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A study on functional outcome of communited tibial plateau fractures treated by modified frosch lobenhoffer approach

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Abstract
Background: When dealing with complex tibial plateau fractures, trauma surgeons face a significant challenge. Good articular reduction preserves congruity by lowering long-term complications. It has the potential to prevent or postpone the onset of post-traumatic osteoarthritis. It is well known that achieving the best possible articular congruity after a tibial plateau (TP) fracture is associated with long-term functional outcomes. Reduction in complex tibial plateau fractures is difficult, especially in the posterior segments of the lateral TP; impaired visualisation of this part of the articular surface through standard surgical approaches is the most important risk factor for mal reduction.
Objectives: To study the functional outcome of complex tibial plateau fracture with different surgical approaches for proximal tibial plateau fractures.
Design: A prospective study.
Study site: At SVRRGG hospital Tirupati.
Methods: This is a prospective study carried out in Department of orthopedics, S.V.R.R.G.G. Hospital, Sri Venkateswara Medical College, Tirupati. All patients with tibial plateau fracture which are admitted into hospital were evaluated. Cases satisfying inclusion and exclusion criteria were included into study. tibial plateau fractures were treated surgically by (using Locking Compression Plate, Buttress plates) via modified Frosch, Loben Hoffer approaches at our institution. The patients were evaluated clinically and radiologically for outcomes. Knee society score was used for evaluation at 3, 6 and 12 months respectively. All patients were followed up for an average of 12 months.
Observation and Results: Average age of patient in our study was 34.6 years. There were 15 male and 9 female patients. 15 patients had fracture on right side while 9 patients had it on left. There were 20, 4 patients with schatzker type 5 and 6 respectively. We used Frosch approach in 8 patients while remaining had Loben Hoffer approach. Knee Society score was 65, 76 and 89 at 3, 6, and 12 months respectively.
Conclusion: We recommend Frosch and Galla Loben-Hoffer approaches for proper reduction, fixation, and better functional outcome of posterior proximal tibial fractures.

Keywords: Frosch approach, Galla Loben Hoffer approaches, proximal tibial plateau fracture

Introduction

Proximal tibial plateau fractures that extend to the knee joint are difficult to treat. These fractures are difficult for trauma surgeons to treat, and proper restoration of knee articular surfaces requires a high level of expertise. Weight bearing requires the restoration of the articular surfaces of the proximal tibia in particular. Functional impairment can result from complex tibial plateau fractures. They cause problems with knee alignment, movement loss, and knee instability. In elderly patients, proximal tibial fracture accounts for about 1% of fractures. Lateral tibial condyle fractures (55–70%), isolated medial condyle fractures (10–23%), and bicondylar fractures (10–30%). Tibial plateau fractures have been extremely difficult for nearly 200 years, with numerous written experiences, publications, and books containing trials demonstrating various treatment modalities.

Severe injuries, such as type V and VI fractures, are more difficult to treat. Many treatment modalities, such as open reduction and internal fixation, percutaneous closed reduction, and external hybrid fixation, are advocated [1].

Tibial plateau fractures with compound injury were initially treated with external fixation for wound care. They are finally fixed later. This can lead to multiple procedures, increasing the financial, mental, and social stress on patients and their families. A single hybrid fixation could help with wound care as well as fracture union. In this view we wanted to start a study using Frosch and Loben Hoffer approaches for treating complex tibial fractures. We want to evaluate how these approaches wound result in fracture reduction, union and complications regarding.

Proximal tibial fractures with posteromedial split and fracture dislocations are uncommon in major traffic accidents involving high energy injuries. Because there is no description of a medial fracture pattern, whether posterior or associated with dislocation, these fracture patterns do not have classification in AO or schatzker. This is due to the fact that such fractures are the result of high energy trauma, which can result in severe soft tissue damage and fracture displacement! Tibial plateau fractures necessitate good articular reduction to avoid long-term complications. With the introduction of 3D CT scans, it is becoming easier to understand the fracture pattern and plan for reduction and plating. Posterior and medial fragment reduction necessitates more expertise. Furthermore, fragment reduction and stabilisation are difficult with commonly used techniques and approaches. The posteromedial fragment, in particular, displaces and destabilises with knee flexion [14]. For fixation and stability of the fragment, this particular fragment fixation requires a posteriorly oriented buttress plate. In the supine position of the patient, the conventionally described approaches are anterior, medial, and posteromedial. These approaches involve arthrotomy via the medial parapatellar approach, medial vastus dissection for implant placement via the medial approach, or both. With these conventional approaches, fragment reduction and implant placement are difficult. Posterior knee exposure necessitates a wide dissection with disruption of the medial and lateral head of the gastrocnemius, the posterior capsule, and soft tissue [9]. However, the reduction of posterior tibial fractures remains controversial. The posterior approach, which was technically more difficult and involved neurovascular bundle dissection, was described in 1960 [15, 16]. Galla and Lobenhoffer described a direct posteromedial approach for treating these types of fractures [16]. This approach provides an excellent view of the fracture fragments, no dissection of the neurovascular bundle, minimal soft tissue dissection, and good hardware placement. This method necessitates a supine position. Furthermore, with axial traction and hyperextension, this supine position aids in fracture reductions for posterior fracture reduction, the Frosch and Lobenhoffer approaches were proposed. The disadvantages of these approaches include a large skin incision, difficulty in exposure, and damage to the posterolateral articular surface of the tibia, which may necessitate fibular head osteotomy.

