

Outcome of internal fixation of posterior cruciate ligament avulsion injury fixation

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ABSTRACT

Introduction: The posterior cruciate ligament (PCL) avulsion from tibial attachment can be managed by fixation with many techniques, in this study, open reduction and internal fixation with cannulated cancellous screws through posterior approach done and the radiological union and functional outcome was evaluated. **Methods:** Total 24 cases of PCL avulsion managed with fixation through posterior approach with cannulated cancellous screws over a period from February 5, 2017 to June 30, 2024 with the follow-up for 12 months was performed. The final outcome was evaluated on the basis of radiological union and Lysholm score. **Results:** In this study, the mean age was 33.91 years, male (75%) and female (25%) with most injuries on right side (79.16%). At the final follow-up for the mean duration of 13.1 months (SD=1.21 months) in all patients, fracture was united and all patient had full extension and mean flexion $125^{\circ} \pm 7.5^{\circ}$. The functional outcome assessed by the Lysholm scoring system was excellent in 17 patients, good in six patients and fair in one patient (average Lysholm score was 97 ± 7.6). Around five patients had residual pain and swelling in the joint and six the patients had mild (grade 1) instability tested clinically using the drawer test. **Conclusions:** Fixation of PCL avulsion was safely done with posterior approach and the results were excellent in terms of radiological union and function of the knee.

Keywords: Functional outcome, posterior approach to knee, posterior cruciate ligament avulsion.

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INTRODUCTION

The posterior cruciate ligament (PCL) is the strongest ligament of the knee inhibiting posterior translation of the tibia and providing rotational stability.¹ Isolated Posterior cruciate ligament injuries in knee joint account for 20% of total knee ligament injuries.² PCL injuries occur most commonly through posterior-directed forces applied to the tibia, such as motor vehicle dashboard injuries and sports-related mechanisms. While the majority of PCL injuries are intra-substance tears, a small subset of injuries involve avulsion fractures off the femoral or tibia attachment.³ More commonly at tibial-sided insertion.⁴ The tibial bony avulsion may be treated by ORIF or arthroscopic fixation with screws or sutures.⁵ The fixation of PCL avulsion is necessary as there can be functional instability and has potential for early degenerative arthritis.⁶ The aim of this study was to assess the result of PCL avulsion fracture managed with open reduction and internal fixation (ORIF) with cannulated cancellous screw.

METHODS

This was a prospective, interventional study done at College of Medical Sciences and Teaching Hospital, Bharatpur, Nepal. The necessary clearance from Ethical Committee of the Institution. All the cases presenting at our hospital with isolated PCL tibial avulsion within the period of February 5, 2017 to June 30, 2024 in Emergency room or outdoor patient department who satisfied the inclusion

and exclusion criteria were included in the study. Inclusion criteria were isolated PCL tibial avulsion fractures, age 18 to 55 years, injury with less than three weeks of duration. Exclusion criteria were, multi ligamentous injury of the same joint, any other bony injury of the same limb, pat medical co-morbidity precluding the surgery, bony avulsion very small to be fixed with screws ($<20\text{mm}^2$) and the patient having concomitant vascular injuries. The patients were counseled and explained regarding the procedure and informed consent was obtained. The relevant history of trauma, age, sex, side of the injured knee and all patients underwent thorough clinical examination. All the cases were clinically assessed by the drawer test to confirm PCL injury. The collateral ligaments were assessed with varus and valgus stress in extension and in 30 degrees flexion. The Dial test and external recurvatum test were performed to assess the associated posterolateral ligament complex insufficiency. Anteroposterior and lateral radiographs including the posterior stress view of the knee were taken to confirm the injury. (Figure 1) A computed tomography scan (Figure 2) was done for patients in whom the injury could not be defined well on radiographs. Magnetic resonance imaging (Figure 3) was done for every patient in order to confirm associated ligament injuries of the knee. All the patients were re-examined under anesthesia before doing surgical intervention.

