Direct Access to the Proximal Posteromedial Tibia for Fixation of Large Posteromedial Tibial Fractures Utilizing the "Lobenhoffer Approach" in Lateral Decubitus Position

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ABSTRACT

Objective: To determine the effectiveness and safety of "Lobenhoffer approach" for treating large posteromedial tibial fractures of the proximal tibia.

Methods: The descriptive study was carried out from 23rd January 2017 to 25th December 2019 at Qaisrani Medical Center (QMC) Multan. All patients of proximal tibia fractures having a large posteromedial plateau fragment alone or in combination with bicondylar fractures (Hohl and Moore type I /Schatzker type IV) fulfilling the inclusion criteria were operated with Lobenhoffer approach. Fracture reduction was confirmed by per-op visualization with image intensifier and post operatively with radiographs. The radiological reduction was anatomical if fracture was accurately reduced without any step and non anatomical if step was noted(≤ 2mm).The patients were followed up for one year and radiological evaluation, functional assessment and any potential complication was documented. Comparison of important outcome variables were made and *P* value was calculated with the help of Chi square test (*P* value < 0.05 was considered significant)

Results: A total of 15 patients were included in our study. The mean age was 36.73± 10.9 years (range 18 to 56 years). Posteromedial and bicondylar fracture was present in 12(80%) patients while 3(20%) patients had isolated posteromedial fracture. Immediate post operative radiographs revealed anatomical reduction in 12(80%) and non anatomical reduction in 03(20%) patients (*P* >0.05). No per operative or immediate post operative complication was noted. Union was achieved in all patients. Majority(73.3%,n=11) patients achieved full range of knee motion, only 1(6.6%) patient had extension lag of 10 degrees(*P* < 0.05). Grade II osteoarthritis was noted in 2(13.3%) patients(*P* >0.05).

Conclusion: Accurate anatomical reduction and excellent functional outcome can be achieved by fixing posteromedial tibial fractures through Lobenhoffer approach in lateral decubitus position. It is a safe approach and has no major per operative or post operative complications. We recommend this approach for all proximal tibial fractures with posteromedial fragment.

Keywords: Anatomical reduction, Hohl and Moore, Lobenhoffer, Posteromedial, Schatzker.

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INTRODUCTION

Proximal tibial fractures results from high energy trauma like road traffic accidents and can be classified using Schatzker system of classification, AO system and Hohl and Moore classification.[1,2] It has been observed that posterior half of the tibial plateau fractures are similar in configuration to the Hoffa fracture of the distal femur.[3] Posteromedial fracture of the proximal tibia has been reported in nearly one third of the bicondylar fractures and can be classified as Hohl and Moore type I and warrants fixation.[4] Treatment of bicondylar fractures include non operative immobilization in cast, bi column plating and Ilizarov ring fixator.[5-7]

The medial plateau bears nearly 60 percent of the body weight and is usually fractured vertically as a large piece with posterior and inferior sagging.[8] Attempts to fix this fracture from medial or anterior side avoids accurate fracture reduction and definitive buttressing resulting in weak construct and delayed rehabilitation.[7] Fracture fixation through posteromedial Lobenhoffer approach preserves popliteal muscle, semi-membranous and medial gastrocnemius muscles which are usually sacrificed in other approaches.[7,9,10] Lobenhoffer approach requires less soft tissue dissection and allows accurate reduction and stable fixation under direct vision with adequate buttressing and early range of motion.[10,11]

To our knowledge Lobenhoffer approach in lateral decubitus position has not been used routinely in many centers in Pakistan. In our institution proximal tibia fracture with large posteromedial fragment are usually treated according to the individual surgeon's preference and surgical expertise. The objective of our study was to determine the effectiveness and safety of "Lobenhoffer approach" for treating large posteromedial tibial fractures of the proximal tibia in lateral decubitus position. The results of this study will be used to formulate standard guidelines to treat these fractures in our centre.

METHODS

We conducted this descriptive study from 23rd January 2017 to 25th December 2019 at Qaisrani Medical Center (QMC) Multan. All adults patients with proximal tibia fractures and large posteromedial fragment of the medial tibial plateau alone or in combination with bicondylar fractures (Hohl and Moore type I /Schatzker type IV) presented to the Accident and emergency/OPD of our hospital within one week of sustaining the fracture were included in our study. Patients with compromised skin over the fracture, open fractures, pathological fractures, floating knee injuries and poly trauma patients requiring multidisciplinary interventions were excluded from our study.The study was approved by the Ethical Committee of our hospital and informed consent was taken from all patients. Radiographs and 3D CT scan was done in all patients to plan for surgery.

