

Outcome of Isolated PCL Tibial Avulsion Fractures Treated with Cannulated Cancellous Screw Fixation

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Abstract

Background: The posterior cruciate ligament (PCL) presents commonly as avulsion fractures from the tibial attachment site. Isolated tears of the PCL can be caused by a fall on the flexed knee or dashboard injury in road traffic accident. Such a mechanism (the upper tibia driven posteriorly with the knee flexed) may produce PCL disruption as the only clinically detectable instability. For the PCL avulsion fractures fixation, there are various methods available like closed reduction and internal fixation (CRIF), open reduction and internal fixation (ORIF), and arthroscopic fixation. This study was performed to assess the result of PCL avulsion fracture managed with ORIF with cannulated cancellous screw.

Methods: We performed ORIF using cannulated cancellous screws with the posterior approach in 11 patients with isolated PCL tibial avulsion injuries. The minimum follow-up period was 6 months. The results were assessed radiologically and clinically. The spectrum of outcomes following PCL tibial avulsion fracture were measure using the Lysholm knee scoring system and range of motion (ROM) of the knee joint.

Results: 63.6, 27.3, and 9.1 percent of the cases had excellent, good, and moderate fracture healing, respectively.

Conclusion: PCL tibial avulsion fractures managed with open reduction with cannulated cancellous screw fixation yields good functional outcome with less complications.

Keywords: Avulsion Fracture; Fracture Fixation; Knee; Posterior Cruciate Ligament

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Background

The posterior cruciate ligament (PCL) is the largest intra-articular ligament, with an average length of 38 mm and a mean diameter at the midpoint of 13 mm; its cross-sectional area is approximately 120 to 150% greater than that of the anterior cruciate ligament (ACL) (1).

The PCL provides the majority of the total restraint to posterior tibial displacement at all flexion angles and 95% of the posterior stability between 30 and 90 degrees (2). Isolated tear or avulsion of the PCL can be caused by a fall on a flexed knee or by striking of the flexed tibia on the dashboard in a motor vehicle accident (3).

Avulsion fractures of tibial attachment are rare injuries and might be missed on initial evaluation (4). The treatment of tibial bony avulsion may vary from ORIF to arthroscopic fixation with screws or sutures (5, 6).

The arthroscopic techniques remain appealing but technically demanding and more expensive; therefore, ORIF of PCL avulsion fractures continue to be an important treatment option. Most reports on PCL insufficiency consider the problem of functional instability, and few emphasize the potential for early degenerative arthritis (7).

The aim of this study was to assess the result of PCL avulsion fracture managed with ORIF with cannulated cancellous screw.

Methods

This was a prospective study of 11 cases of isolated PCL

tibial avulsion injuries treated by ORIF with cannulated cancellous screw. The period of the study and follow-up extended from August 2019 to December 2020 in the Department of Orthopaedics, Jhalawar Medical College and Hospital, Jhalawar-Rajasthan, India. The study sample size was 11 patients, in which the patients with isolated PCL tibial avulsion fractures who satisfied the inclusion and exclusion criteria were included in the study. The patients were evaluated clinically and functionally at the time of examination. The study was approved by the Ethical Committee of the college.

Inclusion Criteria

1. Isolated PCL tibial avulsion fractures.
2. Age 18-55 years.
3. Injury with less than three weeks of duration.
4. Patients treated with ORIF with the cannulated cancellous screw.

Exclusion Criteria

1. Patients with associated any other ligament injury of the same joint.
2. Patients with any other bony injury of the same limb.
3. Patients with any medical co-morbidity precluding the surgery.
4. Infected knee joint.
5. Patients with conservative treatment, chronic fractures, and other types of fixation.

The injury was clinically diagnosed by examination like Lachman test and Varus and valgus stress in extension and 30 degrees of flexion. Plain radiographs were taken in



antero-posterior (AP) and lateral views. Computed tomography (CT) scan and magnetic resonance imaging (MRI) evaluations were performed to confirm the diagnosis, document the size of the avulsed fragment, and also rule out any associated lesions in the affected knee.

