



Evaluation of patients treated with single bundle transtibial posterior cruciate ligament reconstruction using hamstring autograft: A retrospective study

Dr. Santosh Kumar Sahu

Assistant Professor, Department of Orthopaedics, IMS & SUM Hospital, Bhubaneswar, Odisha, India

Abstract

Objective: To retrospectively evaluate the functional outcome after arthroscopic single bundle posterior cruciate ligament (PCL) reconstruction in patients with PCL injuries with single bundle autogenous hamstring graft using International Knee Documentation Committee (IKDC) subjective knee evaluation and Lysholm Knee scoring scale.

Methods: This was a retrospective study of 42 patients who underwent arthroscopic PCL reconstruction. This study was a retrospective observational analysis on a series of 42 patients who underwent primary posterior cruciate ligament reconstruction for isolated grade III and above PCL injuries. The diagnosis was mainly based on clinical tests demonstrating the signs of posterior and rotational knee laxity (Sag test, Posterior drawer test, Lachman Test) and subjective complaints of the patients reporting instability of the affected knee. The mean age was of 34.79±6.88 years (range: 15 to 65), with male predominance 39 (92.85%) and twenty four cases left shoulders, with RTA (28:65.11%) being the most common mode of injury. Arthroscopic PCL reconstruction was performed in all patients after a mean of 15.5 months of injury (range: 2wks to 33 months) with a mean follow-up of 20.9months (range: 8to38months).

Results: There was a significant difference between the pre-and postoperative functional outcome ($p < 0.001$). The Lysholm score at final follow-up was 90±3.87(range:81-96) compared to a preoperative score of 71±6.70(range:42-78). The IKDC score at final follow-up was 90±3.65(range:80-95), compared to a preoperative score of 71±7.62(range:42-77).

Conclusion: Thus it can be concluded that transtibial single bundle PCL reconstruction with hamstring graft resulted in satisfactory clinical, function all outcomes.

Keywords: PCL, hamstring graft, transtibial, arthroscopy

Introduction

Injuries to the posterior cruciate ligament (PCL), once considered a rarity, reportedly have an incidence that varies between 3% of all ligament injuries in the general population and 37% of all ligament injuries in an emergency room trauma setting [1, 3, 4, 5]. Nevertheless, research into the treatment of PCL injuries is sparse compared with studies of anterior cruciate ligament (ACL) injuries. Whereas there is an established “gold standard” for ACL reconstruction, there is no such model for the surgical treatment of PCL injuries. In fact, there is significant controversy regarding the surgical indications for PCL reconstruction. No studies to date have shown that reconstructing the PCL in isolated injuries alters the natural history of PCL deficiency. In the past 2 decades, there has been an increase in both basic science research detailing the anatomy and biomechanics of the native posterior cruciate ligament (PCL) and outcome studies evaluating management of the ruptured PCL. While the methodology of the latter continues to improve, results based on the current level of evidence must be interpreted cautiously [2].

Aims and objectives of the study

To evaluate the functional outcome after arthroscopic single bundle posterior cruciate ligament (PCL) reconstruction in patients with PCL injuries with single bundle autogenous

hamstring graft using International Knee Documentation Committee (IKDC) subjective knee evaluation and Lysholm Knee scoring scale.

Materials and method

This study was a retrospective observational analysis on a series of patients who underwent primary posterior cruciate ligament reconstruction for isolated grade III and above PCL injuries. The study was conducted at the Dept. of Orthopaedic surgery, IMS & SUM Hospital, Bhubaneswa from 2013 to 2018 on 42 patients admitted as in patients for surgical management of their posterior cruciate ligament tear and consequent signs of laxity. The diagnosis was mainly based on clinical tests demonstrating the signs of posterior and rotational knee laxity (Sag test, Posterior drawer test, Lachman Test) and subjective complaints of the patients reporting instability of the affected knee. Pre operatively, hamstring and quadriceps function in terms of power as compared to the opposite limb was evaluated. Patients with ≥ 1 grade power difference were essentially put on a graded quadriceps strengthening exercise protocol for one months. In order to preserve homogeneity of cases, patients with concomitant postero-lateral corner injury, other ligamentous or meniscal injury, or osteoarthritis grade III-IV were excluded. We