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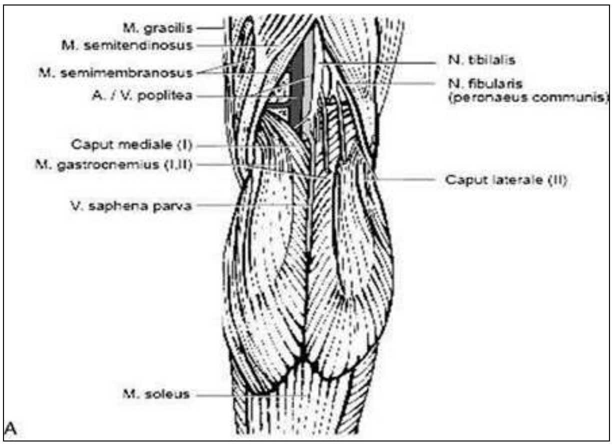
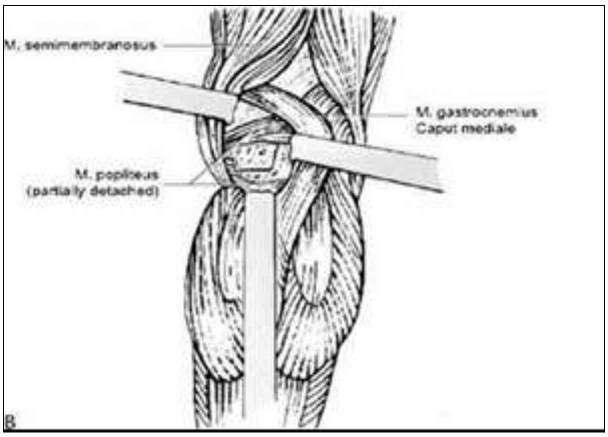
Surgical Approaches Galla and Lobenhoffer Approach Patient is positioned in prone on fracture table. The lower limb is exsanguinated and upper thigh tourniquet is applied. The medial border of popliteal fossa, medial head of gastrocnemius and hamstrings are palpated. A 68 cm long straight skin incision is given with starting at straight border of gastrocnemius and ends at level of medial joint line. It is made sure that incision should not cross the popliteal fossa. With sharp dissection, skin, subcutaneous tissue and popliteal fascia are Incised. Small saphenous vein Is Identified In the sulcus between two gastrocnemius heads. Medial sural cutaneous nerve, a branch of tibial nerve in popliteal fossa identified. This nerve is to be carefully identified and tagged. Our dissection is at medial border of medial gastrocnemius head. There is no inter nervous plane of dissection here. Through blunt dissection of medial gastrocnemius head, the muscle is laterally retracted with retractor. Careful placement of retractors is required to prevent injuries to neurovascular structures through shear forces. Semimembranosus complex is separated by blunt dissection without any detachment of insertion on posteromedial tibial head and retracted medially with retractor. Popliteus muscle upper border identified, detached subperiosteally. This detachment is done till posteromedial wedge fracture of proximal tibia is seen clearly during fixation. Sub periosteal detachment and incision of semimembranosus on medial side is carried in case of require for further exposure of fracture. Similarly, soleus elevation from its attachment from fibula and tibia posteriorly and inferiorly is carried out in hardware placement. With this exposure, axial traction and hyperextension of knee, fracture fragments can be reduced with restored anatomy. Once fracture fragments are reduced, they can be held in that position with periosteal elevator or ball spike. After that they are fixed with K wire. Reduction of fragments is assessed by C arm in antero-posterior and lateral views. Thereafter they are fixed definitively with T buttress plates and screws. At least 2 to 3 holes are placed distally fracture fragments. Once the fixation is done and assessed by C -arm we proceed for closure of wound. Hardware is readily covered by soft tissue once retractors are removed from their positions. Deep drain is placed subfascially. Popliteal fascia covered by single sutures. Subcutaneous and skin tissues are closed in layers respectively. This procedure allows early postoperative mobilisation, and continuous passive range of movements in the knee joint. Partial weight bearing walking is advised for a period of 8-10 weeks. At times this procedure can be done in supine position in patients with chest trauma etc., and in patients undergoing multiple procedures at the same time. For this it is required to have sand bag on contralateral hip for external rotation of affected leg. Surgeon needs to approach the surgical site from opposite limb side. But this is technically more demanding. It was found that by using external spanning fixator as temporary measure in chest trauma and management of other comorbidities, will have time for soft tissue healing. There after it can be operated once the patient have recovered from the polytrauma. Limitations include prone position of patient, requirement of additional lateral incision for management of bicondylar fractures.

