



OUTCOME OF ISOLATED CHRONIC PCL AVULSION FRACTURES TREATED WITH CANCELLOUS SCREW FIXATION

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ABSTRACT

PURPOSE: The most efficient treatment of chronic posterior cruciate ligament (PCL) avulsion is still debatable. The study was aimed at management of posterior cruciate ligament (PCL) avulsion fractures with delayed presentation more than 3 weeks with open reduction and internal fixation (ORIF). This study also evaluated the effect of delay in treatment and presence of occult PCL injury on the final outcome after surgery.

METHODS: 15 patients (12 males and 3 females) with a median age of 28 years (range: 19-45 years) who underwent ORIF through Burks posterior approach for PCL avulsion fractures were studied after a median follow up of 18 months (range 12-42 months). All the patient included in the study had delayed presentation minimum 3 weeks after injury (3 weeks to 6 months). Patients were assessed using Lysholm questionnaire, physical examination and radiological examination. For the statistical analysis, a significance level of 0.10 and 95% confidence interval were used.

RESULTS: The results were fair or good in patients with open reduction and cancellous screw fixation of PCL avulsion injury with delayed presentation and these results were found to be statistically significant.

CONCLUSION: The management of tibial chronic (delayed presentation) PCL avulsion fractures with the use of a cancellous lag screw and a washer by means of the posterior Burks approach leads to satisfactory clinical, radiographic, and functional results.

KEYWORDS : PCL avulsion, Screw fixation, Delayed presentation

Introduction:

Isolated bony PCL avulsion fractures are infrequent, estimated to account for 20% of knee ligament injuries. Anatomically PCL acts as a posterior knee stabilizer and limits the posterior tibial translation [1, 4, 5, 6]. The road traffic accidents (RTA), and sports injuries are common causes. The mode of trauma in PCL injuries is peculiar and comprises dashboard, hyperextension and hyperflexion injuries (1). Many studies [2, 3] have established that the chronic PCL insufficiencies lead to medial femoral and patellofemoral compartments, degenerative arthritis and increased risk of meniscal tears. Torisu et al [8] have quoted that PCL bony avulsion neglected beyond 11 weeks, have poor results. Griffith et al [9] strongly advocated fixation of displaced PCL avulsion fractures to avoid the morbidities associated with PCL avulsion fracture nonunion. Research advocate controversial treatment protocols in PCL tibial avulsion fractures but most studies advocate fixation of the avulsed fragment is a endorsed procedure [7, 8, 9, 10].

We centered our study explicitly on isolated bony PCL avulsion fractures so that we can preclude the compounding factors.

Methods:

This study included 15 patients (12 males and 3 females) with a median age of 28 years (range: 19-55 years). Ethical committee approval was taken prior to the study protocol application and consent was taken from all the patients.

Study sample size: 15 patients.

Inclusion criteria:

- 1) Isolated PCL avulsion fractures with Chronic (delayed presentations > 3 weeks) as confirmed with CT and MRI.
- 2) Skeletally mature knees.

Exclusion criteria:

- 1) Multi ligamentous knee injuries
- 2) Fracture dislocations around knee
- 3) Arthritic knees with PCL avulsion fractures

- 4) Poly-trauma patients
- 5) Skeletally immature patients
- 6) Prior knee surgery

At the time of presentation in casualty/OPD all patients were examined thoroughly for vital signs, distal neurovascular examination was done and monitored for the compartment syndrome signs.

Standard antero-posterior and lateral radiograph views of affected knees were obtained to figure out the major fractures associated. Subsequently all patients underwent CT and MRI scans to rule out any concomitant injuries in the knee joint thereby excluding any additional tear of extra-articular ligaments.