recorded postoperative complications, clinical and functional outcome measures. All patients with age between 15-65 years, Injury of single side (patients with meniscal/PLC injury), willing to Participate in at least two follow up visit out of which one should be the 1st visit. were included in the study. Patients with other concomitant bony injuries of the lower limb that would impede the normal rehabilitation protocol, history of prior reconstruction of PCL or other knee surgeries in the same limb were excluded. After admission, demographic variable of the patients namely name, age and sex were recorded. Also noted were the chief complaints, mechanism of injury, time since injury, history of associated injury incurred and treatment history. A clinical assessment of the posterior and rotational laxity (with sag test, Lachman & posterior drawer Test) was made. The posterior excursion of the tibia on performing posterior drawer test, Lachman test were graded as grade 1: ≤ 5 mm, grade 2: >5 mm and <10 mm, grade 3: >10 mm and <15 mm, grade 4: >15 mm. Anterior drawer test, Lachman test, pivot shift test were performed to rule out ACL injury. Similarly Mc Murrays test and Valgus and Varus strain test was performed to assess themeniscal, medial collateral ligament and lateral collateral ligament respectively. The range of motion of the normal knee and the abnormal knee was recorded for further reference. The Lysholm score was used to assess the functional knee outcome after and before the surgery. Because both these test are altered by the post-operative rehabilitation protocol the scoring was done once before the operation and second time at around 9 months. In the absence of pre-operative clinical and functional knee scores, the statistical analysis looked at the relationship between post reconstruction clinical and functional outcomes and other variables, namely, length of follow-up and time interval between injury and reconstruction. A diagnostic arthroscopy was done initially to confirm the diagnosis and to look for other concomitant pathologies of the knee. In the wake of meniscal, ACL, PLC injuries, these pathologies were first addressed before proceeding on to PCL reconstruction. 14 patients not meeting the inclusion criteria were excluded from the study out of which 8 were those who defaulted in the follow up visit, 2 had concomitant ACL injuries, 2 had collateral ligament injuries and 1 patient had history of patella fracture which was operated 2 years back.

Surgical Technique

Harvesting of the Hamstring graft: Through a vertical incision on the proximal medial tibia hamstring tendons (gracilis and semitendinosus) were obtained as free grafts. Graft prepared for a size of 7-8 millimetre and length of about 10-11 millimetres. The hamstring tendons were harvested through a 3 to 4-cm vertical skin incision placed 2 cm medial to the tibial tubercle across the top of the pes anserinus. Both tendons were delivered out of the wound with a curved clamp, their distal expansion to the crural fascia was severed and the tendons were stripped to the proximal musculotendinous junction with a 7.5mm closed, smooth tendon stripper. The distal ends of the tendons were left attached to bone and fascia. Retained muscle and fat tissue were

removed by blunt dissection with a periosteal elevator, and number-1 Vicryl absorbable sutures were sewn to the tendon ends. In order to taper the tendons when tension was applied to the sutures, one-quarter of the circumference of each tendon was encircled with each throw of the suture to achieve a crisscrossing Chinese fingertrap pattern. The midpoint of both tendons was then looped over a single suture. This suture was used to pull the four-bundle graft through a series of calibrated cylinders. The diameter of the snugest-fitting cylinder defined the diameter of the four-bundle graft and the size of the cannulated reamer used to drill a snug bone tunnel. Fifteen (35.7%) were treated with a 8-mm graft; 18 knees (42.85%), with an 9-mm graft; and 9 (21.4%), with a 10-mm graft. Once prepared, the graft was rolled up and placed under a mop soaked with normal saline to avoid contamination before insertion.

The operative technique consisted of routine examination under anaesthetic and arthroscopy for the confirmation of diagnosis and any other concomitant injuries using standard antero-lateral and antero-medial portals. A postero-lateral portal was created to resect the torn posterior cruciate ligament and define the tibial and femoral PCL footprints. Through a vertical incision on the proximal medial tibia, hamstring tendons (gracilis and semitendinosus) were obtained as free grafts. Using a drilling guide (Linvotec™ tibial drilling guide), the tibial tunnel was made over a guide wire. The aiming guide was positioned on the PCL footprint on the posterior tibia under direct 70° arthroscope and the drill sleeve positioned on the anteromedial aspect of the proximal tibia. A cannulated reamer was used to create the tibial tunnel, with a curette positioned through the postero-lateral portal to protect the posterior neurovascular substructures. Tunnel edges were chamfered with PCL instruments rasps, and the resulting 45° angled tibial tunnel provided a smoother turn of the graft. The tunnel opens at the isometric point under direct vision of a 70° arthroscope. Similarly the femoral tunnel guide pin was inserted under direct vision of a 70° arthroscope, with the entry point aimed at the centre of the PCL stump. A cannulated reamer was used over the guide pin while employing a curette to protect the anterior cruciate ligament (ACL) and chondral surfaces. The intra-articular openings of the tunnel were chamfered, An important step to prevent damage of the graft. The two tendons were looped into four strands and railroaded as a single bundle from the tibia to the femoral tunnel with the help of a suture passer and traction suture. The looped ends of the graft were fixed to bone with the help of bio absorbable interference screws. The basic tibial and femoral tunnel placement and drilling was done under arthroscopic visualization using the respective zigs for the purpose. In all cases the tibial tunnel was drilled upto 8-10mm diameter and the femoral tunnel was drilled either upto 8-10mm. After the operation a fixed knee brace (long type) was used over the 3-4 layered Jones compression bandage. A post operative X ray was ordered. Graft position was confirmed under arthroscopic direct vision. Postoperative rehabilitation patients were encouraged for passive movements and prone knee bending for 12 hours then discharged from hospital at about 24 hours when mobilising independently on crutches.

