V and VI tibial plateau fractures, closed fractures, Grade I and II compound fractures and patients willing to give voluntary consent.

Exclusion Criteria:

Age < 18 years, Grade III compound injuries, Old fractures (> 4 weeks old), Extensive soft tissue injury with healing period more than 3 weeks, patients not willing to give voluntary consent, open fractures, pathological fractures, additional fractures of the same extremity, neurovascular injuries, soft tissue ligament and meniscus injuries with fractures, having been operated on for other surgical procedures and those not having attended regular follow-ups.

Surgical Intervention: we included a total of 56 patients based on inclusion and exclusion criteria. We divided the patients into two groups by simple random sampling. Group 1 consisted of 23 patients who underwent surgical treatment with DLP and Group 2 consisted of 23 patients who underwent surgical treatment with SLLP. All the patients were operated in supine position and a pneumatic tourniquet was used to control bleeding. All the patients were operated by same orthopaedic surgeon.

Procedure for SLLP:

The standard anterolateral approach was used in the proximal tibia in patients who were operated on using this procedure. The lateral meniscus was lifted with a suture after horizontal capsulotomy to provide joint vision. After the anatomic restoration of the joint was achieved, it was temporarily fixed with K-wires. In the case of bone defect, the defect was filled with an allograft. Next, a SLLP of appropriate length for the fracture pattern was placed using the MIPO technique. A separate mini incision was made to the distal of the plate so that the screws could be applied to the distal of the fracture. Final fracture fixation was completed by placing screws of appropriate length. After fluoroscopic control, the capsule was repaired and the operation was terminated.

Dual Locked Plate:

In this technique, in addition to patients with a SLLP, a posteromedial approach was made from the proximal tibia at least 5 cm distal to the anterolateral incision. After the SLLP procedure was completed, the DLP procedure was started. During the posteromedial approach, the patient's leg, which is in the supine position, is placed in a figure four position to facilitate the approach. The interval between the medial head of the gastrocnemius muscle and the semimembranosus muscle was explored. When necessary, the pes anserinus was separated from the adhesion site and posteromedial tibia was seen. Joint reduction was achieved by elevating the collapsed posteromedial fragment. In the case of bone defect, the defect was filled with an allograft. Next, additional fixation was made using another locking plate suitable for the anatomy and fracture pattern of this region. After fluoroscopic control, the pes anserinus was sutured instead of the adhesion and the operation was terminated.

All patients were given an angle adjustable knee brace postoperatively, regardless of which surgical procedure was performed. All patients were observed in the hospital until their soft tissue injuries healed. Extremity oedema was prevented by frequent elevation and ice application, especially in the first 24 hours after surgery. All patients were regularly trained by an experienced physiotherapist. While 0°-30° flexion range of motion (ROM) was allowed in the early postoperative period, the degree of flexion was gradually increased to 120° in the sixth week. All patients were given partial weight-bearing at the 8th week and full weight-bearing at the 12th week postoperatively.

Statistical analysis:

All the data was entered into Microsoft excel and analysis was performed using SPSS 19 version. The comparison between the two groups was performed using student t test and the p value <0.05 is considered statistically significant.

RESULTS & DISCUSSION

In this prospective study, 56 cases of tibial condylar fracture were treated by surgical methods. We divided the subjects into two groups by simple random sampling. Group 1 consisted of 23 patients who underwent surgical treatment with DLP and Group 2 consisted of 23 patients who underwent surgical treatment with SLLP.

In Group 1 out of 23 patients 16 were males and 7 were females, the mean and SD of age in years was 40.9± 7.89. In Group 2, out of 23 patients 18 were males and 5 were females, the mean and SD of age in years was 38.9± 6.89.

Mechanism of injury: Out of 56 patients 29 (51.7%) had 4-wheeler road traffic accident, 8 (14.2%) had bicycle accident, 9 (16.07%) had history of fall from height, 6 (10.7%) had history of simple fall and 4 (7.14%) had crush injury. The most common mode of injury was road traffic accident.

We assessed the surgical details of the patients between the two groups, the average time to surgery (days), mean operation time (minutes), mean reduction time (minutes) and bone grafting (number of patients) in Group 1 were 9 days, 132 minutes, 39 minutes, 20 bone grafting and 8.9 days, 108 minutes, 38 minutes and 18 bone grafting respectively. The p value was statistically significant only for mean operation time (p = 0.028). The mean operative time was significantly decreased in Group 2 compared to Group 1.

We compared the complications between the two groups, we did not find statistically significant differences in post-operative malalignment, postoperative mal reduction, radiographic healing time, loss of reduction, loss of alignment, implant irritation, knee range of motion and HSS score at 24 months follow up between the two groups. In group 1, four patients developed deep infection and in group 2 one patient developed superficial infection, which was statistically significant.

With a single incision required for lateral SP fixation, we did have a statistically significant difference in surgical time were found between the two groups. However, there was no difference in time required for reduction of fracture. The advantages of SP/LISS fixation include unilateral fixation and application of self-drilling and self-tapping screws, may theoretically shorten the operating time. However, reduction of fragments and restoration of alignment for bicondylar fractures through a single lateral incision are technically demanding and this may offset any decreases in operating time during fracture fixation.

Soft tissue complications are a major concern in the treatment of bicondylar tibial plateau fractures with plates. Papers reporting the results of DP through a single extensile incision have shown the incidence of deep wound infection of 23-88%.^{4,13} With the two incision DP technique, the incidence drops to 4.7-8.4%.^{13,14} With LISS fixation, it is reported to range from 0% to 22%. Jiang et al. [13] had a deep infection rate was 4.7% in DP group and 7.3% in LISS group. Zhang et al. had a deep infection rate of 3.8% which was comparable to 3.12% seen in our study. In addition, in our study we had 4 cases with superficial infection wherein no organism was isolated and healed by prolonged antibiotics for 2 weeks.

Malalignment was common, with immediate postoperative malalignment and delayed loss of alignment occurring in 11.64 and 15.84% respectively in SP group and 7.26% and 0.56% in a double plating group in our study. Malalignment has also been reported at a significant rate in other studies. The criteria used for malalignment have varied, and the quality of radiographs and the reliability of the measurement techniques make it hard to compare the different series [15]. Varus collapse was the most common pattern for change of alignment.

In osteoporotic bone or in severe comminution, the fixation may not be strong enough to provide stability to the proximal tibia, because the best quality bone is close to the subchondral area. Barei et al. [16] in CT based study demonstrated the occurrence of a posteromedial fragment in approximately one third of AO/Orthopedic Trauma Association C-type bicondylar tibial plateau fractures. This is clinically relevant because laterally applied fixed angle plate/screw devices that are used to treat bicondylar tibial plateau fractures may not effectively neutralize this osteoarticular fragment and require alternate or supplemental exposures and/or fixation strategies.

Limitations of our study:

The number of patients in our study is a weakness as no prior power analysis was made. At the time of surgery in DP group, two plates of different makes were used which we do not recommend.

The final follow up evaluation was only 24 months after the surgery. It is possible that, with time, many of these patients may have posttraumatic arthritic change develop in the knee, especially since the articular reduction and alignment restoration were imperfect in some of them.

CONCLUSION

The results of this study demonstrate that DP through two incisions resulted in a better limb alignment and joint reduction with an acceptable soft tissue complication rate.

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