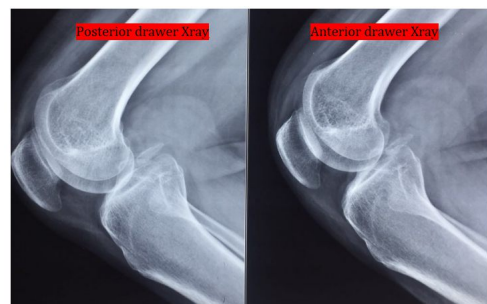


Figure: 1 Preoperative Knee x-ray lateral view showing posterior tibial subluxation and avulsed fragment of PCL

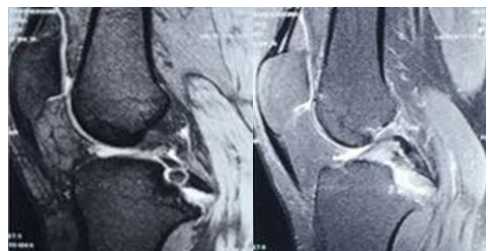


Figure: 2 Preoperative Knee MRI images showing intact PCL substance and avulsed fragment of PCL



Figure: 3 Immediate Post-operative X-ray showing well reduced avulsion fragment and no subluxation of tibia



Figure: 4 Immediate Post-operative X-ray showing well reduced avulsion fragment and no subluxation of tibia.

All surgeries were performed under regional anesthesia. All surgeries were performed under tourniquet in prone position. We utilized a standard Burks [11] and Schaffer’s approach. By protecting the medial sural cutaneous nerve, the interval between the medial gastrocnemius and the semimembranosus tendon was developed and the posterior joint capsule was exposed. As the capsule was exposed, the medial head of the gastrocnemius protected the neurovascular structures.

Length of the incision varied from 6 to 8 cm. The incision was L shaped long enough to negotiate the cancellous cannulated screws with washers. All the cases were fixed with two screws with washers. Three cases needed multiple punctures in PCL substance to reduce the shortening due to possible fibrosis as described by Dhillon et al (12).

The avulsed PCL bed was debrided of soft tissue before fixation. The posterior capsule was incised longitudinally in line with PCL. Screws position was confirmed under image intensifier in each case.

Post-operatively the patients were given compressive bandage dressing and knee immobilizer. Static and dynamic quadriceps exercises and ankle mobilization was started as soon as patient’s recovery and pain permitted, usually from second postoperative day. Non-weight bearing walking was permitted. Suture removal was done on postoperative day 14. 1st Follow up was on 14 post-operative days after the patient was discharged for suture removal.

Subsequent follow up was conducted regularly at an interval of 4-6 weeks in the OPD. At follow up, a thorough clinical evaluation was done for progress of union and for joint range of motion. Partial weight bearing walking was allowed after 4 weeks followed by full weight bearing walking at the end of 6 weeks unless the X-rays showed delayed Union wherein the weight bearing was further delayed by additional 2 weeks. Range of motion exercise was started after two weeks, passive first, active assisted later after four weeks. Active knee bending was allowed thereafter.

At follow up, the standard X-rays were done and the Lysholm and IKDC score was evaluated up to 8 months, 12 months and 24 months post surgery

Clinical

- 1. Lysholm score.
- 2. IKDC score

Radiological Status: -

- 1. Union status
- 2. Position of screw

Assessment Criteria

All patients were reviewed in OPD clinic and radiographs were obtained immediately post operatively and then at 6 weeks, three months, 12 months and 24 months. From 3 months onwards symptoms and functions were assessed using the scoring system of Lysholm and IKDC score.

Results:

1) Age wise distribution

- Patients were of age group between 19-45 years.
- Median age 28 years (range: 19-55 years)

2) Sex distribution

- The males were 80% (12 out of 15) as compared to the females who amounted to 20% in this study.
- There was definite male preponderance.
- The reason for male dominance is due to the road traffic accidents and injuries in sports. The domestic falls were common among females.

3) Mode Of Injury

- 60% had dashboard injuries, and 26.67% had hyperextension and 13.33% had hyper-flexion injury.
- Road traffic accident dashboard type was the main cause to produce PCL avulsion fractures in our study. 9
- Other cause is fall from hyperextension 4 or hyper-flexion 2 involving either of trauma due to vehicular accident, sports or domestic injury.

4) Comparison of IKDC, Lysholm scores preoperatively and post operatively.

