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POSTERO-MEDIAL APPROACH: A SAFE APPROACH TO POSTERIOR CRUCIATE LIGAMENT AVULSION FRACTURE

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Abstract

Introduction: The posterior cruciate ligament plays a major role in knee stabilization. Clinically isolated tear or avulsion of the PCL can be caused by a fall on a flexed knee or striking the flexed tibia on the dashboard in a motor vehicle accident. Postero-medial (burks and schaffer) approach is a simpler, less invasive approach to fix PCL avulsion fracture that better preserves muscular elements.

Materials and Method: 20 patients with acute isolated PCL avulsion fracture of the tibial attachment are treated surgically by fixation with cannulated cancellous screws through posteromedial approach at tertiary care teaching hospital of Southern Rajasthan. Preoperative MRI was performed to rule out other concomitant intra-articular ligamentous and meniscal lesions. Patients were assessed for intra and post-operative for stability and complications also clinically by using knee society score and radiographically with x-ray at post-operative day 1, 2 weeks, 3 months, 6 months.

Results: Out of 20 patients, 18 were men and 2 were women. According to knee society score 14 patients showed excellent and 6 patients showed good functional outcome. Postoperative radiographs showed all PCL avulsed fragment fixation were maintained and consecutive radiographs showed fracture healing in all cases by the end of 3 months. Posterior drawer

and reversed pivot shift signs were negative in all patients. And from all none was having neurovascular complications.

Conclusion: The treatment of PCL avulsion fracture with placement of an appropriately sized lag screw through the “safe postero-medial approach” results in good clinical and radiographic outcomes.

Keywords: PCL, Avulsion fracture, Posteromedial approach (Burks and Schaffer)

Introduction:

PCL is an important ligamentous structure in knee joint as it is one of the major knee stabilizers which acts by limiting the posterior tibial translation¹. Clinical studies have shown increasing incidence of isolated PCL injury^{2,3}.

PCL originates from lateral border of the medial femoral condyle and inserts on the posterior intercondylar fossa 1.0 cm below the joint line on the tibia. It has two bundles, anterolateral and posteromedial bundles, that help the PCL act as a primary restraint to posterior tibial translation and a secondary restraint to varus, valgus, and external rotation forces⁴. Specifically, the anterolateral bundle acts as a restraint to posterior tibial translation at midrange knee flexion while the posteromedial bundle acts as a restraint to posterior tibial translation during extension and hyperflexion⁵.

The most common mode of isolated PCL injuries is motor vehicle accidents and contact sports^{6,7} with peculiar mechanism of dashboard injury from direct trauma to tibia in anteroposterior direction with knee in flexion or in sports due to sudden excessive flexion of extended knee or fall on flexed knee⁸. Most commonly used approach for open reduction and internal fixation with cancellous screw is classic posterior approach, using the interval between the medial and lateral gastrocnemius heads so it also requires identification and protection of the popliteal neurovascular elements¹.

Minkoff also described limited posterior approach where curved posterolateral incision is given and plane is made between lateral head of gastrocnemius and soleus, here identification and retraction of common peroneal nerve is done⁹.

Modified open posterior approach

to fix PCL avulsion fracture is given by Nicandri¹⁰.

A safe posteromedial approach described by Burks and Schaffer used a curved posteromedial incision and interval between medial head of gastrocnemius and semimembranosus. Thick belly of gastrocnemius protects the neurovascular structure¹¹.

In this study we have discussed the technique and result of open reduction and cancellous screw fixation using safe Burks and Schaffer approach for isolated PCL avulsion fractures.

Materials And Method:

The study was carried out in the department of orthopaedics of a tertiary care teaching hospital of Southern Rajasthan. The study was commenced after obtaining approval from institutional research ethics committee. A total of 20 patients with PCL avulsion fracture who gave consent to participate with age >18 years were included in the study. Exclusion criteria were floating knee (both distal femur and proximal tibia fractured), open fractures, proximal tibia fractures and previous knee joint surgery.

The ligament avulsion fracture patients were clinically examined and diagnosis was confirmed radiologically. The patients were subjected to the Lachman test, and the anterior and posterior drawer test for integrity of cruciate ligaments. The collateral ligaments were assessed with varus and valgus stress in extension and in 30 degrees flexion. Magnetic resonance imaging (MRI) was carried out in patients prior to surgical intervention to look for associated bony, meniscal and capsule-ligamentous injuries which could have been missed at initial evaluation or in case of inconclusive

clinical examination findings. All the patients were examined again under anaesthesia in the operative room prior to surgical intervention.