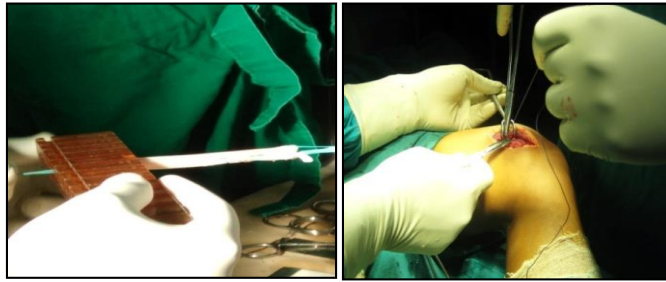


Fig 1a, b: Hamstring graft preparation.

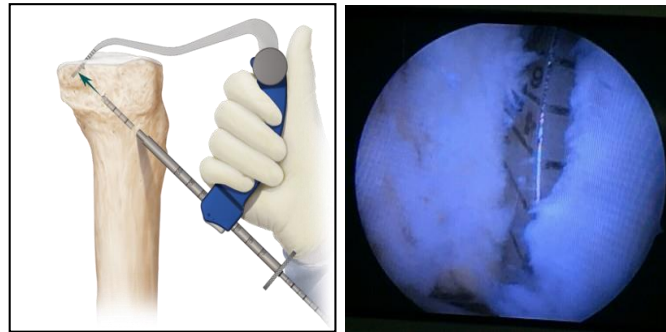


Fig 2a, b: Placement of tibial jig

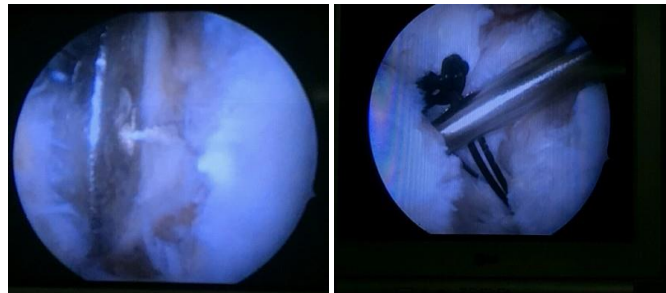


Fig 3a, b: Tibial tunnel preparation



Fig 4a, b, c: femoral tunnel preparation

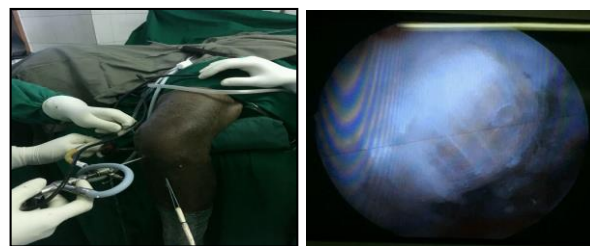


Fig 5 a, b: Advancement of graft

Postoperative Management

The knee was braced in extension for 4 weeks, supporting the tibia with a bump to prevent posterior translation and excessive stress on the graft. Partial weight bearing as tolerated and quadriceps exercises start on the first postoperative day. Closed chain exercises start at approximately 6 weeks, followed by proprioceptive training at 12 weeks, increasing knee stability. Patients are progressed slowly through passive flexion exercises in the early postoperative period and, in most cases, regain full flexion in 5 to 7 months. Hamstring exercises are delayed for 4 months, because they place excessive posterior loads on the tibia during the early stages of graft healing. Light jogging begins at 6 months. The patient is allowed to return to full activities 9 to 12 months after surgery, depending on the individual demands of daily activity and the progression of physical therapy. The goal of rehabilitation is to achieve adequate knee contralateral leg.