Surgical Technique

Patient was placed in lateral decubitus position and then tilted further by placing an arm pillow and a sand bag at the ipsilateral anterior superior iliac spine to keep space for abdominal movement for breathing. Likewise we utilized small drapes bolsters to extend the knee during surgery to achieve reduction and while fixing the fracture with plating. Pre operative antibiotics(Injection Cefuroxime 1.5 gm IV) was administration before tourniquet inflation. A digital pneumatic tourniquet was used in all cases and released in all cases after final fixation to achieve meticulous hemostasis before layered closure. All fracture fragments and their reduction was under direct vision and a C-arm image intensifier was used in all cases to confirm the articular reduction.

Fig. IA, IB: Skin incision in the form of an inverted L.

In Lobenhoffer approach the skin incision was given in the form of an inverted L with the vertical limb of the L (Fig. IA)medially just posterior to the medial edge of the tibia and the transverse limb in the popliteal groove almost up to the lateral edge of the popliteal fossa. Skin, superficial and deep fascia was incised along the vertical limb of L (Fig.IB). The gastrocnemius muscle (Fig.IIA,IIB) was identified and retracted laterally in its entire bulk while the medial hamstrings were retracted medially to reach the bone. The technique of "stick to the bone" was followed and nothing sharp was used like diathermy or knife to avoid damage to the major neurovascular bundle in the vicinity. In the proximal part of posterior tibia, a portion of soleus muscle was lifted off subperiosteally to reveal the fracture in majority of cases. Retractors were gently applied laterally to retract the major muscle bulk. The neurovascular bundle was retracted with a right-angled retractor.

Fig IIA, IIB: Gastrocnemius muscle retracted and soleus lifted off the bone and fractured fragments identified.

The fractured fragment was gently mobilized and edges cleaned with small curette taking care not to scrape off the very delicate spongy bone. The posterior fragment was fixed first in all the cases. The fractured fragment was reduced with traction of the leg while keeping the knee in slight hyperextension with the help of a small drape bolster kept underneath the distal thigh anteriorly. The fractured fragment was stabilized with a small K-wire or a small Schanz pin to joystick it into reduced position. Once reduced it was temporarily fixed with a smooth K-wire from posterior to anterior(Fig. III A). Reduction was checked visually, by manual inspection and with C-arm (AP and lateral imaging) to rule out any step off.

Once reduction was fully confirmed, a T locking plate of appropriate size was placed on the posterior aspect and one more K-wire passed through it. Cortical screw was placed just near and distal to the fracture to position the plate firmly on the posterior tibia. Remaining screws were then placed as needed. Once again reduction was confirmed with image intensifier (Fig. IIIB, IIIC). The wound was then packed and tourniquet released. Meticulous hemostasis was secured and closure of the wound was performed in layers with out any drains. Taking precautions with sterilization, patient was then turned supine, tourniquet re-inflated and plating of the lateral tibial plateau was done in cases of both column fractures.

Post operative radiographs were done and radiological reduction was anatomical if fracture was accurately reduced without any step and non anatomical if step was noted(≤ 2mm). Isometric quads, straight leg raise, toes and ankle range of motion exercises were started on first post operative

day under the supervision of physiotherapist. At 2nd week gentle knee range of motion exercises were started up to 90 degrees of flexion along with non-weight bearing mobilization with the help of walker frame. At 4th week patients were encouraged to gradually increase the range of motion to complete in next two weeks with touch toe weight bearing. From 6th to 12th weeks weight bearing was gradually increased to full weight bearing with walker. Patient was then asked to use stick for a month before eventually walking aid free at around 4th or 5th month.