Surgical technique:

Preoperative antibiotic (1.5 gm cefuroxime, intravenous) was administered in all the cases at the time of giving anaesthesia. The operative procedures were performed under spinal or general anaesthesia with tourniquet control. The patients were positioned in prone position. Skin incision was made over the posterior aspect of knee with the horizontal limb over the popliteal crease and vertical limb on the medial aspect of gastrocnemius (figure a).



Figure a - Skin incision

The deep fascia over the medial gastrocnemius was incised and interval between medial gastrocnemius and semimembranosus tendon was identified. The dissection was carried bluntly with finger until the posterior capsule of knee joint was reached. The medial gastrocnemius was retracted laterally, protecting the neurovascular structures. The posterior aspect of femoral condyles and proximal tibia could be palpated at this stage (figure b)

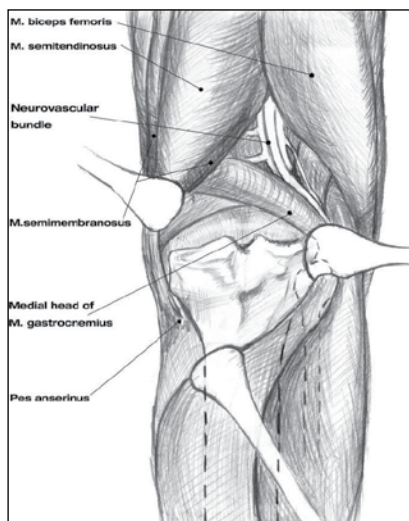


Figure b- Exposure of posterior aspect of proximal tibia after dissection

Avulsion fracture identified and the bony base of avulsion was debrided (figure c). The bony fragment was pushed down and secured with a kirschner's wire and positioning verified under fluoroscope.(figure d).

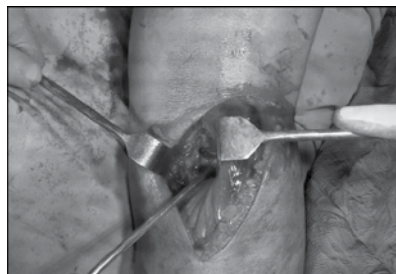


Figure c - Fracture fragment identification

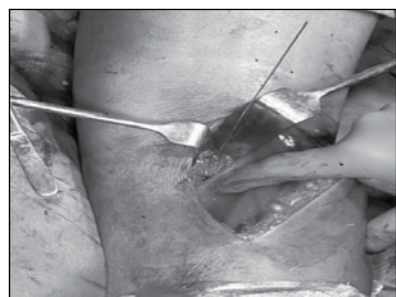


Figure d Fracture avulsion fixed with k wire temporarily

The bony fragment was then fixed with 4.5 mm partially threaded screws with washer. The position of bony fragment was again assessed under fluoroscope and if found adequate

the wound was washed, haemostasis achieved, closure done in layers with or without drain.

Postoperatively, the patients were advised to wear knee brace and range of motion exercises of the operated knee were started at 0 to 30 degrees from day one. The range of motion of the operated knee was advanced as per pain tolerability and considering other associated injuries. The patients were allowed to bear weight as tolerated with hinge knee brace (up to 30° flexion) depending upon the concomitant injuries and advised to remove the brace for range of motion exercises. The patients were followed up at two weeks, six weeks, three months, six months. Except at the first visit, in which only range of motion and suture removal was done, subsequent visits included thorough clinical and radiological assessment. Clinical examination included posterior drawer test and radiological assessment was done with anteroposterior and lateral radiographs of knee. Functional outcome was assessed by knee society scoring system¹². The patients were allowed to fully bear weight depending upon the associated injuries and ambulate without brace subsequent to bony union. Bony union was defined as bony consolidation seen on radiographs, absence of pain and stable knee. This was achieved in the majority of cases between ten to twelve weeks. Strengthening exercises were carried out after bony union and majority of the patients had returned to their previous occupation within six months.

