RESEARCH ARTICLE

Clinical and Radiological Outcomes Following Arthroscopic Dual Tibial Tunnel Double Sutures Knot-bump Fixation Technique for Acute Displaced Posterior Cruciate Ligament Avulsion Fractures

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Abstract

Background: Many fixation options (Open and arthroscopic) are described for Posterior Cruciate Ligament avulsion (PCL) fractures. In this retrospective series, we evaluated functional and radiographic outcomes following arthroscopic dual tunnel double sutures knot bump technique for acute PCL tibial end avulsion fractures.

Methods: 23 patients with acute PCL avulsion fractures who were operated between 2009 and 2016 by Arthroscopic dual tunnel double sutures technique at a minimum of two years of follow-up were included in the study. Clinical outcomes were measured by Lysholm and International Knee Documentation Committee (IKDC) scores. The radiographic assessment included union status of fracture, the grade of osteoarthritis, and knee laxity.

Results: The mean age of patients was 34.43 years (range, 18-54 years) with a mean follow up of 52.8 months (36-94 months). At the final follow-up, mean subjective IKDC and Lysholm scores were 82.71 (range, 65.5-100) and 95.82 (range, 81-100), respectively. On the IKDC objective scale, ten patients (43.47%) were graded as A, 11 patients [47.82%] as grade B, and two patients as grade C [8.7%]. On kneeling stress view, knee laxity in 21 patients (91.3%) was graded 0, and the remaining two as grade I and II. The fracture had united in all cases by the end of 12 weeks except one which had non-union. 21 patients had no evidence of osteoarthritis at the final follow up.

Conclusion: Arthroscopic dual tibial tunnel double suture knot bump technique for acute PCL avulsion fractures is a safe and reliable technique that restores the stability and function of the knee.

Level of evidence: IV

Keywords: Arthroscopy, Avulsion, Fractures, Posterior cruciate ligament, Sutures

Introduction

Posterior cruciate ligament (PCL) tibial avulsion fractures are generally rare. Although, the exact incidence of this injury pattern is unknown owing to limited research (1, 2), this injury pattern is more common in Asian countries than in the western world due to motorbike accidents (3). Undisplaced PCL tibial avulsion fracture can be managed conservatively whereas displaced ones (≥ 3mm) require operative intervention to restore biomechanics, joint stability, prevent non-union of the fracture and prevent osteoarthritis (4-8). A single,

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large non-comminuted fracture fragment can be managed by cannulated cancellous screws with or without washers with good to excellent outcomes (9, 10). However, if the PCL avulsion fracture fragment is comminuted or small (<1.5 cm), it is challenging to reduce and fix accurately with screws due to fear of further comminution while passing the screw through the fragment. Recently, a few authors have described the open reduction and fracture fixation using suture anchors (suture bridge technique) for comminuted PCL avulsion fractures (11-13). Though the results have been promising, the open procedure requires careful dissection in the posterior aspect of the knee to approach the fracture, which may endanger the integrity of the neurovascular bundle. In recent years, many arthroscopic suture fixation techniques have been devised to fix the avulsed PCL fragment, especially if the fragment is small and/or comminuted (4, 5, 14-18). The biomechanical strength of suture fixation and screw fixation is similar (19, 20).

Nevertheless, the arthroscopic procedure is technically demanding as accurate reduction remains the key to the successful outcome. In this series, we utilized a different method wherein a dual suture bump from double high strength sutures was used to reduce and fix the PCL fragment (small and/or comminuted) through dual transtibial tunnels. This retrospective series of PCL avulsion fixation is based upon the hypothesis that arthroscopic fixation of displaced PCL avulsion with dual tibial tunnel double suture bump method is a safe and reliable technique and would result in an acceptable clinico-radiological outcome and may prevent the development of early osteoarthritis of the knee.

