

The Minimally Invasive Approach to the Retro-Spinal Surface in Tibial Reinsertion of Posterior Cruciate Ligament Avulsions

Abderrafia Rachdi^{1*}, Ahmed Hicham Benomar¹, Youssef Benyass¹, Jalal Boukhris¹, Bouchaib Chafry¹

¹Department of Orthopedic Trauma, Mohamed V Military Hospital, University Mohamed V – Souissi Rabat, Morocco

DOI: <https://doi.org/10.36348/sijap.2025.v08i01.001>

| Received: 25.12.2024 | Accepted: 31.01.2025 | Published: 04.02.2025

*Corresponding author: Abderrafia Rachdi

Department of Orthopedic Trauma, Mohamed V Military Hospital, University Mohamed V – Souissi Rabat, Morocco

Abstract

Traumatic lesions of the posterior cruciate ligament (PCL) remain particularly rare, with avulsions being even more uncommon and often associated with tibial plateau fractures. This study focuses on describing a minimally invasive approach to the retro-spinal surface, enabling tibial reinsertion of avulsion of the posterior cruciate ligament in five athletes who experienced high-energy sport-related accidents.

Keywords: Knee, posterior cruciate ligament, tibial avulsion.

Copyright © 2025 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution **4.0 International License (CC BY-NC 4.0)** which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

INTRODUCTION

Posterior cruciate ligament (PCL) tibial avulsion is an uncommon injury pattern, representing approximately 3% of acute knee ligament injuries. While various surgical approaches have been described, from extensive posterior exposure to arthroscopic techniques, each presents specific challenges regarding adequate exposure and tissue preservation. The optimal surgical management remains controversial, particularly concerning the preservation of key anatomical structures essential for knee stability.

We report our experience with five cases of PCL tibial avulsion treated using a minimally invasive approach to the retro-spinal surface, focusing on the surgical technique and functional outcomes in high-demand patients.

PATIENTS AND METHODS

Series Description

Our study focused on five cases of tibial avulsion of the posterior cruciate ligament (PCL) (Fig 1), collected at the Traumatology-Orthopedics II department of the Mohammed V military Teaching Hospital in Rabat between January 2010 and December 2019. The series includes three professional athletes and two military personnel engaged in intense and regular training.

All patients underwent a surgical procedure involving a minimally invasive approach to the retro-spinal surface for tibial reinsertion of the posterior cruciate ligament. This approach allows for the preservation of the integrity of the internal gastrocnemius muscle and, most importantly, the popliteal muscle, a crucial element in controlling posterior and postero-external knee laxity.

Description of the Technique:

The minimally invasive approach represents a safe method that, through a rigorously codified technique, provides excellent exposure of the retro-spinal surface of the tibia. It allows avoiding extensive tendons-muscle sections or avulsions often advocated in posterior cruciate ligament surgery. The success of this approach relies on the correct patient positioning, precise marking of the skin incision, and a thorough understanding of the operative steps.

The incision is made in an inverted “L” shape (Fig 2), followed by a vertical opening of the fascia, which is carefully dissected and cleaved. Subsequently, the half-membranous muscle and the internal gastrocnemius muscle are identified along its inner edge which is well individualized and followed to its condylar insertion. A Mac Burney incision of the muscle is then performed.