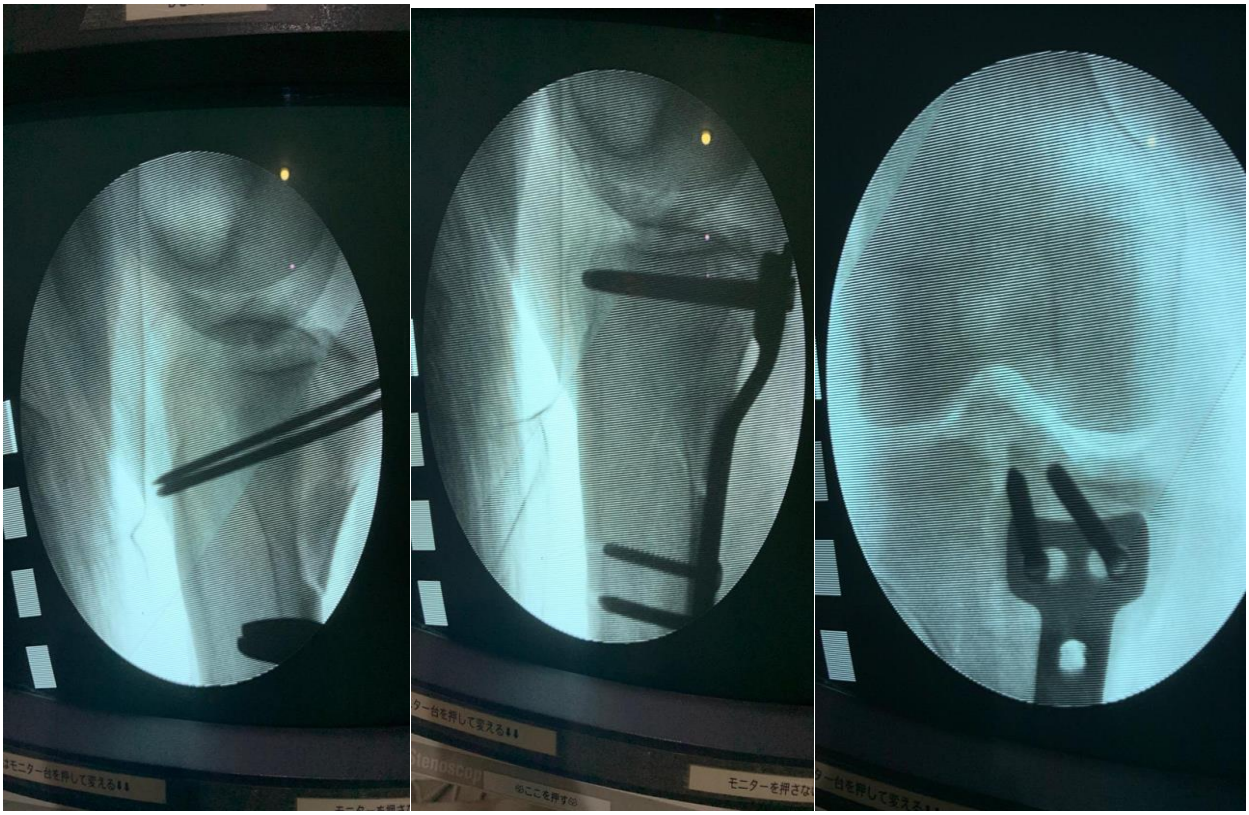

Fig. IIIA, IIIB,IIIC: Temporary fixation with k wires and then conversion to a buttress T locking plate and images taken under C-arm.

Patients follow up was done every 2nd week for one month and then monthly for one year. Patients were evaluated radiologically for union, and loss of reduction and clinically for range of motion, weight bearing, pain or any complication. Arthritic changes were assessed with Kellgren-Lawrence system.[12]

We analyzed our data with SPSS version 22. Frequency and percentages were calculated for side of fracture, aetiology of fracture and type of plating. Mean and standard deviation was calculated for age of the patient and time of union. Chi square test was applied to compare the outcome of important variables like single versus dual plating and *P* value < 0.05 was considered significant.

