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Case Report

Case report of a new technique for with posterior cruciate ligament avulsion fractures treated with a mini transverse incision

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ABSTRACT

Posterior cruciate ligament (PCL) is a strong stabilising ligament of the knee joint originating from posterior part of Intercondylar eminence oof tibia and attaches to the anterior part of medial surface of lateral condyle of femur. The PCL plays a major role in knee stabilization, and are statistically one of the rarest injuries around the knee. Due to the surrounding neurovascular elements in the popliteal space, very few open approaches to repair such injury were performed. The ‘‘safe transverse mini-incision approach’’ to PCL avulsion fracture is a simple approach, does not require exploration of the neurovascular elements, and produced satisfactory results in the majority of patients.

Keywords: Posterior cruciate ligament, Avulsion injuries, Mini transverse incision

INTRODUCTION

Tibial avulsions of the PCL are seen in younger patients and often due to high-energy trauma. Associated knee and ipsilateral limb injuries are common. Surgical treatment is recommended for displaced avulsion fractures with a defunct PCL, in order to restore PCL function and stability to the knee joint. Several open surgical approaches and arthroscopic techniques have been described for treating these fractures.[1,2]

The open large incisions, which often cross the flexion crease of the knee provide access to the PCL insertion site either through incision on midline, posteromedial or posterolateral sides. The new transverse mini-incision approach for fixation of PCL avulsion fracture is quite small and elaborate so extensive soft tissue exposure is not required. A new transverse mini-invasive approach for fixation of posterior cruciate avulsion fractures has significant safety and advantages and excellent patient-reported outcome measures.

CASE REPORT

A 51-year-old male came to our hospital with Alleged history of self-fall from bike and sustained injury to right knee and also sustained a Lacerated wound over right side of infra orbital region and lacerated wound over lower lip of size 2.5×2×2 cm. Patient has pain and swelling in right knee and range of motion of right knee was restricted and painful. X ray of right knee Ap and lateral view showed a posterior cruciate avulsion fracture. 3D CT scan of right knee showed communited displaced avulsion fracture involving the posterior tibial plateau at the insertion of PCL. Avulsed fragment measuring about 13×20×6.2 mm in size with separation of 6 mm (Figure 1).

MRI right knee also was done and revealed the same Avulsed fracture fragment measuring size of 10×15×6 mm at the insertion of PCL (Figure 2).

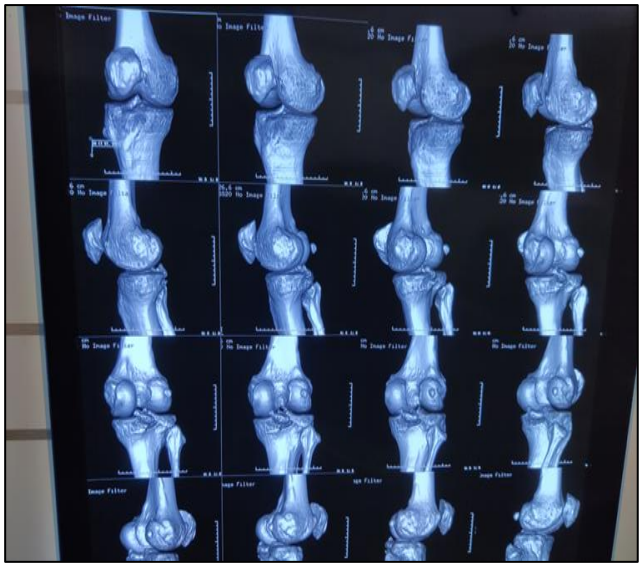

Figure 1: 3 D CT scan of the right knee joint.

Figure 2: MRI scan of right knee joint.

Subsequently we explained the patient and their attenders regarding the need for surgical fixation of the avulsed fracture fragment and gained informed consent for the same.

Surgical technique

The key point to the surgical technique is the mini transverse skin incision. The patient was giving spinal anaesthesia and made to lie in prone position, tourniquet inflated and the limb in neutral rotation. Using fluoroscopy guidance, with the beam centre on the knee a horizontal k wire was placed 1 cm proximal to the joint line and a vertical k wire was placed perpendicular to the first k wire centre on the tibial eminence and the skin incision was marked, (Figure 3).

A five centimeter transverse incision is made centered on the intersection of the two lines (Figure 4).

Figure 3: C arm image of k wire prior to making incision.

Figure 4: Mini transverse incision over the popliteal fossa.