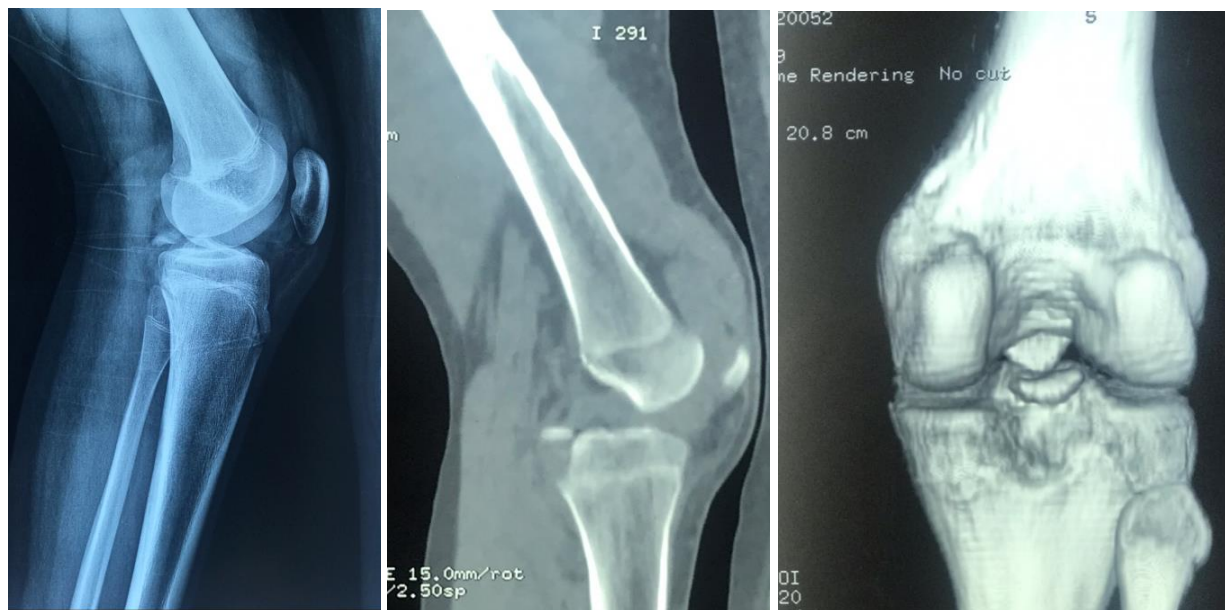


Figure 1: Imaging illustrating the avulsion of the posterior cruciate ligament and the osseous fragment from the retro-spinal surface



Figure 2: Incision path in inverted « L » shape

The incision of internal gastrocnemius is performed with Mayot scissors along the direction of muscle fibres, limited to 4 cm below to the condyle to avoid injuring the deep muscle pedicle (Fig 3). Three trans-muscular spreaders are placed: medial, lateral and inferior, ensuring perfect exposure of the internal condyle and the posterior capsule and the capsule on the internal condyle is done obliquely, from top bottom and from inside to outside, for better exposure of the lateral face of the internal condyle, essential for easy retrieval of the avulsed bone fragment.

The exposure of the retro-spinal surface (Figure 4) is followed by the fixation of the bone fragment using a screw mounted on a washer (Figure 5). Intraoperative fluoroscopy is used to verify the correct positioning of the screw (Figure 6).

The procedure concludes with meticulous closure of the various layers, one by one, following careful haemostasis.

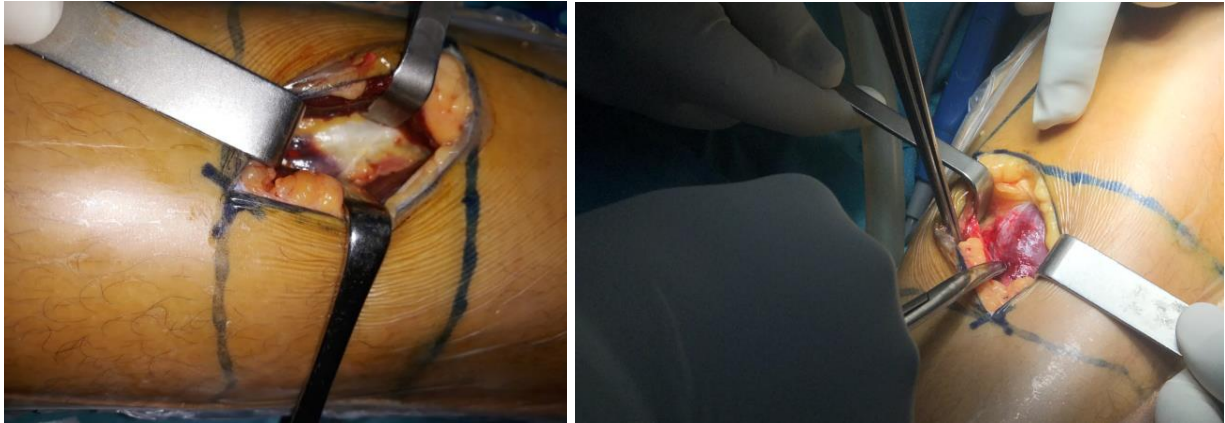


Figure 3: Opening and cleavage of the fascia and identification of the semi-membranous and internal gastrocnemius muscles along its inner edge



Figure 4: Exposure of the retro-spinal surface with the avulsed fragment (Arrow)