Picture 1: Delineation of medial and lateral head of gastrocnemius. Popliteal fossa border. It also shows incision position medial to medial head of gastrocnemius. (Picture taken from J Orthop Trauma) [15]

Picture 2: Showing 5- 6 cm incision showing exposed skin and subcutaneous fascia (picture taken from J Orthop Trauma) [15]



Picture 3: Showing Anatomy of popliteal fossa, with surrounding muscles, vasculature, and nerves. (Picture taken from J Orthop Trauma) [15]



Picture 4: showing described direct posterior approach By Lobenhoffer and Galla. (Picture taken from J Orthop Trauma) [15]

Picture 5: Showing Galla and Lobenhoffer approach showing anti-glide plate fixatin with screws. Picture also shows appropriate reduction of fracture fragments. (Picture taken from J Orthop Trauma) [15]

Frosch approach

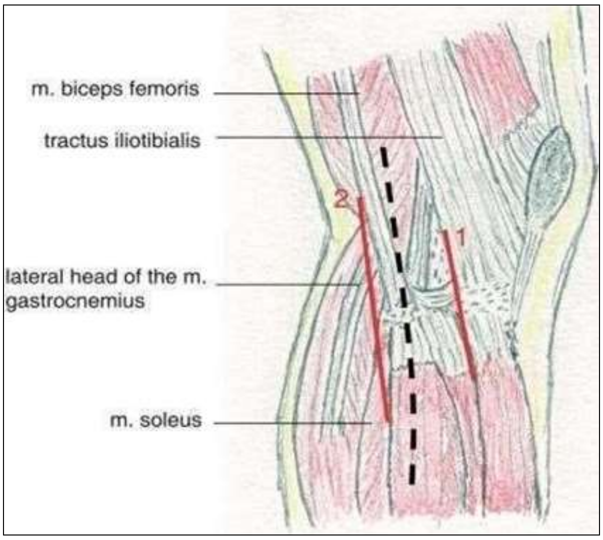
For posterolateral approach patient positioned lateral. Here knee is supported by a thick, rolled pillow. In this position leg weight causes varus stress, resulting in opening of joint gap laterally. Lateral and posterolateral fracture partial reduction occurs here without any further traction.

Anatomical landmarks of proximal fibula and joint line on lateral aspect of knee marked. An incision of 15cm long is given on posterolateral aspect of knee. The incision should start 3 cm above joint line and proceed downwards along the fibula distally. This incision should not be directed to anteriorly to avoid the scar contractions. Standard arthrotomy was performed on direct lateral aspect of knee. Through the same plane iliotibial tract is incised on dorsal side, with detachment of its fibers on Gerdy's tubercle. Lateral capsular incision is given and meniscus over tibia is dissected at about 2mm away from its insertion on tibia and parallel to joint surface. This gives proper view of lateral tibial plateau, poster lateral corner. Proper fracture and fragments can be seen through this approach. Reduction of fracture fragments through this approach is difficult due to strong fibular and tibial ligaments, other tendinous structures here. Posterolateral exposure of fragments is necessary. Using the same skin incision we can create another window. Through the incision on fascia, peroneal nerve is exposed on the rear edge of biceps femoris and tagged. Now the blunt dissection is carried out in popliteal fossa between lateral head of gastrocnemius and soleus. After careful dissection we find artery, vein and popliteus are exposed. These structures are protected under lateral head of gastrocnemius using Langenbeck retractor. With Langenbeck hook popliteus muscle is pulled medially and cranially. Soleus muscle is carefully detached from fibular head downwards carefully till peroneal nerve. This muscle is mobilized approximately 4-5 cm distally.

This given good L shaped area at dorsal side of lateral tibial plateau.

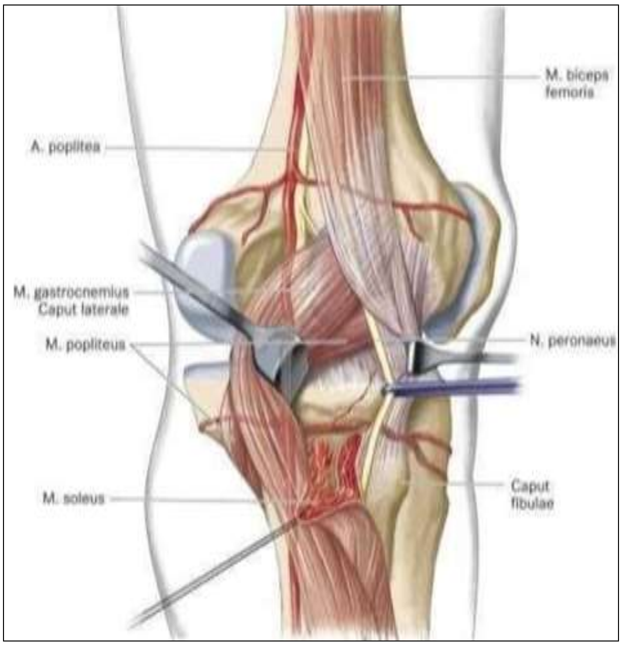
Fracture fragments exposed can be view. Impacted, depressed articular fracture fragments can be mobilized laterally, elevated through cortical window. These fractures are temporarily held with K wires. Under c arm guidance, fracture reduction checked and T or L plate can be applied.[16]

Picture showing anatomy of lateral and posterior and lateral region of knee. Dotted line represents skin incision. 1. Lateral standard arthrotomy 2. Blunt dissection of the popliteal fossa between soleus and gastrocnemius lateral head 16.