Case 1



Case 2



Follow Up:



Posterior Sag Sign Negative

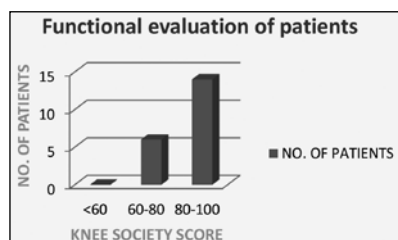


Full Weight Bearing And Stair

Climbing**Cross Leg Sitting****No Extension Lag****Results:**

Out of total 20 patients who met the inclusion criteria 18 were males and 2 were females. The average age was 36.4 years (range 25-55 years). From total 11 had involvement of left lower limb and 9 had involvement of right lower limb. In 85% cases mode of injury was either fall from bike or road traffic accident rest 15 % was due to fall at home. From 20 cases, 15 cases were treated with only one 4.5 mm c.c.screw with washer while 5 cases were treated with two 4.5 mm c.c. screws with washer. Post operatively PCL was assessed by posterior drawer test, in all cases it was negative, there were no laxity noted. All patients functional outcome were assessed using knee society score on follow-ups from 20 cases, 13 cases had score > 80 while 7 cases had score between 60-80 (due to moderate pain while walking and climbing stairs). According to this 13 cases had an excellent outcome and 7 had good outcome. In all patients flexion of knee was possible of average 100 degrees (range 90-110 degrees) and they were able to walk, climb up stairs, sit, squat and do daily activity postoperatively. They were also

subjected to radiograph both AP and Lateral view of knee joint taken. All patients showed signs of radiological union before their last follow up. They all started full weight bearing at or before 3 months. No significant intra or postoperative complications were noted. No neurovascular complications occurred while performing procedure with this approach.

**Discussion:**

Various surgical approaches have been described for the fixation of PCL avulsion fractures. It is difficult to execute open approaches due to presence of neurovascular elements in the popliteal space. The standard classical approach described by Abbott¹³ was time consuming, as it required handling of popliteal vessels. Later on modifications were described by Trickey *et al*¹, Ogata¹⁴, Nicandri¹⁰, Minkoff⁹ and Burks and Schaffer¹¹ to the standard posterior approach. Trickey¹ had made some headway in decreasing the operative time but still required the division of the medial head of gastrocnemius which led to delayed rehabilitation. Ogata¹⁶ had described the osteotomy of fibular neck which increased the complexity of the procedure. Nicandri¹⁰ has the disadvantage similar to the classical approach and Minkoff¹¹ approach uses the lateral side of the knee so it may damage the complex lateral knee stabilizers and common peroneal nerve. Burks and Schaffer¹¹ simplified the procedure and did not require division of medial head of

gastrocnemius or fibular osteotomy. Dissection of neurovascular structure in the popliteal fossa can also be avoided in this approach. The exposure obtained through the "safe postero-medial approach" (Burks and Schaffer) also facilitates the placement of an appropriately sized lag screw which provides adequate stability at the fracture site and patients can begin the range of motion exercises immediately in the postoperative period.

The post-operative rehabilitation was accelerated and good functional results were obtained. Many authors had recommended immobilisation in cast for six weeks in cases of PCL avulsion treated by open reduction. They had reported stiffness as a major complication in their studies^{1,15}. Nicandri *et al*¹⁰ had reported arthrofibrosis in only one of the ten cases when aggressive physiotherapy protocol was initiated instead of cast immobilisation. They recommended the use of functional brace and early range of motion exercises to achieve good functional results. However the prerequisite for the same is stable fixation. We followed the physiotherapy protocol as described by Nicandri *et al*¹⁰ and experienced arthrofibrosis in none of the patients. There is controversy regarding the operative and nonoperative management of PCL avulsion fracture, however Seitz *et al*¹⁶ had reported excellent results in their series of 26 patients treated for PCL bony avulsion with open reduction and internal fixation. Meyer¹⁷ had reported poor functional outcome in patients of bony PCL avulsion treated non-operatively.

Relatively small sample size (20 patients) might limit the scope of findings reported here.

Conclusion:

Burks and Schaffer's improvised approach is safer, easier and less time consuming than classic posterior approach. For PCL avulsion fractures open reduction and internal fixation with cannulated screw is one of the excellent techniques. Fixation of displaced PCL avulsion fracture gives excellent clinical and radiological outcome with safe posteromedial approach and cannulated screw.

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