All the patients were operated under spinal anesthesia. Patients were positioned prone on a radiolucent operating table with proper padding of the pressure areas and the affected lower extremity was held in 30° flexion at the knee joint over a bolster at ankle. Pneumatic tourniquet was used in some cases. Patients were operated using the modified posterior approach described by Burks and Schaffer.⁷ An inverted 'L' incision starting on the medial border of the gastrocnemius and curving along the flexor crease of the joint towards the lateral side. The fascia is incised in the line of skin incision and in the interval between the semimembranosus and gastrocnemius capsule of the joint is identified. The capsule was incised longitudinally, PCL along with the avulsed fragment was identified. The avulsed fragment was debrided if needed and reduced using a clamp. The fragments were stabilized temporarily with K wire, C-arm (fluoroscopy) was used to confirm the reduction and the avulsed fragment was fixed using one or two 4 mm cannulated cancellous screws with washers (Figure 4). Post-operatively, a long knee brace applied for six weeks. Quadriceps strengthening was started from the 2nd postoperative day. Suture removal was done after two weeks and passive knee ROM quadriceps exercises were advised. Partial weight bearing was allowed

after six weeks and then active knee exercises advised. Weight bearing gradually increased and full weight bearing allowed at 12 weeks unsupported. Contact sports and heavy physical exercises allowed after six months. Patients were regularly followed up every month for the first three months and every three months thereafter for a minimum of 12 months. At every follow-up, patients were assessed clinically and radiographically. Outcomes were assessed in terms of stability and range of motion (ROM). Stability was assessed clinically by the drawer test and radiologically by lateral X-ray. Final functional outcome was assessed using the Lysholm knee scoring scale.⁸ Any complication, wound infection, pre-existing medical illness or relevant past history were noted.

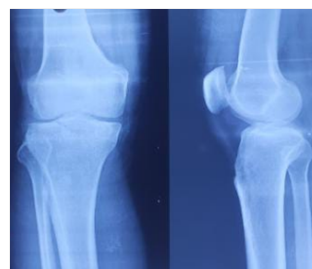


Figure 1: Pre-operative Xray

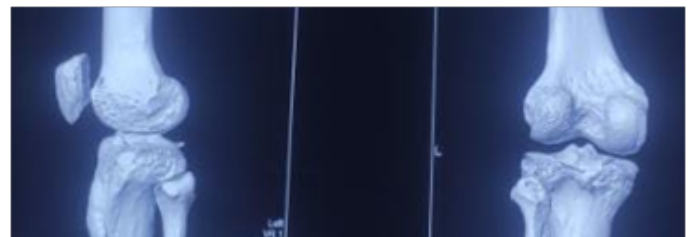


Figure 2: Post-operative Xray

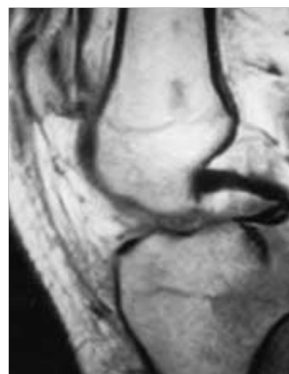


Figure 3: MRI showing PCL avulsion from tibial attachment



Figure 4: Post-operative Xray after fixation

RESULTS

In this study, 24 cases of PCL tibial avulsion were included satisfying the inclusion criteria. The majority of them were males (75%). The age-group ranged from 22 to 55 years (mean age 33.91 years). Most of the patients had injury on right side (79.16%). The most common mode of injury in this study was road traffic accidents (66.66%) followed by fall from height from height (20.83%) followed by two cases of sports related injury (8.33%) and one case (4.16%) due to physical assault was also included in this study. All these demographic data have been summarized as below. (Table 1) The mean operative time was 57.5 minutes (SD=15.81 minutes) with mean blood loss of 50 ml. All cases were operated under spinal anesthesia. The mean stay at hospital was three days. Total four cases had superficial surgical site infection treated with local wound care and appropriate antibiotics. Final follow-up was at the mean duration of 13.1 months. (SD=1.21 months)