Materials and Methods

Patient selection

It is a retrospective study of 23 patients with acute tibial-side bony avulsion of PCL who were operated between 2009 and 2016 with a minimum follow up of two years. Institutional review board approval for the study was obtained. Between 2009 and 2016, 28 cases with acute PCL avulsion fractures were operated by dual tibial tunnel double suture bump technique. With five patients lost to follow up, a total of 23 patients were included in the final study. The inclusion criteria for the study were: skeletally mature patients who had acute (<3 weeks), small size (<2cm) with or without comminution, displaced (≥ 3 mm from the fracture crater) PCL tibial side avulsion fractures, and who demonstrated grade III posterior drawer. Displacement of the fracture was defined as an elevation of fragment more than 3 mm from the crater (15, 18). Exclusion criteria were periarticular fractures, other ligamentous injuries to the ipsilateral knee [collateral or corner injuries, multi-ligament injuries], or associated neurovascular injury to the knee. All patients underwent standard clinical evaluation, and the data was entered in a standardized knee injury evaluation proforma. The imaging evaluation included a plain radiograph of the knee (anteroposterior and lateral view) and Computed tomography (CT) scan [Figure 1]. The fragment size (in mm), comminution, and displacement (in mm) were measured on a CT scan.

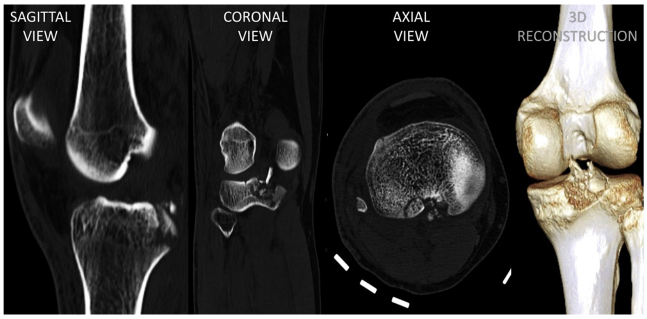

Figure 1. Computed tomography (Sagittal, coronal, axial 2D and 3D) images of Posterior cruciate ligament tibial avulsion showing comminuted fragment.

The mean size of the fragment was 13 mm (range, 8.7-17 mm), and the displacement of the fragment was 5.3 mm (range, 3-12 mm). Eight patients had comminution in the fragment.

Surgical technique

With the patient supine, the surgery was performed in spinal or general anesthesia under tourniquet. The clinical examination was again performed under anaesthesia to confirm the grade of the posterior drawer and to rule out any collateral or corner injuries. After standard preparation and draping, standard anterolateral (AL) and anteromedial (AM) portals were established. Diagnostic arthroscopy was carried out to assess the status of the cruciate ligaments, menisci, and the cartilage. Concomitant cartilage and meniscal lesions, if present, were treated in standard fashion. Next, with arthroscope in AL portal and motorized shaver and radiofrequency device from AM portal and knee in 90^0 flexion, a window was created between ACL and PCL by carefully removing the fat pad and soft tissue (part of median septum) between ACL and PCL avoiding any damage to the cruciate ligaments [Figure 2A,B]. Then, arthroscope was pushed between PCL and medial femoral condyle and two posteromedial portals (posteromedial superior (PMS) & posteromedial inferior (PMI) were created using 18-gauge spinal needle and 5.5 mm plastic cannulas were introduced through the portals [Figure 2C]. The PMI portal was created at the level of the knee joint, whereas PMS was created 2.0-3.0 cm above the joint line. The arthroscope was reinserted in AL portal keeping ACL-PCL window in vision and residual soft tissue and overlying median septum behind the PCL was resected using shaver from PMI or PMS portal till the tip of shaver was visble through the ACL-PCL window. While shaving the soft tissue from posterior portals, always keep the shaver tip opening towards the back of tibia an never towards popliteal fossa in order to avoid inadvertent injury to the popliteal vessels and nerves. Afterward, arthroscope was pushed into the ACL-PCL window to confirm that adequate posterior tissues were debrided. A clear view of PMS and PMI cannulas through the window was reassuring.

Next, the arthroscope was shifted to the PMS portal, and further debridement of the soft tissues around the avulsed fragment was performed. The avulsed fragment was carefully lifted using the shaver tip, and hematoma from the fracture crater was carefully shaved to visualise the entire crater [Figure 3A]. Once the avulsed fragment was delineated, it was held with a shoulder suture retriever (Arthrex, Naples, USA) via the PMI portal, and reduction in the crater was attempted to assess the ease and accuracy of reduction.