Data analysis

All the data were compiled in a tabulated manner. A professional statistics analysis software “WINKS SDA version 6.05 :Texasoft inc” was used to analyse the data and calculate the Mean/median /variance/standard deviation ect as per the requirement and nature of the data. The provision for exclusion of missing data during calculations present in the software were used. Test of significance: The Mann Whitney U test was used for continuous and non continuous variables. The Wilcoxon signed rank t test was used for comparison of pre and post operative values within a group. Initially “the test for equality of variance was done to assess the correct version of independent t test to be used for the result. In cases where the P value for equality of variance was >0.05 the equal variance t-test was used as a test for significance. For all calculations the confidence limit was set to 95% and p value<0.05 were considered significant.

Result analysis

Table 1: Age the mean age was 34.79 years with range of 15-65 years and standard deviation of 6.88 years overall.

	Frequency	Percentage
<25 years	9	21.42
25-35 years	18	42.84
35-45 years	6	14.28
>=45 years	9	21.42
Total	42	100

Table 2: (Sex) out of 42patients 39 were males and 3 were females.

	Frequency	Percentage
Male	39	92.85
Female	3	7.15
Total	42	100

Table 3: Side involved

	Frequency	Percentage
Right	18	42.85
Left	24	57.14
Total	42	100

Table 4: Mechanism of injury

MOI	Numbers
RTA	28
ADL related	9
Sports related	6
Others	0

RTI were by far the most common mode of injury (28 patients: 65.11%) followed by slips or falls during activities of daily living (9 patients20.9%) followed by sports related injuries (6 patients 13.95%).

Injury operation interval (in months)

<1month	12
1-3 months	15
3-6 months	6
6-12 months	6
>12months	3

Table 5: Showing Preoperative Posterior drawer grade

Grade	Number	Percent
I	3	7.14
II	15	35.71
III	21	50
IV	3	7.14

Table 6: Showing final follow up Posterior drawer grades

Grade	Number (n=36)	Percent
I	33	91.66
II	3	8.33
III	0	0
IV	0	0

Table 7: (Lysholm score)

Time	Number	Median	Range	SD
Pre-operative	42	71	41-78	7.62
Final follow-up	36	90	81-96	3.87

Table 8: IKDC Score

Time	Number	Median	Range	SD
Pre-operative	42	71	42-77	6.70
Final follow-up	36	90	80-95	3.65

Subjective assesment of the patients: VAS score.

Table 9: VAS 1:“Are you happy that you got yourself operated for your problems”? The answer to which were asked in affirmation or negation (yes/no)

Response	Number(n=36)	Percent
Yes	33	91.66
No	3	8.33

Table 10: VAS 2: “how much on scale of 0- 100 (with 0 being the worst possible score and 100 being the best possible score) would you rate this operation in fulfilling the expectations you had when you decided to get yourself operated?”

Number(final follow-up)	Median	Range
n=36	87	25-100

Complications

Peroperative period was uneventful in all our cases. As all the surgeries were done by an experienced and highly skilled surgeon of our institute. Post operatively, Superficial infection was observed in 1 patient which was managed with dressing of the wound and oral antibiotics and none of the patients required any alternative treatment for their infection.

Discussion

Arthroscopic posterior cruciate ligament reconstruction is a surgically demanding procedure aimed at restoring normal knee kinematics and function. Isometric reconstruction and potential risk of injury to the posterior neurovascular bundles create potential complications. In this study, we evaluated the performance of single bundle transtibial hamstring autograft PCL reconstruction in a patient population with isolated grade III and above PCL injury. We found satisfactory long-term clinical and functional results without significant complications. There is a paucity in the level of evidence present in the relevant literature, and studies on isolated PCL injury are rare and often with small sample size. The largest sample size study we identified reported on 32 cases [6]. Studies which used similar graft material, graft preparation and surgical technique showed comparable results [7]. In a recent review Hammoud and colleagues reported satisfactory results in isolated PCL reconstruction with a return to preinjury activity level of 50–82 % [7]. Several graft options are available for PCL reconstruction: hamstring, patellar, Achilles, synthetic, and cadaveric grafts [8]. The surgical reconstruction described relied on the use of autologous four strand hamstring graft because of its strength, its biological bulk and the belief that it has a greater resistance at the killer bend [10]. There is also a lack of prospective studies supporting superiority of transtibial versus tibial inlay techniques; the evidence available suggests satisfactory results in both approaches and choice is often due to surgeons experience [9]. Chamfering the sharp edges of the bone at the entrance of the tunnels in our experience helps reduce risk of reconstruction failure by graft abrasion without the need to alter the graft position angulation or tibial tunnel route suggested in other studies [10]. The average interval of time between the injury and reconstructive surgery in this study was of 15.5 months. Although no other study had previously looked at the impact of this variable, it is widely accepted that earlier reconstruction may be associated with better outcomes overall due to the preservation of posterior soft tissue tensile integrity [8]. Our study showed no significant relationship between timing of surgery and clinical and functional outcomes. Our postoperative rehabilitation consisted of a standard fast track programme without the use of a knee brace or support. Despite this rapid