Table 1: Sociodemographic information of the patients

Variables	Frequency (%)
Sex	
Male	18(75%)
Female	6(25%)
Age (years)	
18-25	6(25%)
25-40	18(75%)
Mode of injury	
Road traffic accident	16(66.66%)
Fall from height	5(20.83%)
Sports injury	2(8.33%)
Physical assault	1(4.16%)
Side of injured knee	
Right	19(79.16%)
Left	5(20.83%)

At the final follow-up, in all patients fracture was united. (Figure 5) At six weeks after surgery, after removal of knee splint, the ROM was 60° to 90° in 18 patients and remaining six patients had less than 60° ROM, but all regained more than 90° of flexion after more than six postoperative weeks. At the final follow-up, the all patient had full extension and mean flexion 125°±7.5°. The functional outcome assessed by the Lysholm scoring system was excellent in 17 patients, good in six patients and fair in one patient. The average Lysholm score was 97±7.6.5 patients had residual pain and swelling in the joint. No other complications were observed. Instability tested clinically using the drawer test found to be mild (grade 1) in six of the patients while the rest of the patients had no residual instability.

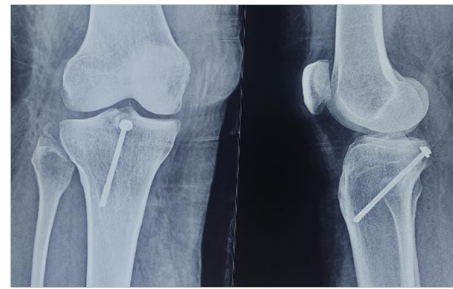


Figure 5: X-ray at final follow-up

DISCUSSION

PCL avulsion injuries are result of high velocity injuries and need fixation as PCL laxity has been associated with early degeneration of patelofemoral joint and cause knee pain.³ Various surgical approaches have been described for the fixation of PCL avulsion fractures. There were approaches described by Abbott et al.⁹ which was later modified by Trickey et al. but they required handling of vessels and division of the medial head of gastrocnemius which was having detrimental effect in outcome.¹⁰ Ogata et al. also described a procedure but it involved osteotomy of fibular neck which was complex procedure.¹¹ Burks and Schaffer approach⁷ was simplified and post-operative rehabilitation was quicker with good functional results. We had used this approach in the management of all the cases of PCL tibial avulsion injury.

Many authors had recommended application of cast for six weeks after fixation of PCL avulsion but there was stiffness as a major complication in their studies. Nicandri et al. had reported arthrofibrosis in only one of the ten cases when aggressive physiotherapy protocol was initiated instead of cast immobilization. They recommended the use of functional brace and early range of motion exercises to achieve good functional results.¹² The fixation of PCL avulsion is recommended always as conservative management by non-operative methods have poor functional outcome as shown in Meyer's study.⁴ In study done by Sachin et al., they had 14 cases fixed with canulated screws and excellent functional and radiological outcomes. They also noted some laxity in a case on follow up.¹³ In a study by Gopinath et al., he stated that both non-operative and surgical management of PCL tibial avulsion fractures resulted in high rates of fracture union and good functional outcome, non-operative treatment yielded a high side-to-side posterior displacement (>4 mm) with a lower rate of fracture union compared to surgical treatment.¹⁴ In our study, we had excellent functional outcome and radiological outcome which is similar to outcomes of many different studies done by Khatri et al.¹⁵, Ghilley et al.¹⁶

CONCLUSIONS

PCL avulsion can be managed by open reduction and internal fixation with cannulated cancellous screws with excellent radiological and functional outcomes. The posteromedial approach used here is safe and allows early rehabilitation with decreased stiffness and complication.

CONFLICTS OF INTEREST: None declared

SOURCE OF FINDING: None

AUTHORS' CONTRIBUTION

HKG designed the research, performed all the clinical and radiographic examinations and procedures, collected data, statistical analysis, and prepared the draft of the manuscript.

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