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Treatment of posterior cruciate ligament tibial avulsion by a minimally-invasive open posterior approach

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ABSTRACT

Objective: To assess the surgical technique and report the outcomes following fixation of PCL bony avulsions through mini-invasive posterior knee approach as described by Burks and Schaffer.
Methods: From June 2012 to July 2015, 27 patients enrolled in the study (21 males and 6 females). Fixation of tibial PCL avulsion fractures was done with one or two cannulated screws, or sutures through Burks and Schaffer's approach. The mean interval before surgery was 16 days (1–70) .Patients was followed up for an average of 51 weeks. The outcome measures evaluated at final follow-up were (1) clinical stability as assessed by posterior drawer test, (2) radiologic union, (3) functional assessment by Lysholm score, and (4) gastrocnemius muscle strength as a measure of morbidity.
Results: Average operative time was 43 min. Improvement of both subjective Lysholm score (mean 93) and objective stability testing by posterior drawer test (returns to normal in 81.1% of patients) at the final follow-up. Good radiographic union at average of 5.6 weeks. No morbidity of the gastrocnemius with few complications.
Conclusions: The approach was fast and safe with excellent visualization. It allows surgeons to address other injuries in the same setting. It can be considered as a minimally-invasive open surgery without surgery-related morbidity. It is a reproducible technique that can be done at any trauma centre by surgeons with average experience. The subjective and objective results of the technique are excellent and comparable to the arthroscopic procedures that needs more specific centres with well-trained surgeons.

Introduction

Injuries of the PCL represent about 20% of all knee ligamentous injuries [1]. These injuries are more prevalent in young males with road traffic accidents and among motorcyclists [2,3]. The PCL injury can occur in isolation or in combination with other bony or ligamentous injuries around the knee. In many cases, this injury is overlooked and undiagnosed in the acute trauma settings [4]. In our country, the number of motorcycles and 3-wheel vehicles are rising annually with more incidences of related accidents. PCL injuries are not infrequently seen as a result.

Unlike the controversies about the ways of repair, augmentation or reconstruction of the PCL substance tear [5], there is an agreement on the advisability of fixing the bony avulsions to ensure bone–bone healing with better functional outcomes [6–8]. The controversy remains in the choice of the surgical approach, value of arthroscopic techniques and the methods of fixation.

For orthopaedic surgeons, the most common indication for posterior approach of the knee is bony avulsions of the PCL [5,9]. The standard approach, described by Abbott and Carpenter in 1945, through the popliteal fossa is primarily a neurovascular approach with hazards and time consumption [10]. In 1967, Trickey described a modification to this classic approach. He used to divide the medial head of gastrocnemius longitudinally with retraction off all the neurovascular structures laterally with the lateral half of the muscle [11]. Later in 1973, Hughston described an approach through a long, gently curved medial incision. This exposure was designed to facilitate examination of the medial collateral ligament, medial meniscus, and posteromedial capsule in addition to the PCL [12]. However, this approach was far medial and not suitable when fixation of a bony fragment is intended [13]. In the late 70 s and early 80s, McCormick and Ogata, in two separate publications, described PCL approaches through the posterolateral aspect of the knee. As a part of the procedure, they had to osteotomize the fibular neck and detach the popliteus tendon. Risk of peroneal nerve injury was high in addition to more

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time consumption in reattaching the structures when closure was attempted [14,15].

In our case series, we avoided these extensive approaches. We used a less-invasive approach that was first described by Burks and Schaffer in 1990. In their article, they started to use this approach is in only 2 patients [13]. It allows safe, rapid and simple approach utilizing the interval between the semimembranosus and medial gastrocnemius head. We considered it as a minimally-invasive one as it avoids any injury to the gastrocnemius muscle.

Patients and methods

The current study was conducted as a single center retrospective case series study. In the period between June 2012 to July 2015, 27 patients were enrolled consecutively (21 males and 6 females) . They were admitted to our hospital as tibial bony avulsion of the PCL. Among them 17 patients were admitted after road traffic accidents, the remainder were admitted after bicycle and tricycle accidents. Only 11 patients had isolated bony avulsion of the PCL. Three patients were initially overlooked due to other concomitant injuries. Another 3 patients presented 2 months after injury as an isolated PCL bony avulsion injuries in the hospital's outpatient clinic after they were treated initially as posttraumatic haemoarthrosis outside our institute. All participants were screened for eligibility by the first author. All were operated on consecutively by the first author 1–70 days (average 16) after injury utilizing the minimally-invasive posterior approach described by Burks and Schaffer.

