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Posterior Cruciate Ligament (PCL) Avulsion Fracture Treated by Single Screw Fixation Via the Posterior Trickey Approach: Interest and Complexity of The Approach – A Case Report

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Abstract | **Case Report**

We present the case of a 28-year-old motorcyclist who suffered a direct impact to the anterior tibia during a collision, with the knee flexed at 90° [1]. Clinical findings included abundant intra-articular effusion, posterior tenderness on palpation, frank posterior drawer, and a positive posterior sag sign [2]. Standard radiographs showed a retro-tibial triangular bone fragment, confirmed by CT scan as a type III Meyers and McKeever fracture (8 mm displacement) [3]. Osteosynthesis via the posterior Trickey approach was performed. Rehabilitation began on day 1 with passive mobilization under a locked extension brace, and at 6 weeks healing was achieved with flexion of 90°.

Keywords: PCL avulsion; posterior cruciate ligament; Trickey approach; screw fixation; early rehabilitation.

INTRODUCTION

Avulsion fractures of the tibial insertion of the posterior cruciate ligament (PCL) are rare but severe injuries, accounting for less than 10% of PCL injuries [1]. The isolated form is more frequent after high-energy trauma, particularly in motorcycle accidents, when the flexed knee receives a direct impact to the anterior tibia (dashboard injury mechanism) [2]. The PCL is the largest and strongest ligament of the knee, the primary stabilizer against posterior translation of the tibia relative to the femur [3] (Figure 1). It consists of two main bundles – anterolateral and posteromedial – whose bony avulsion leads to posterior instability sometimes associated with meniscal lesions or secondary osteoarthritis in the medium term [4]. Displaced fractures (type II or more than 5 mm of displacement according to the Meyers and McKeever classification) (Figure 2) warrant reduction and surgical fixation to restore stability and prevent joint stiffness [5]. The posterior Trickey approach, initially described for exposure of PCL fractures, allows direct screw fixation of the osteochondral fragment; it is characterized by a posteromedial L-shaped incision (vertical branch following the medial border of the medial gastrocnemius) that exposes the popliteal neurovascular bundle (artery, vein, and tibial nerve) [6]. We report the case of a 28-year-old patient who sustained an isolated PCL tibial avulsion fracture treated by screw fixation via the Trickey approach, and we discuss the details and complexity of this approach [7].

OBSERVATION

The patient is a 28-year-old right-handed motorcyclist with no significant medical history, who was involved in a rear-end collision. The left knee was forcibly flexed at 90°, and the proximal tibia received a posteroanterior impact (dashboard injury). The patient immediately felt acute pain, rapid knee swelling, and a sensation of instability when walking.

On admission to the emergency department (H+4), clinical examination revealed a swollen knee with significant intra-articular effusion, tenderness on palpation of the posterior intercondylar notch, a frank posterior drawer (grade II at 90° flexion), and an obvious posterior sag sign. Active flexion was limited to 30°, full extension was possible but painful. The neurovascular examination (pedal pulses, sensation in the common peroneal nerve territory) was normal.

Standard anteroposterior and lateral radiographs of the left knee showed a characteristic retro-

tibial triangular image: a 12 × 8 mm bone fragment completely detached from its insertion site, with 8 mm of posterior displacement (Figure 3). This was a type III fracture according to the Meyers and McKeever classification (complete displacement), confirmed by CT scan (Figure 4).

Given the displaced and unstable nature of the fracture, osteosynthesis via the posterior Trickey approach was decided. The procedure was performed under general anesthesia in the prone position, with the knee in slight flexion (15°) on a cushion placed under the ankle (Figure 5). The surgical steps were as follows (Trickey approach):