LYSHOLM SCORE		IKDC SCORE	
PRE-OP	POST-OP	PRE-OP	POST-OP
23.44	84.7	28.8	85.0

4) Preoperative and Postoperative posterior drawers tests. in the 15 cases

- Preoperative testing showed that all three groups had posterior sag and the drawer test was positive either in grade 1, 2 or 3.
- None of PCL avulsion fractures had normal anterior tibial offset.

	GRADE 0	GRADE 1	GRADE 2	GRADE 3
PDT PREOP	0	2	8	5
PDT POST OP	11	3	1	0

5) Radiological fracture union

Table 1: Time for fracture union.

- Majority 12 out of 15 of the fracture united radiologically within 12 weeks.
- 3 out of 15 of cases developed delayed union although when followed up to 20 weeks showed radiological union without any further intervention.

TIME	NO. OF PATIENTS	PERCENTAGE
0 TO 12 WEEKS	12	80
12 TO 16 WEEKS	0	0
16 TO 20 WEEKS	3	20
TOTAL	15	100

14) Complications

Table 2: Complications found in the present study.

COMPLICATIONS	NO. OF PATIENTS
Difficulty in squatting	02
FFD up to 5 degrees	2
Delayed union	3
Delayed wound healing	1
Superficial Stitch infection	1

There were 2 cases of restricted full flexion with difficulty in deep squatting movement.

There was 1 case with superficial skin stitch infection both of which healed uneventfully after minor debridement.

Discussion: In our study most patients were of age group between 19-45 years with median age 28 years (range: 19-45 years). The males were 80% (12 out of 15) as compared to the females who amounted to 20% in the study.

Seitz et al in his retrospective study of 26 patients reported mean age of 23 years and 73% males (13). Torisu et al had 76% males in his study of 21 patients with PCL tibial avulsion fractures (8). R Piedade et al in 2007 reported ages from 15 to 53 years with a mean of 29 years also having predominantly males (76%) (14). There was definite male preponderance. The reason behind male dominance is obvious due to the road traffic accidents and involvement in sports.

The mechanism of injury was 60% had dashboard injuries, and 26.67% had hyperextension and 13.33% had hyperflexion injury. As compared to our study, Torisu et al (8) in his study of 36 patients found 47 % anterior tibial injury suggesting of dashboard type whereas in the retrospective study [13] by Seitz et al found 87% to be dashboard type with all these patients having pretibial ecchymosis. [14] In R Piedade et al 2007 case series, 57% of the injuries were resultant from motorcycle accidents, and 17% have been caused by car accidents, while the presence of injury on the anterior leg surface was found in 62% of the cases.

There are few studies of delayed presentations of PCL avulsion fractures (7,8,10,15, 16). Surgical repair after 3 weeks is not considered to be worthwhile in some studies(17,18). However, delayed presentation does not necessarily contraindicate open reduction and internal fixation, which achieves best clinical outcome for acute cases(<3 weeks)(19). The posterior burks approach is commonly used despite technical difficulties(7,8,10). Fixation with a lag screw, staple, or suture achieves good outcome in acute cases(7,10).

15 cases of delayed presentations (> 3 weeks) of PCL avulsion fractures were repaired surgically and achieved complete resolution of symptoms, although 2 of them had residual anteroposterior instability.

Two of our patients had residual anteroposterior instability of 4 to 5 mm, but had good to fair functional outcome at the final follow-up. Their preoperative magnetic resonance images showed abnormal density in the PCL substance, probably owing to strain of the PCL fibres or partial tear.

Nonetheless, in one study 10 patients achieved good to excellent functional outcome after lag screw fixation despite residual anteroposterior instability (mean laxity, 2.4 mm), and their mean Lysholm score was 91 (20).

In another study, 3 patients had a laxity of 3 to 4 mm, but their functional outcome was good, with the time to union being 7 to 9 weeks (15). The healing time and functional outcome were similar to our series.

One limitation of our study was the small sample size for subgroup analysis. The method of treatment was not randomised and mainly based on the characteristics of the soft tissues and fractures.