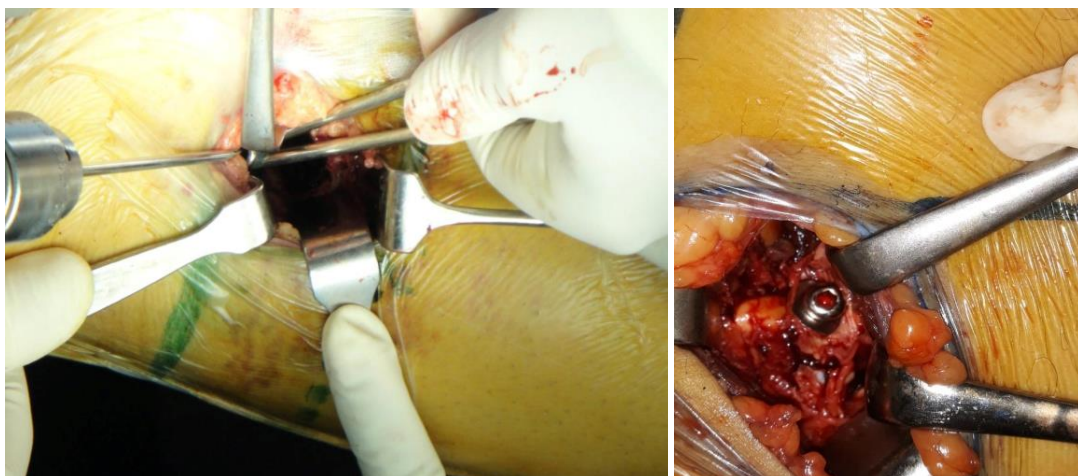


Figure 5: Preparation, packing, and fixation of the avulsed fragment (screw and washer)

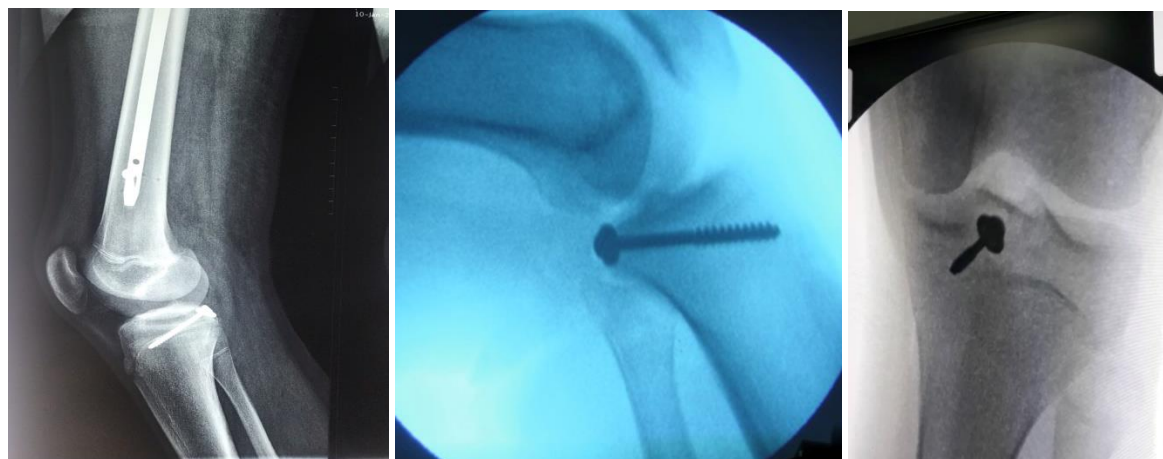


Figure 6: Radiological verification of screw fixation

RESULTS

The average follow-up period extended over two years, and postoperative outcomes were favourable with no complications; there were no postoperative hematomas, thromboembolic events, or infectious complications observed.

A standardized rehabilitation protocol was implemented for all five patients. Prudent postoperative rehabilitation allowed for weight-bearing only from the third week. The operated knee was maintained in extension using a brace with a wedge behind the calf for 8 weeks to counteract the posterior drawer induced by the supine position. Passive flexion was gradually introduced (0-20° in the second week, 45° in the third week, 60° from the sixth week), without engaging the hamstring muscles, functional maintenance of the quadriceps is crucial. Finally, the resumption of sports activities was prohibited for 6 to 9 months.

All patients were reviewed in follow-up consultations at 45 days, 3 months, 6 months and one year postoperatively. Satisfactory functional outcomes were achieved with fully three of our patients fully returning to their preoperative sports levels.