Skin flaps are developed both in craniocaudal directions. The deep fascia is incised along the line of incision and the plane between the two heads of the gastrocnemius is identified and developed by blunt dissection, (Figure 5).

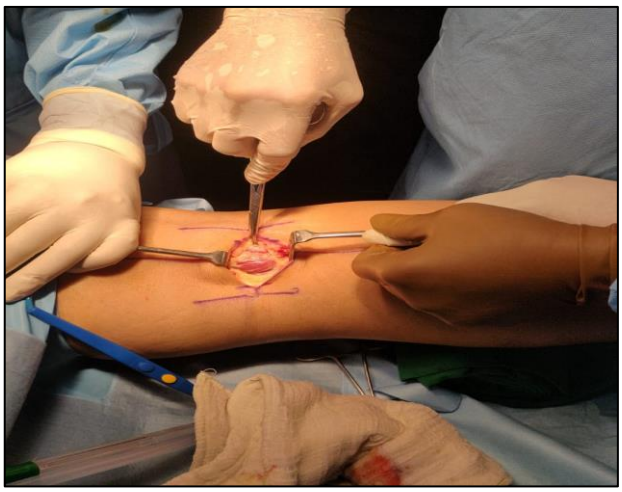

Figure 5: Gastronemius medial and lateral head.

The popliteal vessels and tibial nerve is safely retracted using a two-centimeter broad Langenbeck retractor towards the lateral side, while developing the plane between the two heads. Once the posterior capsule and oblique popliteal ligament are identified, Langenbach retractors were used and gently distracted to get access to the posterior capsule, (Figure 6).

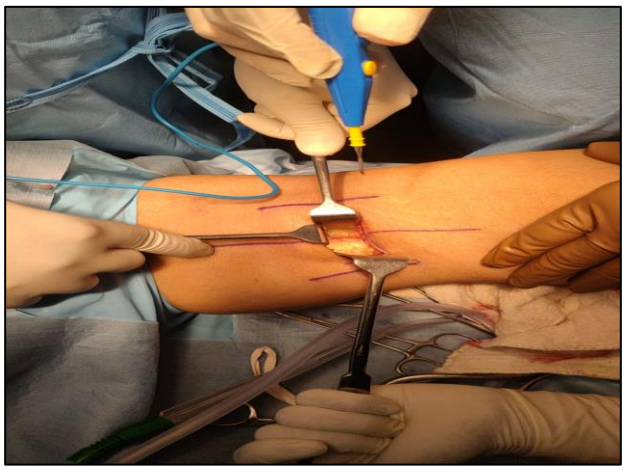

Figure 6: Plane between two heads of gastronemius.

The posterior capsule is incised longitudinally and the fracture site is identified and using punch the fracture fragment was reduced into its position. With the knee slightly flexed two 1.25 mm guide wire was passed through the fracture fragment was held in its reduced position and confirmed under fluoroscopy, (Figure 7).

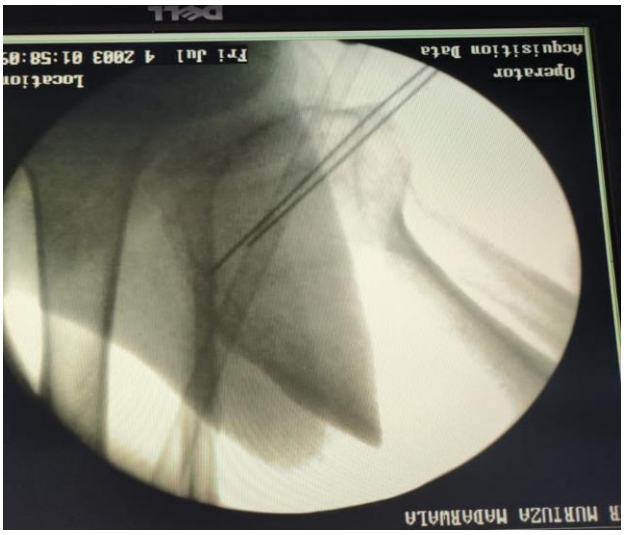

Figure 7: Two k wires through the fracture fragment under C arm guidance.

The guide wire is drilled towards the anterolateral cortex at a 45° angle to the long axis of the tibia. To, avoid any injury to neurovascular bundle the track is drilled with a cannulated drill bit over the long drill sleeve. Two 55×4 mm partially threaded lag screw is inserted and tightened over a washer, (Figure 8).