Conclusions: The isolated PCL avulsion fractures with delayed presentations >3 weeks treated with primary fixation by ORIF and Cancellous screw fixation tend to have good Lysholm and IKDC scores, although objective laxity is present in significant number of cases without subjective disability.

REFERENCES

1. Veltri DM, Deng XH, Torzilli PA, Warren RF, Maynard MJ. The role of the cruciate and posterolateral ligaments in stability of the knee. A biomechanical study. *Am J Sports Med.* 1995; 23:436-43.
2. Boynton MD, Tietjens BR. Long-term followup of the untreated isolated posterior cruciate ligament deficient knee. *Am J Sports Med.* 1996; 24:306-310.
3. Dandy DJ, Pusey RJ. The long-term results of unrepaired tears of the posterior cruciate ligament. *J Bone Joint Surg Br.* 1982; 64:92-4.
4. O'Donoghue DH. Surgical treatment of fresh injuries to the major ligaments of the knee. *J Bone Joint Surg Am.* 1950; 32:721-38.
5. Hughston JC. The posterior cruciate ligament in knee joint stability. *J Bone Joint Surg Am.* 1954; 54:1045-6.
6. Miyasaka KC, Daniel DM, Stone ML. The incidence of knee ligament injuries in the general population. *Am J Knee Surg.* 1991; 4:3-8
7. Torisu T. Isolated avulsion fracture of the tibial attachment of the posterior cruciate ligament. *J Bone Joint Surg Am.* 1977; 59:68-72.
8. Torisu T. Avulsion fractures to the tibial attachment of the posterior cruciate ligament: indications and results of delayed repair. *Clin Orthop Relat Res.* 1979; (143):107-14.
9. Griffith JF, Antonio GE, Tong CWC, Ming CK. Cruciate ligament avulsion fractures. *Arthroscopy.* 2004; 20(8):803-12.
10. Meyers MH. Isolated avulsion of the tibial attachment of the posterior cruciate ligament of the knee. *J Bone Joint Surg Am.* 1975; 57:669-72
11. Burks RT, Schaffer JT. A simplified approach to the tibial attachment of the posterior cruciate ligament. *Clin Orthop*
12. Dhillon et al. Posterior cruciate ligament avulsion from the tibia: Fixation by posteromedial approach. *Acta Orthopaedica Belgica.* 2003; 69:2. 1990; 254: 216-219
13. Seitz H, Schlenz I, Pajenda G, Vecsei V. Tibial avulsion fracture of the posterior cruciate ligament: K-wire or screw fixation? A retrospective study of 26 patients. *Arch Orthop Trauma Surg.* 1997; 116:275-8.
14. R Piedade , M M Mischan. Surgical treatment of avulsion of the knee PCL tibial insertion: experience with 21 cases. *Acta Orthop Bras.* 2007; 15(5): 272-275.
15. Zhang CL, Xu H, Li MQ. Posteromedial approach of gastrocnemius for reduction and internal fixation of avulsed tibial attachment of posterior cruciate ligament. *Chin J Traumatol* 2006; 9:25-8.
16. Lysholm J, Gillquist J. Evaluation of knee ligament surgery results with special emphasis on use of a scoring scale. *Am J Sports Med* 1982; 10:150-4.
17. Trickey EL. Rupture of the posterior cruciate ligament of the knee. *J Bone Joint Surg Br* 1968; 50:334-41.
18. Kennedy JC, Grainger RW. The posterior cruciate ligament. *J Trauma* 1967; 7:367-77.
19. Bali K, Prabhakar S, Saini U, Dhillon MS. Open reduction and internal fixation of isolated PCL fossa avulsion fractures. *Knee Surg Sports Traumatol Arthrosc* 2012; 20:315-21.
20. Chiarapattanakom P, Pakpianpairoj C, Liupolvanish P, Malungpaishrope K. Isolated PCL avulsion from the tibial attachment: residual laxity and function of the knee after screw fixation. *J Med Assoc Thai* 2009; 92 Suppl 6: S181-8.