Picture 6: Picture showing anatomical planes and visibility of posterolateral corners of tibia.

Tagged peroneal nerve, Biceps medially. Popliteus muscle retracted cranially. Medial border of Gastrocnemius lateral head laterally. Soleus head detached from fibula. Posterior lateral aspect of tibia seen clearly on the floor.



Picture 7: Picture showing lateral popliteal dissection

Picture 8: Picture showing exposed posterior-lateral view of proximal tibia and L plate insertion.[16]

With the introduction of Computerized Tomography and 3D imaging, the understanding of proximal tibial plateau fractures in terms of comminution and pattern has improved. This has also aided in the architecture and topography of the proximal tibial fracture. MRI provides a complete picture of the soft tissue damage around the fracture. (21)

According to Audige *et al*., are that a classification should help us in not only to understand, but to communicate and also influence in decision making regarding management of particular fracture.

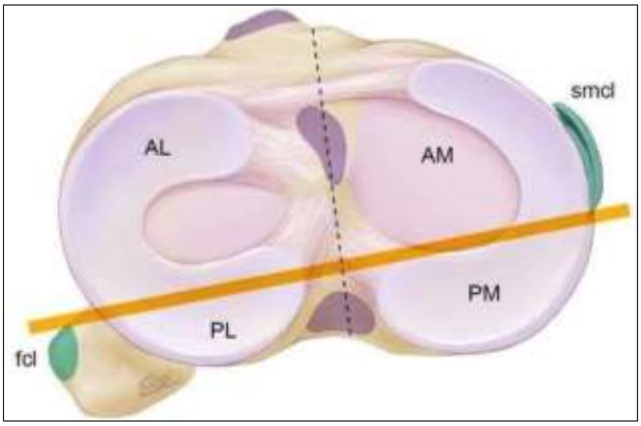
Validation of specific fractures necessitates measurement of quality parameters in terms of relevant clinical diagnostic elements, reliability, and accuracy. Accuracy refers to how many cases in a real-world scenario are similar to proposed classification models, while reliability demonstrates consistency, on repetition, and decreased variation on intra and interobserver usage.

With the use of three-dimensional imaging, the Schatzker classification was revised. We already know that the tibial plateau has two columns: medial and lateral. The tibial plateau was divided into anterior and posterior compartments to form a virtual anatomic equator. This equator has two anatomical reference points: 1) the lateral collateral ligament attachment on the fibula's lateral tubercle and 2) a point on the tibial plateau posterior to the superficial medial collateral ligament. The second point is posterior to the tibial crest. The previously proposed six classification patterns continue to exist. Modifiers were added to all fracture patterns. The letters "A" and "P" stand for anterior and posterior quadrants, respectively, to denote the quadrants located anteriorly and posteriorly.

Fracture line running in axial plane is determining from to anterior to anterior as a/a, posterior to posterior as p/p or anterior to posterior as a/p Fracture apex in metaphyseal plane as x. if fracture apex is anterior ax and posterior as px[4]

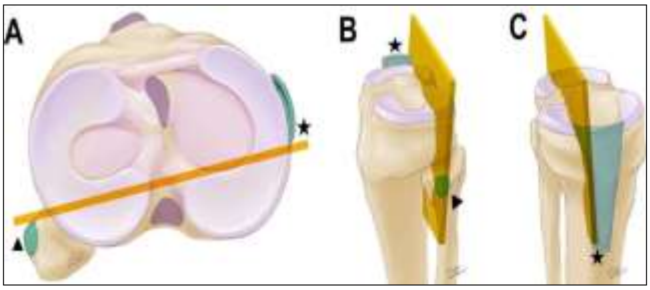
For example a/a/ax represents anterior wedge with fracture line running anteriorly (a to a) with apex anteriorly represented by ax

With arrival and modification of Schatzkers fracture classification, it necessitated proper reduction of posteromedial and lateral articular wedge fractures with Galla Loben hoffer and Frosch approaches.

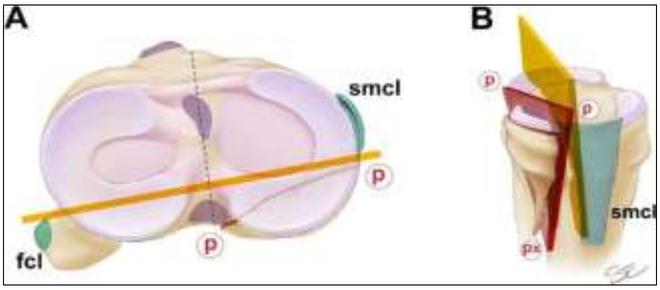


Picture 9: Picture shows tibial plateau divided into four compartments[4] AL represents anterolateral AM represents anteromedial PL represents posterolateral PM represents posteromedial