1. Skin incision: a posteromedial L-shaped or "hockey stick" incision. The vertical branch is 6–8 cm long and follows the contour of the medial border of the medial gastrocnemius (medial head); the horizontal branch is short (2–3 cm) and follows the popliteal crease. The skin and subcutaneous tissue are incised.
2. Flap dissection: the skin flaps are raised to expose the popliteal fascia.
3. Incision of the popliteal fascia: the fascia is opened along the axis of the incision.
4. Identification of the tibial nerve: located superficially medially, it is protected with a vessel loop. The popliteal artery and vein lie anterior to the nerve.
5. Dissection of the interval: between the semimembranosus (medially) and the medial head of the gastrocnemius (laterally). These two structures are retracted to reach the posterior capsule.
6. Vertical posterior capsulotomy: the capsule is incised for 3 cm, posterior to the medial femoral condyle. The avulsed bone fragment and its tibial bed are then visualized (Figure 6).
7. Debridement of the bone bed: removal of hematoma and fibrous debris with a curette.
8. Fragment reduction: using a reduction forceps, the fragment is replaced into its bed.
9. Drilling and screw fixation: drilling with a 3.5 mm drill bit, then placement of a 4.5 mm cancellous screw with a washer. The screw is countersunk, ensuring compression.
10. Final check: verification of stability and absence of impingement.
11. Closure: capsular closure with absorbable suture, then fascia and skin closure. A suction drain is left for 24 hours.

Immediate postoperative course was uneventful: no postoperative neurovascular deficit, pain controlled. Rehabilitation was started on day 1 : hinged knee brace locked in full extension for 4 weeks, passive flexion limited to 30° the first week, then up to 90° from the 3rd week, isometric quadriceps exercises, no hamstring work. The patient was seen at 6 weeks: radiograph showed healing. At 3 months, active flexion was 120°, full extension (0°). At 4 months, return to office work. Return to sport (running) is planned at 6 months.

Figure 1: Posterior displacement of the tibia after a complete rupture of the posterior cruciate ligament

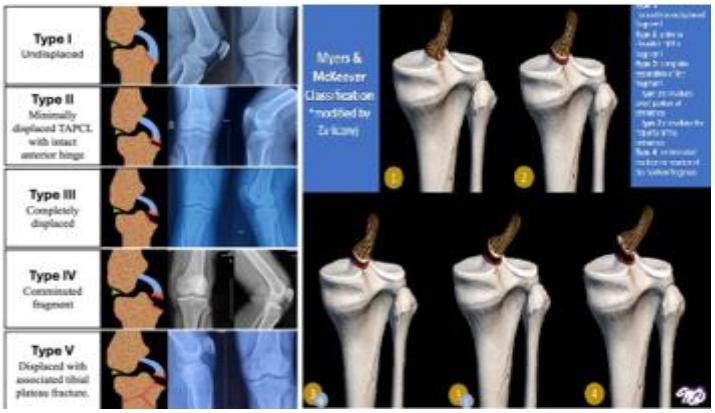

Figure 2: Meyers and McKeever classification

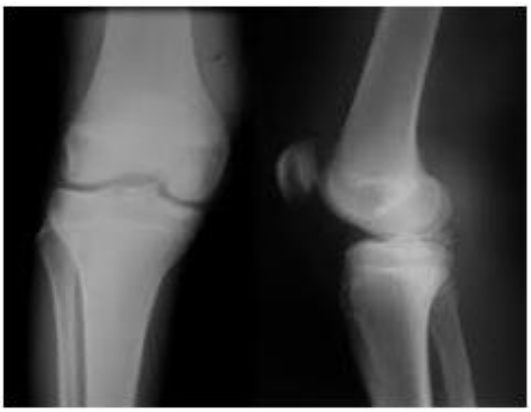

Figure 3: X-ray of the knee showing the detached posterior tibial fragment

Figure 4: CT scan confirming the diagnosis

Figure 5: Preoperative images showing patient positioning and marking of the skin incision according to the Trickey approach

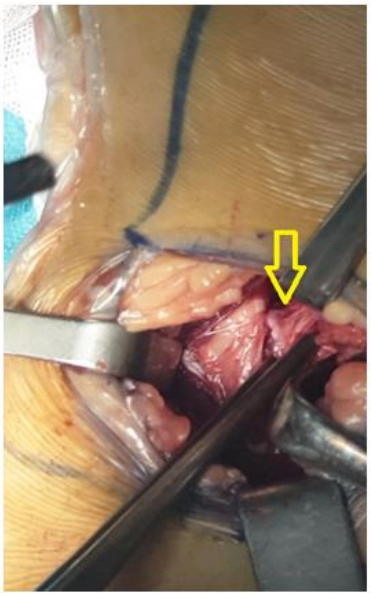

Figure 6: showing an intraoperative image with the detached bone fragment (yellow arrow)