While keeping the arthroscope in the PMS portal, PCL tibial angle drill guide (Smith & Nephew, Andover, USA) was inserted through the AM portal and was negotiated between PCL and medial femoral condyle to place the tip of the jig 5mm distal to the fracture crater [Figure 3B]. The angle of jig was fixed between 55-60^0, and the drill sleeve was pushed against the proximal tibial metaphysis. A 2cm long incision was made 2cm medial and oblique to the tibial tuberosity at the tip of the drill sleeve. The incision was deepened till the tibial metaphysis was exposed. Next, two guide wires (2.4 mm) were drilled sequentially through the drill sleeve 5 mm below the medial and lateral side of the avulsion crater, and the distance between two guide wires was kept a minimum of 1 cm over tibial metaphysis side. The PCL tibial angled guide was removed, and PCL wire catcher (Acufex, Smith Nephew, Andover, USA) was inserted from the AM portal to protect the tip of the wires. Using a 4.5- mm cannulated drill bit (Smith Nephew, Andover, USA), over drilling over the guidewires was performed to create a 4.5 mm tunnel while protecting the tip of the guidewire by PCL wire catcher. The guide wires were removed. Next, two high strength sutures (Fibrewire number 2, Arthrex, Naples, USA) were passed through the AM portal wrapping around the PCL, and limbs of the sutures were retrieved through the PMI portal [Figure 4A]. Care was taken on the lateral side of PCL wherein the suture was passed below the ligament of Humprey and Wrisberg as suture above the latter ligament may prevent an accurate reduction of the fragment. A sliding knot (Nicky's) was snuggly tied, but not-too-tight, over each pair of suture followed by 5-6 half hitches thrown using a knot pusher creating a 'knot-bunch' over the avulsed bony fragment [Figure 4B] which would eventually act as a buttress or a bumper pressing upon the avulsed fragment. A snug but not-too-tight knot is created by avoiding excess past-pointing over the first sliding Nicky knot complex and further two-three half hitches while creating a bumper. Also, a snug but not-too-tight knot would avoid strangulating the blood supply of the PCL. Next, the suture retriever was inserted through

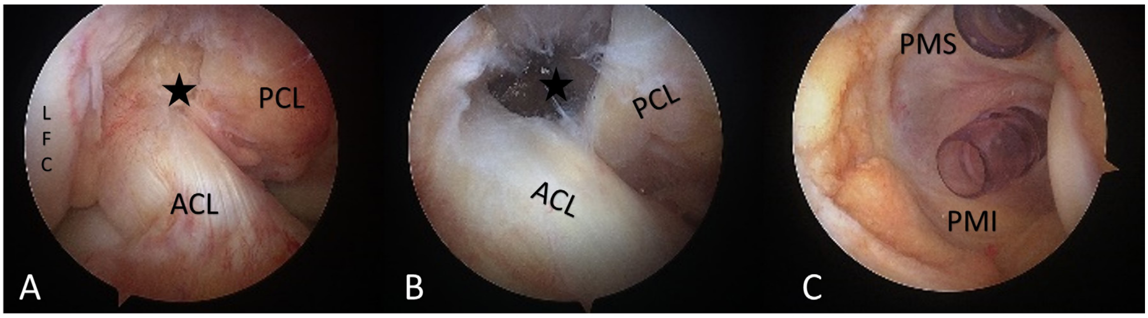

Figure 2. Arthroscopic images.
2A: Lax ACL in PCL tibial avulsion (black star is the interval between ACL and PCL; 2B: Opened interval between ACL and PCL (black star) 2C: Posteromedial portal creation via Cannula in PMS & PMI portals visualized through the opened interval between ACL and PCL. LFC, Lateral Femoral Condyle); ACL, Anterior cruciate ligament; PCL, Posterior cruciate ligament; PMS, Posteromedial Superior; PMI, Posteromedial Inferior.