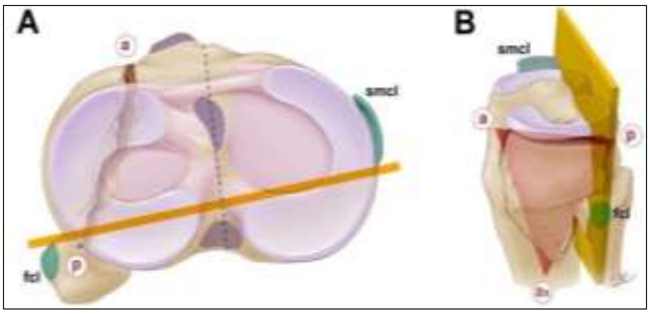
Dotted line represents division into medial and lateral compartments
Yellow line presents division into anterior and posterior compartments
FCL – attachment of fibular collateral ligaments
SMCL – attachment of superficial medial collateral ligament



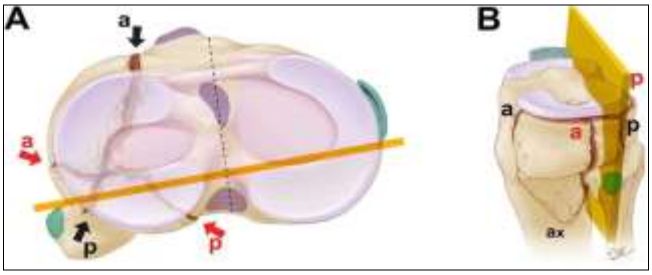
Picture 10: Picture showing three dimensional representation of virtual equator[4]



Picture 11: Picture showing Type IV Schatzker fracture, posterior compartment -P‖, fracture line extending from posterior-p‖ to posterior-p‖ in axial view, px representing exit of fracture at metaphyseal area-px‖[4] Classification Type IV schatzker P p/p/px



Picture 12: Picture showing Schatzker type I fracture showing involvement in anterior and posterior compartments A+P with fracture line running from anterior to posterior (a/p) with fracture apex anterior over metaphysis (ax) hence Schatzker type I A+B (a//p/ax)



Picture 13: Picture showing comminuted fracture of proximal tibia Fracture pattern is Schatzker Type II involving both anterior -A‖ and posterior -P‖ compartments Schatzker type II A+B

Two wedges presenting fracture lines extending anterior to posterior with two wedges a/p/px(posterior wedge) and a/p/ax (anterior wedge) [4]

Clinical evaluation

A patient with a fracture around the knee is likely to experience shock as a result of blood loss into the thigh muscles or into the joint.

Swelling of the proximal leg, hemarthrosis, deformity, and tenderness will occur locally. The presence of abnormal mobility and limb shortening will round out the clinical picture.

Distal pulsation in the dorsalis pedis and posterior tibial arteries must be examined, and tibial and peroneal nerve injury, as well as compartment syndrome, must be ruled out.

To develop an optimal treatment plan for each tibial plateau fracture, the extent of soft tissue and bone injury must be precisely determined. A thorough physical examination and imaging study of the injured knee are required to obtain this information. Swollen and painful knee, unable to bear full weight on the affected extremity. A history of valgus injuries, such as bumper injuries to the knee, football or soccer injuries, or a fall from a height, allows the surgeon to determine whether the injury is caused by high or low energy forces. Only high energy forces cause fracture blisters, compartment syndrome, ligamentous disruption, and neurovascular injuries. The disassociation of the medial condyle and the bicondylar metaphyseal shaft is all consistent with a high energy mechanism. On examination, the knee had limited active and passive motion.

The knee is carefully examined for skin conditions, swelling, and deformity, as well as abrasions and open wounds, because their presence influences the timing and type of definitive treatment that can be used. The knee is frequently swollen and tender. Tenderness is typically found adjacent to the fracture or overlying the site of ligament injury. The alignment of the knees is compared to the normal side. Valgus deformity is the most common, but depending on the fracture configuration, varus deformity, recurvatum, or procurvatum can occur.

The arterial circulation to the lower leg and foot must be assessed early on by palpating arterial pulses around the ankle and foot. Compartment syndrome is uncommon, but it occurs frequently enough that it should be considered, particularly in more complicated fractures.

Similarly Prior to treatment, peroneal nerve function should be tested and documented by noting the patient's ability to feel sensation on the dorsum of the foot and to extend the foot and toes, as this may influence the treatment outcome in these difficult fractures. Deep contusions, hemorrhagic blisters, and the absence of skin wrinkles all indicate internal degloving injury, which precludes the use of extensive incision for emergent formal internal fixation. In this case, consider temporary measures such as spanning external fixation to allow soft tissue to heal before undergoing internal fixation. If there are open wounds, their relationship to the fracture site and knee joint must be determined.

Except for those with bicondylar fractures or tibia or femoral fractures, every injured knee should be evaluated for knee stability. It is often possible to test the stability of the knee shortly after the fracture by applying valgus and varus stresses to the knee without sedation or anaesthesia. The stability of the uninjured knee should be tested first to provide a standard against which the stability of the injured knee can be judged.