RESULTS

A total of 15 patients with mean age 36.73± 10.9 years(range 18 to 56 years) were included in our study. All patients were male. Right tibia was fractured in 9(60%) patients and left in 6(40%) patients. Road traffic accidents were the cause of fractures in 11(73.3%) patients and fall from height in 4(26.6%).Posteromedial and bicondylar fracture was present in 12(80%) patients and were treated with dual plating patients while 3(20%) patients had isolated posteromedial fractures and were fixed with a single plate. Immediate post operative radiographs revealed anatomical reduction in 12(80%) and non anatomical reduction in 03(20%) patients(*P* >0.05). No per operative or immediate post operative complication was noted. Average union time was 14.3±4 weeks(range 12.5 to 19 weeks) Evaluation at final follow up at one year revealed that all the cases

achieved union clinically and radiologically. Full range of motion(0 to 140 degrees) and ability to squat was noted in 11(73.3%) patients while 3(20%) patients had range of motion 0 to 120 degrees and 1(6.6%) had extension lag of 5 degrees. No significant difference was found in between the single plating or dual plating in terms of range of motion or radiological union(P >0.05). No intraoperative or immediate post operative complication related to surgical exposure like nerve palsy, skin breakdown and infection was noted in our series. No secondary loss of reduction or alignment was noted. Grade II osteoarthritis was noted in 2(13.3%) patients at one year follow up(P >0.05).

DISCUSSION

With Lobenhoffer approach proximal tibia fracture is reduced anatomically and is buttressed with a very stable construct which allows early post operative range of motion.[13-15] Furthermore the chances of loss of reduction and the fractured fragment tilting into varus and causing malunion is minimized.[7] With conventional technique of dual plating it is difficult to provide stable buttressing to such fragments.[4,7,16]

Some surgeons approach the posteromedial column with the patient in prone position which not only poses difficulty with anesthesia but also makes re painting and re draping of the patient mandatory as the breach of sterilization is inevitable. This adds to the operative time and to chances of infection. In our technique we used to positioned the patient in lateral decubitus[17] position and tilting into lazy prone position. This position not only provided good access posteriorly but the patients position can be changed to supine easily without sterilization breach and waste of time to address the anterior columns in the same setting.[18]

Zeng[19] compared various mode of fixation for postero medial fragment like lateral locking plate, anteromedial plating, anterio posterior lag screw fixation and postero medial plating and noted that posterio medial buttress plating was biomechanically more stable than others. Lobenhoffer P,[20] the pioneer of posteromedial approach treated 26 patients of proximal tibia fractures and at 4 years follow up noted that 21(80.7%) patients healed without any complication and the Rasmussen functional outcome score was excellent in 12(57.1%) patients, good in 8(38%) and fair in 1(4.7%) patients. The radiological outcome was excellent in 7(33.3%), good in 13(61.9%) and fair in 1(4.7%) patient. Revision surgery was need in 5(10.2%)patients including corrective osteotomy for valgus deformity in3 (60%) patients and revision endoprosthesis in 2(40%)elderly patients.

In our study majority(73.3%,n=11) of patients had achieved full range of motion(0 to 140 degrees) with ability to squat as before. Only 3(20%) patients had range of motion 0 to 120 degrees and 1(6.6%) had an extension lag of 5 degrees. Similar to our study Chandele and Bhalotia[21] treated 32 patients with Lobenhoffer approach and documented excellent score in 29(90.6%) and good in 3(9.3%) patients as per Oxford Knee Score. Knee range of motion of more than 130 degrees was noted in 29(90.6%) and 110 to 130 degrees in 3(9.3%) patients. Post operative loss of reduction was noted in only 1(3.1%) patient. Contrary to Chandele we did not observe loss of fracture reduction in any patient. Arjona-Gimenez and colleagues[22] treated 14 patients of posteromedial tibia fracture with Lobenhoffer surgical approach. They evaluated their results as per Knee Society System Score and noted excellent to good functional results in 8(57.1%), fair in 3(21.4%) and poor in 3(21.4%) patients at the end of two years. They concluded that Lobenhoffer approach was an easy approach with minimum complications.

Our study had few limitations. Our sample size was small perhaps because of our strict inclusion criteria and rarity of the fracture. Our follow up was short. For simplicity and ease the post operative functional outcome was evaluated with knee range of motion and radiographic accuracy of reduction rather than grading through a fixed criteria. Radiographs rather than CT scan was utilized post operatively for confirmation of fracture reduction. We therefore recommend further comparative studies on Lobenhoffer approach to address all such limitations so that our results are further verified.

CONCLUSION

Accurate anatomical reduction and excellent functional outcome can be achieved by fixing posteromedial tibial fractures through Lobenhoffer approach in lateral decubitus position.It is a safe approach and has no major per operative or post operative complications. We recommend this approach for all proximal tibial fractures with posteromedial fragment.

Conflict of Interest: None

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