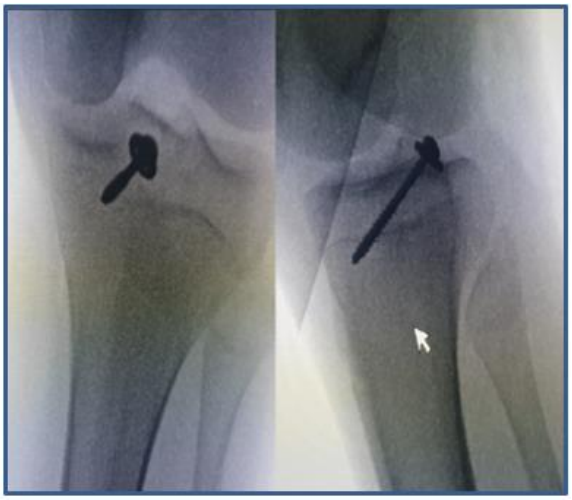

Figure 7: showing the intraoperative scopic control after screw placement

DISCUSSION

PCL avulsion fractures are rare but often underestimated lesions, and the diagnosis should be systematically considered in any high-energy knee trauma associated with effusion and posterior drawer [1]. The dashboard injury mechanism is the most common, corresponding to the impact of the proximal tibia against the dashboard of a car or into a motorcycle handlebar during sudden deceleration [2]. In our observation, the patient was a motorcyclist, the impact occurred with the knee flexed at 90°, resulting in a pure PCL avulsion without associated injury [3]. The PCL is an intra-articular, extra-synovial ligament, twice as strong as the ACL, the primary stabilizer preventing posterior tibial translation ; its role is major in downhill walking and activities in semi-flexion [4]. The Meyers and McKeever classification, although based on standard radiographs, remains the most widely used and distinguishes non-displaced fractures (type I, conservative treatment) from displaced fractures (types II and III, surgical treatment) [5].

The posterior Trickey approach, described by E.L. Trickey in the 1960s, is the reference approach for direct exposure of the PCL [6]. It uses a posteromedial L-shaped incision, the vertical branch of which follows the medial border of the medial gastrocnemius, allowing avoidance of scar contracture and wide exposure of the popliteal fossa [7]. The major complexity of this approach lies in the immediate proximity of the popliteal neurovascular bundle (popliteal artery, popliteal vein, tibial nerve, and common peroneal nerve) [8]. Injury to the popliteal artery can lead to acute limb ischemia, and injury to the tibial nerve can result in foot drop or sensory disturbances [9]. Dissection must be meticulous, with systematic identification of the tibial nerve, and the use of malleable retractors to retract the vessels [10]. Some authors recommend intraoperative Doppler mapping or preoperative arteriography in case of vascular history [11].

In our observation, the Trickey approach was performed without incident. Screw fixation with a 4.5 mm cancellous screw and washer provided sufficient compression for rapid healing [12]. Early rehabilitation, started on day 1, is a key factor for success: it prevents stiffness and quadriceps atrophy [13]. Avoiding hamstring work during the first 6 weeks is fundamental to prevent traction on the PCL [14]. Compared to transosseous suture or pinning techniques, direct screw fixation offers better primary stability and allows immediate passive mobilization [15].

CONCLUSION

PCL avulsion fracture in the young adult requires anatomical reduction and stable fixation, especially when displaced [1]. The posterior Trickey approach, although technically complex because of the neurovascular risks, allows direct access to the fragment and reliable screw fixation [2]. Protected early rehabilitation is essential for functional recovery [3]. This technique should be reserved for experienced surgeons or teams trained in the anatomy of the popliteal fossa [4].

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