The technique is to slowly apply valgus and then varus forces, first in extension and then in a few degrees of flexion, noting the angular deviation and end point in comparison to the normal knee, because instability may persist unless it is corrected. This test is useful for predicting the need for surgical reduction.

Materials and Methods

This is a prospective study carried out in Department of Orthopedics, Sri Venkateswara Medical College, Sri Venkateswara Ram Narayan Ruia Government General Hospital, Tirupati from August, 2020 to August, 2022.

Patients were selected after satisfying inclusion and exclusion criteria. Patients selected were admitted into hospital. These patients were evaluated radiologically and fracture classification was done appropriately. Later with obtained consent, they were posted for open reduction and internal fixation of tibial plateau fractures. Proper postoperative protocol was followed. Patients were followed for a period of 12 months. They were evaluated with Knee society score at periodic intervals of 1st, 3rd and 6th months respectively.

Inclusion criteria

1. Patients with tibial plateau fractures
2. Patients with ages above 18 years
3. Schatzkar's type V and VI fractures
4. Patients who gave consent for surgery

Exclusion criteria

1. Patient below and above the ages
2. Patients not willing for surgery
3. Patients with complications like thrombo-embolic, CVA and uncontrolled hypertension, peripheral vascular disease.
4. Patient with impending compartment syndrome
5. Patient with severe uncontrolled hypertension
6. Patients with knee dislocation and peripheral vascular deficits

Pre-Operative procedures

Patients who were admitted were constantly monitored for distal neurovascular all the time pre and post-operatively during the stay in the hospital. They were also monitored for features of compartment syndromes at the same time. Once admitted into the hospital, they were evaluated for general investigations like complete hemogram, renal and liver function tests, clotting factors. They were evaluated with X-ray and CT scans of tibial plateau fractures for further classification.

They were evaluated with cardiology work-up, Pre-anesthesia evaluation before posting for surgery. Adequate whole blood and blood components were arranged pre-operatively.

Patients were informed regarding procedure, pre, per and post-operative complications of procedure, requirement of procedure, and further benefits of surgery. Their consent for surgery was taken a day before procedure. They were kept nil orally 6 hours prior to surgery. Parts were prepared accordingly a day prior to surgery.

Per-Operative procedure

Patients were given spinal and epidural anesthesia. Patients were positioned prone position or lateral position based on approach used. Lower limb pneumatic tourniquet was applied. Adequate pre surgical cleaning or surgical site done. Adequate draping of surgical site. Implant inventory was prepared and kept before surgery. Approach was taken based upon of lateral or medial posterior wedge.

Fracture reduction was done and fixed accordingly with proper implant.

Adequate debridement, hemostasis achieved and wound closure done.

Post operatively wound care was carried out at regular intervals. The patients were started with active Knee range of movements, active Quadriceps, and hamstrings exercises. They were also asked to perform ankle pump exercises. At times we also used continuous passive motion to improve range of motion in knee post-operatively. Patient was mobilized with walker support. This is absolute non weight bearing walk in hospital and home for a period of 4 weeks.

We started functional knee exercises by end of 4 weeks. Partial weight bearing walk from 6 the week of surgery. We started full weight bearing walk at the end of 3 months once we find radiological signs of union in X ray. Post-operative assessment of fracture union status, knee society score was measured at 3, 6 and 12 months. Radiological assessment of union of fracture was carried out at regular intervals.

Observation and Results

This is prospective study started in S.V.R.R.G.G. Hospital. All the patients satisfying inclusion and exclusion criteria were included in the study. The study was for a period of 2 years.

Here are my observations

Average age of patients is 34.9 years (range from 20 -65 years). Average age of female patients is 36.1 years (20-65 years) and 34.2 years (22-53 years) for male patients.

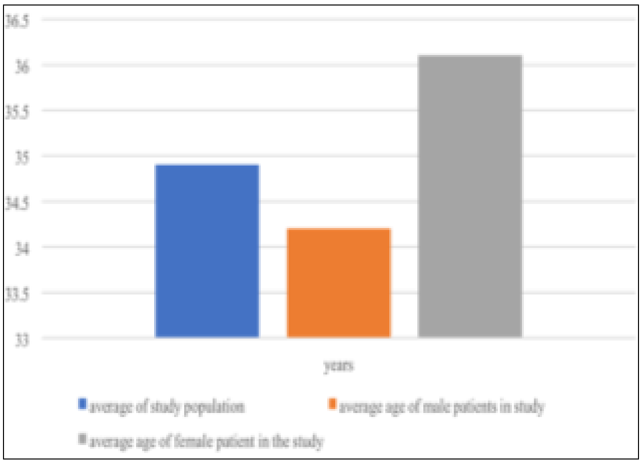


Fig 1: Average age of patients in study in years

Figure showing Column chart with average age, male and female average age in the study population.
There are 9 female patients and 15 male patients in the study
Figure showing pie chart distribution of male and female patients in the study