DISCUSSION

Posterior cruciate ligament (PCL) avulsion remains a rare and often underdiagnosed injury, possibly due to functional adaptation occurring in 85% of cases (Lecuire *et al.*, 1994). Unlike anterior cruciate ligament rupture, instability resulting from PLC ruptures is rare. Consequently, surgical repair of these injuries has been neglected for a long time, especially given the complexity of the surgery and the frequent surgical failures, primarily due to conceptual gaps in reconstruction and difficulties in fixing the avulsed bone fragment (Jacob *et al.*, 1988).

Currently, many authors emphasize the long-term arthritic potential of posterior laxity induced by PCL rupture. This situation is explained by increased

stress on the patellar cartilage and the femoro-tibial compartment (Dejour *et al.*, 1988) (Chotel *et al.*, 2004).

In recent years, PCL surgery has significantly progressed due to a better anatomical and biomechanical understanding, as well as the development of arthroscopic techniques (Candiolo *et al.*, 1959) (Jacquot *et al.*, 2001).

In light of our result and review of the literature, particularly the findings from an anatomical cadaveric study conducted on 20 knees by (Badet *et al.*, 2003) and (Neyret *et al.*, 2002) it appears that the minimally invasive approach offers, through a meticulously codified technique, excellent exposure of the retro-spinal surface of the tibia. This technique provides very satisfactory control of the vessels, the internal condyle, and the retro-spinal surface while avoiding extensive tendon-muscle sections or avulsions often recommended in conventional posterior ligament surgery (Neyret *et al.*, 2002).

Despite the challenges associated with PCL injuries, the described minimally invasive surgical approach for tibial reinsertion of avulsion has demonstrated favorable outcomes in our study. The avoidance of extensive tendo-muscular sections, along with the preservation of essential structure such as the internal gastrocnemius and popliteal muscles, contributes to improved postoperative recovery.

Moreover, the standardized rehabilitation protocol applied uniformly to all patients appears to have contributed to satisfactory functional outcomes and return to preoperative sports levels in a significant portion of our cases. However, further studies with larger sample size and longer-term follow-up are necessary to validate the effectiveness and long-term success of this approach.

CONCLUSION

The meticulously codified technique presented in this study, with its excellent exposure and satisfactory control of key structures, suggests that the minimally invasive approach could be valuable in various surgeries related to the posterior cruciate ligament, offering potential benefits in terms of both surgical outcomes and cosmetic considerations. Further studies continued research will be valuable in confirming the broader applicability and long-term success of this approach in diverse clinical scenarios.

REFERENCES

- Boukhris, J., & Chagar, B. (2014). La réinsertion tibiale du ligament croisé postérieur par abord mini invasif de la surface rétro spinale: à propos de 4 cas et revue de littérature. *Research fr*, 1, 1044.
- Lecuire, F., & Jaffar-Bandjee, Z. (1994). Posterior luxation of the tibia on total knee prosthesis: Apropos of 6 cases. *Revue de Chirurgie Orthopedique et Reparatrice de L'appareil Moteur*, 80(6), 525-531.
- Jakob, R. P., Kipfer, W., Klaue, K., Stäubli, H. U., & Gerber, C. (1988). Etude critique de la reconstitution du ligament croisé antérieur du genou par la plastie pédiculée sur le Hoffa à partir du tiers médian du tendon rotulien: 50 genoux opérés avec recul de 2 à 4 ans. *Revue de chirurgie orthopédique et réparatrice de l'appareil moteur*, 74(1), 44-51.
- Dejour, H., Walch, G., Peyrot, J., & Eberhard, P. (1988). The natural history of rupture of the posterior cruciate ligament. *Revue de Chirurgie Orthopedique et Reparatrice de L'appareil Moteur*, 74(1), 35-43.
- Chotel, F. (2004). Entorses du genou de l'enfant et de l'adolescent. *Cahiers d'enseignement de la SOFCOT*, 85, 209-240.
- Candiollo, L., & Gautero, G. (1959). Morphologie et fonction des ligaments ménisco-fémoraux de l'articulation du genou chez l'homme. *Cells Tissues Organs*, 38(4), 304-323.
- Jacquot, L., Rachet, O., & Chambat, P. (2001). La rééducation du genou après greffe du ligament croisé antérieur. *Sport et Reeducation du membre inferieur. Montpellier*, 31-50.
- Badet, R., Lootens, T., & Neyret, P. (2003). Abord mini-invasif de la surface rétro-spinale, Maitrise Orthopédique, 124.
- Neyret, P. (2002). Entorses récentes du genou chez l'adulte. *Cahiers d'enseignement de la SOFCOT*, 79, 163-186.