Operative Procedure: After taking informed and written consent from all patients, they took on the prone position on the operating table after spinal anaesthesia. A gently curved skin incision was made over the posterior aspect of the knee (Figure 1) as follows: starting laterally over the biceps femoris muscle, and bringing the incision obliquely across the popliteal fossa; turning downward over the medial head of the gastrocnemius muscle, and running the incision inferiorly into the calf; reflecting the skin flaps with the underlying subcutaneous fat; identifying the small saphenous vein as it passes upward in the midline of the calf; On the lateral side of the vein is the medial sural cutaneous nerve; incising the fascia of the fossa just lateral to the small saphenous vein; dissecting out the common peroneal nerve in a proximal to distal direction as it runs along the posterior border of the biceps femoris muscle.



Figure 1. Intraoperative image showing incision

The popliteal vein lies lateral to the artery as it enters the popliteal fossa from below. Then it curves, lying directly posterior to the artery while in the fossa. After protecting the neurovascular structure, detach the tendinous origin of the medial head of the gastrocnemius in the back of the femur to expose the posteromedial portion of the joint capsule. The posterior knee joint capsule was incised vertically to access the contents of the posterior intercondylar notch and tibial attachment of the PCL.

The avulsed tibial fragment was debrided if needed, the reduction was performed, and a guide wire was inserted. The avulsed fragment was fixed using a 4 mm cannulated cancellous screw. The wound was washed, cleaned, and closure was performed layer by layer.

Postoperatively, the limb was kept immobilized using a posterior long knee brace for 6 weeks. Quadriceps strengthening exercise was started from the 2nd postoperative day. Knee bending exercise was started after 2 weeks of surgery. Partial weight-bearing was allowed after 4 weeks and full weight-bearing after 6-8 weeks.

Return to heavy activities, such as running and sports, were allowed only after 4-5 months.

Clinical examination was conducted by the posterior drawer test, and radiological assessment was done carried out with AP and lateral radiographs of knee joint. Functional outcome was assessed by the Lysholm knee society scoring system and range of motion (ROM) of the knee joint.

Case 1

A case of a 35-year old man admitted to our institute with history of road traffic accident, complaining of pain at right knee. On clinical and radiologic examination, he was diagnosed with PCL tibial avulsion fracture (Figure 2).



Figure 2. Preoperative radiograph of a patient

He was managed with ORIF with cannulated cancellous screw (Figure 3).



Figure 3. Postoperative radiograph of the patient

The 3-month and 6-month follow-up outcomes are respectively presented in figures 4-8.

Results

We included a total of 11 patients, of who 9 were male and 2 were female.



Figure 4. Follow-up X-ray after 3 months from the surgery showing bone healing

In the present study, most of the patients, i.e., 5 (45.4%) were from the 26-35 years age group, followed by 3 (27.3%) from the 18-25 years, and 2 (18.2%) from the 36-45 years group.



Figure 5. Follow-up X-ray at 6 months of surgery showing bone healing



Figure 6. Clinical picture showing full range of motion (ROM) achieved after operative treatment at 6 months



Figure 7. Clinical picture showing full range of motion (ROM) achieved after operative treatment at 6 months



Figure 8. Clinical picture showing full range of motion (ROM) achieved after operative treatment at 6 months

The least was from the 46-55 years age group, as 1 (10.1%) (Figure 9).

■ Age group 26-35 years ■ Age group 18-25 years
 ■ Age group 36-45 years ■ Age group 46-55 years

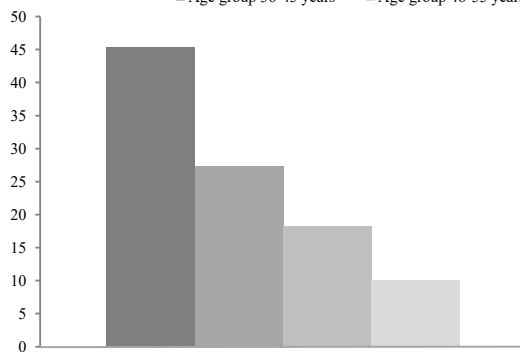


Figure 9. Bar graph of distribution by age

Male predominance was found in the study, as 9 (81.8%) patients were males and 2 (18.2%) were females. The male to female ratio was 4.5:1. Probably, it was because males are more frequently involved in sports and road traffic accidents (Figure 10).