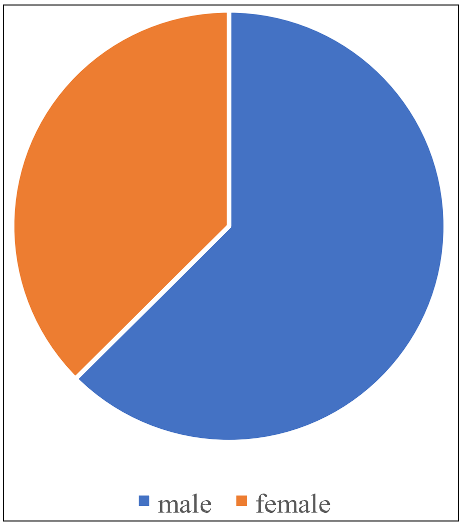


Fig 2: No. of patients

There are 9 patients with left side proximal tibia fracture and 15 patients on right side
Figure showing piechart with no patient on left side and right side in the study

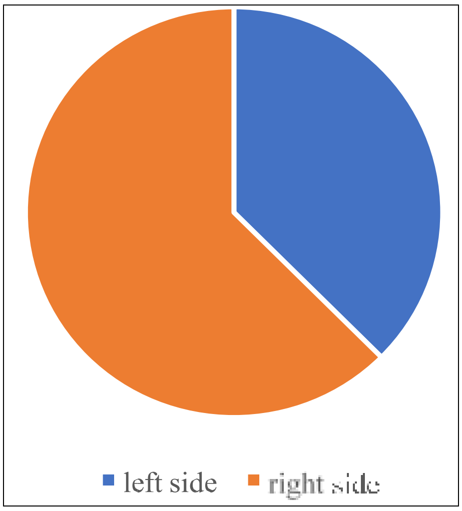


Fig 3: Side of fracture

There are 20 patients with Schatzker type 5 and 4 patients with type 6 fracture pattern.

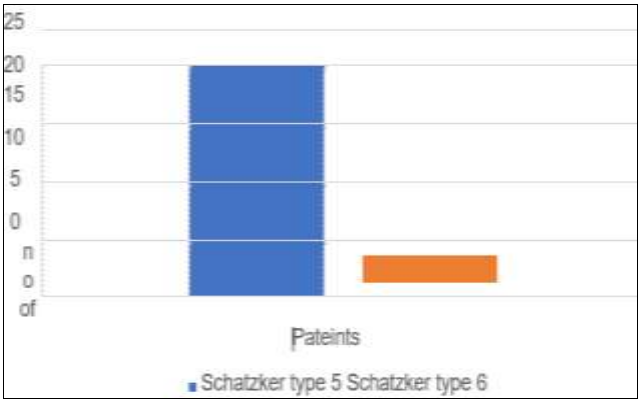


Fig 4: Columns showing no patients with schatzker type 5 and type 6 tractures

We have performed 8 patients with Frosch and 16 patients with Galla Loben hoffer approaches

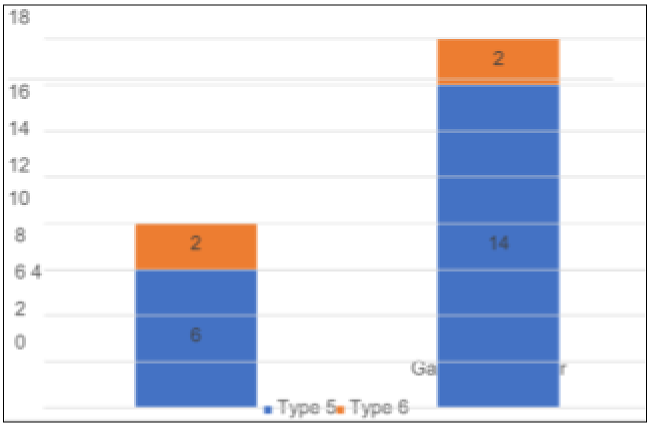


Fig 5: Column chart showing no of patients with frosch and galla lobenhoffer in type 5 and type 6

Patients were evaluated with Knee Society Score during 3months, 6months and 12 months after the procedure

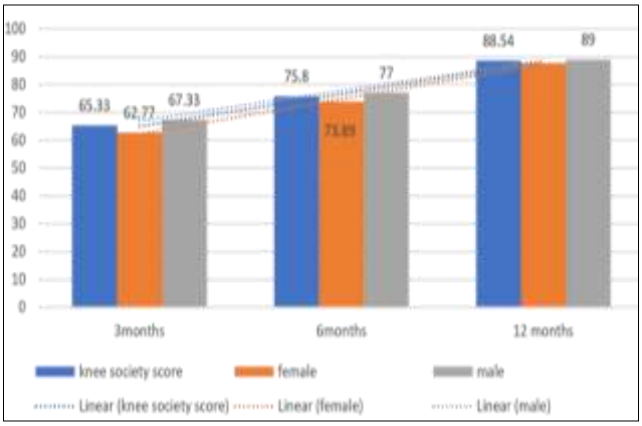


Fig 6: Knee society score at various intervals 3, 6 months post-operatively respectively

Discussion

Knee is a weight bearing joint. Any fracture around knee was previously managed by plaster cast application. A long leg knee cast applied will result in long-term immobilization. This can result in disuse atrophy of muscle, subcutaneous tissue, patchy osteoporosis. Joint on long term becomes stiff due to capsular adhesions and later contractions. There can also be thrombophlebitis, muscle and tendon tears heal with scar tissues and contractions. In 1974, Schatzker proposed classification for proximal tibial fractures and management [18]. There was recent proposal of modification for this classification which is based on presence of wedge anteriorly and posteriorly, definition of fracture fragments clearly. This has resulted in proper management of fractures with clearly defined approaches.