Inclusion criteria

- Male and female patients
- Clinical evidence of PCL laxity after examination of all cases by the first author
- Radiological evidence of PCL avulsion in x-ray and C-T scan. Additional MRI was requested in some patients only when other intra-articular derangement was suspected.
- Willingness to follow the post-operative instructions
- Capacity to provide informed consent

Exclusion criteria

- Avulsions of more than 3 months are excluded
- Presence of vascular injuries needed for repair
- Lacerations and open injuries in the posterior aspect of the knee and proximal leg

Operative procedure, Burks and Schaffer's [13]: (Fig. 1A–F)

Under spinal/epidural anaesthesia, a pneumatic tourniquet was applied and inflated. The patient is turned in prone position with the knee in mild flexion. An inverted L-shaped incision was done, the vertical limb on the medial border of the medial gastrocnemius muscle and the transverse limb over the posterior knee crease (Fig. 1A). Dissection is carried to the deep fascia, which is incised vertically in the direction of fibres of the medial head of the gastrocnemius. The medial border of the medial gastrocnemius is identified and a plane is developed between it and the semimembranosus tendon. This plane is developed by blunt dissection until the posterior joint capsule can be seen (Fig. 1B). The medial head of gastrocnemius is retracted laterally protecting neurovascular structures. The knee is flexed and extended to determine

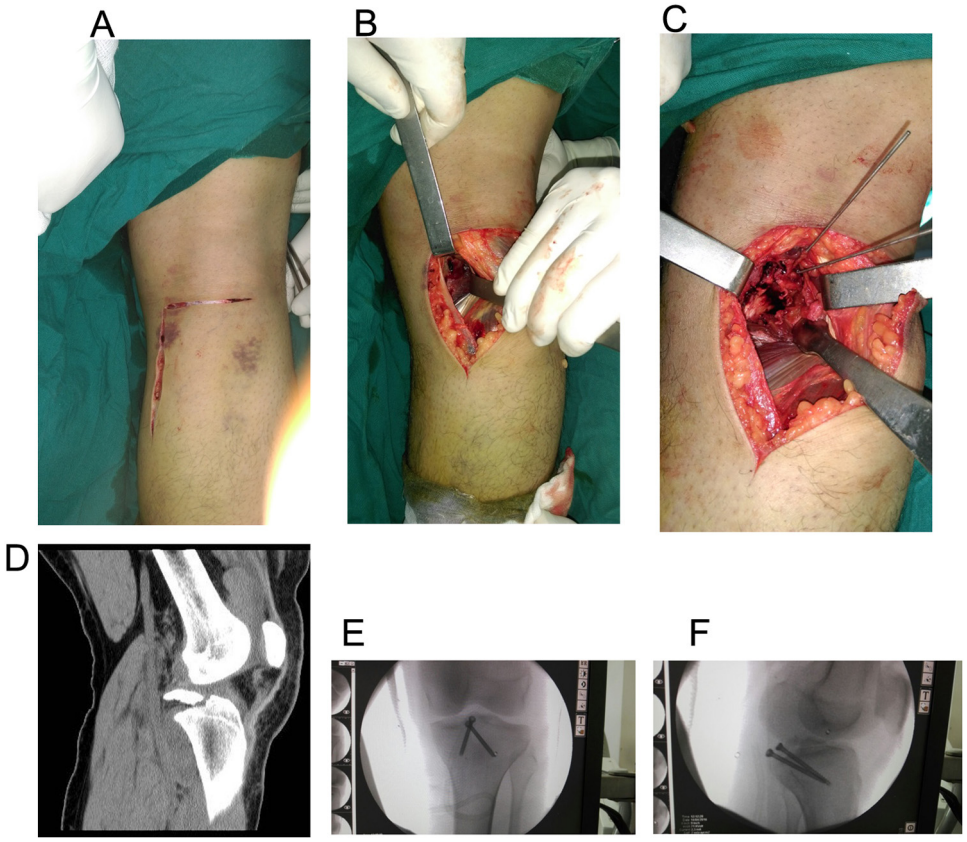

Fig. 1. (A–F): (A) Lines of incision as drawn on posterior aspect of the knee. (B) The plane developed between the medial gastrocnemius head and semimebranosus. (C) Temporary fixation by 2 k-wires before use of cannulated screws. (D) Preoperative C-T cuts. (E–F) Postoperative radiographs.