Figure 8: Two CC screws through fracture fragment.

Capsule is closed and hemostasis is achieved. Wound was closed in layers and sterile dressing was done, (Figure 9).

Figure 9: Five cm horizontal skin incision closure.

Tourniquet was deflated and removed and a above knee cylindrical cast was applied with knee in slight flexion.

Post operatively a small window was done at the operative site and wound dressing was done on post op day 3 and wound was clean and healthy. Post operative x ray showed fracture fragments in position and held with the help of 2 cannulated screws, (Figure 10). Patient was discharged within 72 hours of hospitalisation.

Figure 10: Postoperative X-ray.

DISCUSSION

The strength of the PCL is twice that of the Anterior cruciate ligament and is considered to be one of the strongest ligaments in the knee joint and also plays an important role in the stability of the joint.[3] The incidence of PCL rupture is lower than that of other

Ligaments due to its strong fibrous structure.[4] PCL avulsion injury is a special form of injury that is relatively rare compared with typical PCL tear.[5] The treatment of PCL avulsion fracture is mainly divided into conservative treatment and surgical treatment. Zhao et al suggested that nonsurgical treatment can be successfully used for fractures with displacement less than 5 mm.[6] Although these conservative treatments have achieved good results, there are many complications in the following conservative management of displaced PCL avulsion fractures, which lead to knee instability, severe mobility limitation, and knee degeneration. In order to prevent instability and further degenerative changes, early operation should be performed.[7]

At present, the surgical options for PCL avulsion fracture mainly include open reduction and internal fixation and arthroscopic repair. According to certain studies, the efficacy of open approach and arthroscopic fixation of PCL avulsion fractures is comparable.[7,8] Arthroscopic technology provides a minimally invasive technique and can be used in the same environment to handle any accompanying advantage of the meniscus, the synovial membrane and the surrounding ligament injury.[9] But arthroscopic techniques have a higher rate of arthrofibrosis, longer operation time, high technical requirements, a long learning curve and the need for a specific device. Unlike open technique, it is not possible to see the avulsion fragment directly and as a result fixation of the fracture fragment is challenging in arthroscopic surgery.

The conventional open approaches used for fixing PCL avulsions are divided based on the direction of access: medial, Midline, and lateral. Among these, the Burks and Schaffer medial-based surgical approaches and its subsequent modifications are the most popular.[1] In the medial approach the medial gastrocnemius muscle has to be retracted to expose the PCL insertion site which is difficult in obese or muscular individuals. Through this approach the exposure to the lateral base of PCL is limited and screw placement perpendicular to the fracture plane is difficult. This approach caused extensive damage and weakness to the gastrocnemius muscle and also fracture fixation was compromised. Jazayeri modified the Burks approach and split the medial gastrocnemius muscle to provide access.[15] This approach involves less retraction, but splitting the muscle leads to weakness and more blood loss. The Trickey approach and its modifications use midline access through a long sinusoidal incision crossing the flexion crease with or without division of the medial gastrocnemius muscle.[1,11] These approaches require extensive dissection, are time consuming, and have the potential for residual muscle weakness and scar contractures. Lateral-based approaches described by McCormick, Ogata and Minkoff are not very popular.[12]

The complexity of previous approaches has driven many authors to recommend percutaneous fixation of the fragment under arthroscopic control.[2,13]

Gavaskar et al described 22 patients were similar surgical techniques where the use of a small incision behind the knee was done. In this technique the Langenbach retractors were used to separate neurovascular bundles for better visual field exposure and shorter operation time. The smaller incision placed appropriately provides good exposure of posterior capsule to perform a satisfactory fracture fixation.[14]

In our present transverse mini incision approach to the PCL avulsion injuries the fracture fragments are exposed through minimal soft tissue dissection and damage. The entire PCL fragment was exposed and two cancellous screws are placed at a 45° angle to the long axis of the tibia and satisfactory fracture compression was achieved. In this technique precise placement of the skin incision is important, and an incorrectly placed incision can make the procedure difficult. Since the access is through the midline, risk to neurovascular structures is always possible.

CONCLUSION

To conclude, internal fixation of tibial PCL avulsions can be satisfactorily performed using this Transverse mini-invasive technique. The technique is efficient, less time-consuming, and provides adequate exposure for fixation of the fracture through a small cosmetic incision. The pain relief is excellent postoperatively and can enable early rehabilitation and return to function.

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