Management of these fractures is complex. The worst part of tibial plateau fractures is that until unless you understand the pattern and type of fracture, we cannot plan for better management. There are many classifications proposed in literature, but to the date Schatzker classification remains time tested for planning the management of fractures. It was proposed by schatzker in 1974, as two dimensional model which was guide for planning and management for a period of 45 years [7]. with the advent of CT and MRI there was better understanding of proximal tibial fractures. Previously proposed classification required a modification. Hence in 2018 Schatzker classification was modified, addressing the wedge pattern fragment present in medial and lateral aspect of proximal tibial fractures. These fractures being intra-articular, posterior require good surgical approach for proper vision of fragments, good reduction of fragments. We have two approaches proposed for reduction of fracture fragments, Frosch and Galla Lobenhoffer.

Frosch approach is posterior lateral approach. This approach considerably decreased soft tissue trauma during the procedure of fixation of fracture fragments. This approach also provides good view of posterior lateral fracture fragments and made intra-articular anatomical reduction easy. Through the described approach we can prevent fibular osteotomy, damage to tibiofibular joint and nerve injuries. At times there can be neuropraxia due to manipulation of peroneal nerve injury. This approach requires precise anatomical knowledge.

Loben hoffer approach is posterior medial approach. This approach gives excellent visualization of posteromedial fragments, decreases soft tissue injury, fracture fragment reduction under direct vision. Once reduction of fracture is done, it is initially stabilized with K wires, further plate and screw fixation was carried out. Further through this approach there is no injury to neurovascular bundle. Sub periosteal elevation of popliteus is done. Wound closure here is done without any tension. Wound healing is also good [14].

Both the approach prevented medial parapatellar arthrotomy for reduction of fracture fragments, damage to medial and lateral collateral ligaments. Classical arthrotomy which was carried out with tibial tubercle osteotomy was also prevented through these approaches. These approaches also prevented detachment of gastrocnemius, hamstrings from their anatomical attachments during the surgery, further preventing soft tissue damage [14]. Our sample size is 24. In a study by K C Lin *et al*., they has sixteen patients of which ten male and 6 female patients. Hong wei chen *et al*., study also has 32 patients included. They had nineteen men and thirteen women patients. The sample size in some studies is small like seven in some studies like Karl Heinz Frosch study [16]. We had nine, fifteen female and male patients respectively operated and included in our study. Average age of patients in our study was 34.9 years ($\pm$ 10 years). It was 41.5 years ($\pm$ 14.3 years) and 38.1 years respectively in other studies

The average follow up of our study was 12 months which is much less than 34, 18 and 24 months in other studies. (25, 28, 29) All the patients included in our study had proximal tibia fracture due to Road Traffic Accident. We included type V and Type VI schatzker fractures in our study. We had four cases of TypeVI and remaining Type V fractures. We had eight patients operated with Frosch and sixteen patients operated with Galla Lobenhoffer approach in our study.

There are eight patients operated on right side and sixteen patients operated on left side.

Post-operative fixation was found to better because of both the approaches in our study. Both the approaches allowed us with proper reduction and implantation appropriately. There was good reduction achieved in our study. In Chen *et al*., study they have achieved satisfactory anatomical articular fragment reduction with posterolateral approach with fibular osteotomy. Their study also had excellent results in terms of knee functions. They also had good recovery function without any complications. In Lin *et al*., study they had ten patients with good anatomical reduction, followed by 6 patients with acceptable reduction. They also had no posttraumatic osteoarthritis during their follow up period of 18 months.

In our study we did not face any complications like neuropraxia, or nerve injury. To the extent of study we had no post traumatic osteoarthritis seen in our patients.

All the patients in our study had union achieved by end of 6-8 months. They were back on carrying their activities of daily living with in a period of 6 weeks. This is was similar in K C Lin *et al*., study.

We have been monitoring knee functional outcome through Knee Society Score which constant showed improvement measured at various intervals 3, 6 and 12 months respectively. This score which was 65.63 (±3.90) initially at the end of 3 months, progressed and improved to 85.54 (±5.67) by 12 months. Patients weight bearing capacity improved. Patients were able to perform daily activities of living during initial 3 months. There after their mobility improved further. Most of our patients were daily labourer by occupation. By the end of 12 months, they are able to continue their initial activities of earning before trauma. There was a small percentage of patients who had to change their occupation because of residual mild pain.

Conclusion

We conclude our study saying that frosch and galla loben hoffer approach are better approaches for fixation of posterior medial and lateral fragments. This anatomical reduction of articular fragments in proximal tibia are must and essential to provide good functional outcome, thereby preventing the early onset of posttraumatic osteoarthritis

Conflict of Interest

Not available

Financial Support

Not available

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