rehabilitation, our results were consistent with the often recommended protected postoperative rehabilitation [11]. The results reported in our study demonstrate a very good overall restoration of knee kinematics and function on both objective and subjective scales. Results of subjective perception of normality level in relation to the contralateral uninjured side were 100 % in 18 patients, 80–99 % in 15 patients, 60–79 % in two patients and 40 % in one patient, with a mean perceived percentage of normality on the operated knee of 87 %. In relation to occupational history, none of the patients were heavy manual workers. There were 30/36 sedentary workers and 6 light manual workers. Post PCL reconstruction, 33 patients remained at the pre-injury level of occupation, and 3 reduced their level of occupation. In addition, 12 patients regularly played contact sports and 21 light sports such as badminton, golf. At the final review, 12 patients continued in their chosen sport, whereas 3 patients reduced their level of sporting pursuit. The principal weaknesses in this study are the small sample size. Based on our results however, we conclude that it is possible to achieve satisfactory objective and subjective outcomes with arthroscopic posterior cruciate ligament reconstruction using four strand hamstrings tendon graft even in the long term. Arthroscopic single bundle transtibial PCL reconstruction offers similar clinical and functional outcomes to other techniques previously described. Taking into account the limitations of our study, larger prospective studies are needed to delineate the differences between the various treatment approaches and ultimately make firmer recommendations on future treatment options.

Conclusion

Thus it can be concluded that transtibial single bundle PCL reconstruction with hamstring graft resulted in satisfactory clinical, functional outcomes.

References

1. Clancy WG, Shelbourne KD, Zoellner GB, *et al.* Treatment of knee joint instability secondary to rupture of the posterior Cruciate ligament: Report of a new procedure. *J Bone Joint Surg Am.* 1983; 65:310-322.
2. Dandy DJ, Pusey RJ. The long term results of unrepaired tears of the posterior cruciate ligament. *J Bone Joint Surg Br.* 1982; 64:92-94.
3. Fanelli GC, Edson CJ: Posterior cruciate ligament injuries in trauma patients. Part II. *Arthroscopy.* 1995; 11:526-529.
4. Fanelli GC, Giannotti BF, Edson CJ. Current concepts review. The posterior cruciate ligament: Arthroscopic evaluation and treatment. *Arthroscopy.* 1994; 10:673-688.

5. Miyasaka KC, Daniel DM. The incidence of knee ligament injuries in the general population. *Am J Knee Surg.* 1991; 4:3-8.
6. Kim YM, Lee CA, Matava MJ. Clinical results of arthroscopic single bundle transtibial posterior cruciate ligament reconstruction: a systematic review. *Am J Sports Med.* 2011; 39:425-434.
7. Hammoud S, Reinhardt KR, Marx RG. Outcomes of posterior cruciate ligament treatment: a review of the evidence. *Sports Med Arthrosc.* 2010; 18(4):280-291.
8. Fanelli GC, Beck JD, Edson CJ. Current concepts review: the posterior cruciate ligament. *J Knee Surg.* 2010; 23(2):61-72.
9. May JH, Gillette BP, Morgan JA, Krych AJ, Stuart MJ, Levy BA. Transtibial versus inlay posterior cruciate ligament reconstruction: an evidence-based systematic review. *J Knee Surg.* 2010; 23(2):73-79.
10. Huang TW, Wang CJ, Weng LH, Chan YS. Reducing the "killer turn in posterior cruciate ligament reconstruction. *Arthroscopy.* 2003; 19(7):712-716.
11. Fanelli GC. Posterior cruciate ligament rehabilitation: how slow should we go? *Arthroscopy.* 2008; 24(2):234-235.