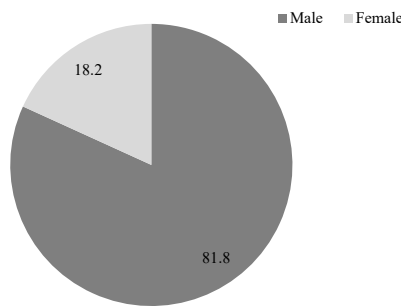


Figure 10. Pie chart of distribution by gender

The mechanism of injury was divided into three major categories, road traffic accidents (72.7%), domestic falls (18.2%), and sports injury (9.1%) (Figure 11).

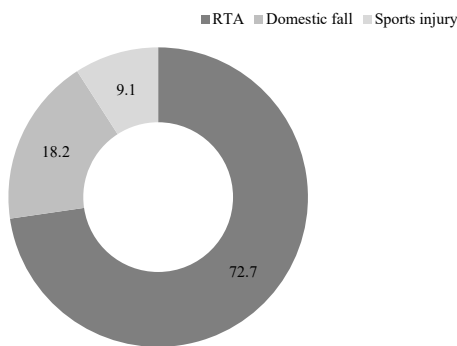


Figure 11. Doughnut chart of distribution by the mode of injury

Outcome evaluation after surgery was assessed by using the Lysholm knee scoring scale and ROM. The result was found to be excellent, good, and fair in 7 (63.6%), 3 (27.3%), and 1 (9.1%) patients, respectively (Table 1).

Lysholm knee scoring scale	n	Percentage
Excellent (> 90)	7	63.6
Good (84-90)	3	27.3
Fair (65-83)	1	9.1
Poor (< 65)	0	0.0
Total	11	100

Full ROM (140° degrees or more) was achieved in 8 cases, and in 2 patients, ROM was between 130-140°, and the remaining 1 patient had an ROM between 120° and 130°, which were clinically acceptable (Table 2).

ROM in degree	No. of patients
>140°	8
130-140°	2
120-130°	1

ROM: Range of motion

There were no major complications such as superficial and deep infection, deep vein thrombosis (DVT), or neurovascular deficit at the 6-month follow-up. 1 patient had knee joint stiffness on examination; however, no patient had any complaints of instability.

Discussion

Treatment of PCL tibial avulsion might be carried out conservatively or surgically (8). The conservative

treatment is immobilization by casting. However, nowadays, this method is left out since it shows poor results with a low functional score and a high incidence of nonunion (9, 10).

Surgical management included either arthroscopic fixation or ORIF. Although arthroscopy is considered the minimally invasive surgical approach, the surgical technique needs advanced instrumentation, a longer duration of surgery, a complicated surgical technique, and a long learning curve (11).

In our study, we operated on 11 patients with isolated PCL tibial avulsion injuries with ORIF using cannulated cancellous screws, and the results were excellent, good, and fair respectively in 63.6, 27.3, and 9.1% of the patients. These results were superior to those reported in previous studies.

Meyer reported poor functional outcomes in patients with bony PCL avulsion treated conservatively (4).

Excellent outcomes were reported by Seitz et al. in their case series of 26 patients treated for PCL bony avulsion managed with ORIF using screws and K-wires (12).

Piedade and Mischan showed excellent results in 53% and good in 47% in regards to the Lysholm knee scoring system of their cases where screws or polyester size 5 were used to fix the fracture (13).

Conclusion

Isolated PCL tibial avulsion fracture managed with ORIF with cannulated cancellous screw yields good stability and excellent clinical and radiological outcomes. Early mobilization, less hospital stay, and excellent stability offered by this treatment modality make it a promising method to deal with the challenging problem of isolated PCL tibial avulsion fracture.

Conflict of Interest

The authors declare no conflict of interest in this study.

Acknowledgements

None.

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