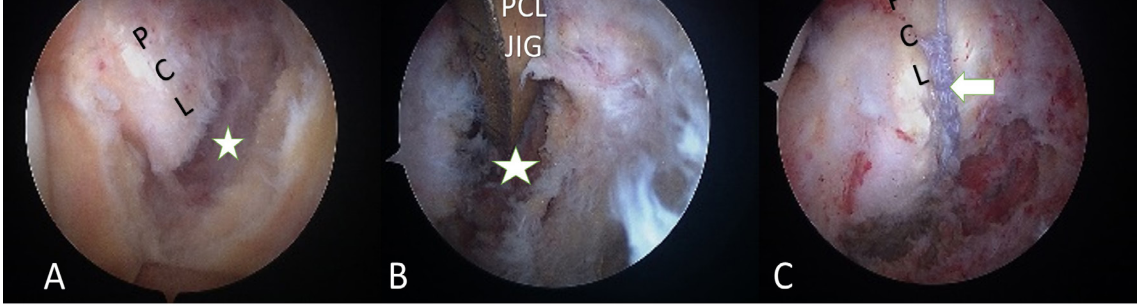

Figure 3. Arthroscopic images visualised from PMS portal. 3A: Avulsed PCL fragment (White star: fracture bed) 3B: PCL jig placed below the avulsion crater. 3C: Fixation of the avulsed fragment with double pull-through sutures and dual knot bump compressing the fragment (white arrow). PMS, Posteromedial Superior; PCL, Posterior cruciate ligament.

the medial and lateral tibial tunnel sequentially. Further, one limb each of both suture pairs in the PMI portal was loaded on to the shoulder knot pusher and was guided to the tip of the suture retriever. The jaws of the suture retriever were opened at the exit end of the tibial tunnel, and the sutures were pulled out from the medial and lateral side of the tunnel, respectively.

Next, with the arthroscope in PMS portal and knee flexion between 70-90^0, the Tibia was pulled anteriorly to optimize the tension in PCL and two pair of sutures from the tibial tunnel were pulled anteriorly by the surgeon resulting in reduction of bony fragment into the crater. If reduction seems imperfect, the bony fragment could be held or pushed anteriorly with suture retriever from the PMI portal to assist in the accurate reduction of the fragment into the crater of the fracture. Further, the suture retriever can also be used to adjust the distance between the two knot bunch, in case they are too close to each other, to ensure wider spread of knot bunch over the bone fragment creating more uniform pressure of the bony fragment over the crater. Further, keeping knee in 70-90^0 flexion and tibia pulled anteriorly by an assistant, the two suture limbs of one pair was tied together over the bony bridge (between the two tunnels) at anterior tibial end of tunnels followed by the tying of the other pair. The tying of suture limbs over the bony bridge pulled two knot-bunches anteriorly over the bony fragment, acting as a buttress over the avulsed fragment keeping the fragment reduced [Figure 4C; D]. Also, the knot bunch along with two diverging suture limbs via medial and lateral tibial tunnels compress the fragment against the crater. After fixation, the tension in PCL and ACL was confirmed arthroscopically using a probe. Post fixation, the posterior drawer was applied to confirm that the grade of the posterior drawer was reduced to zero. The wounds were closed in layers, and a sterile dressing was applied.

Post-op rehabilitation

The knee was immobilized for two weeks in an extension knee brace with a modification of posterior tibial support to prevent the posterior tibial sag. Static quadriceps strengthening exercises, active straight leg raising, and transverse patella mobilization were initiated immediately. Patients were kept non-weight bearing with bilateral axillary crutches for six weeks. Active knee mobilization was initiated at 3rd week, and partial weight-bearing was permitted at the 7th week onwards. Active knee mobilisation was continued. A plain radiograph was taken at six weeks, three and six months to assess the status of fracture union. If fracture united, the x-rays were repeated only at last follow up to confirm the posterior drawer in kneeling stress x-ray. At the end of 12 weeks, patient was send for advanced rehabilitation of knee in terms of strength, agility, proprioception, and plyometrics. Return to preinjury activities and or sports was allowed only at the end of six months, depending on the return of full strength and movements.

Patient review and assessment

Letters were sent to the patients and were also telephoned to visit our clinic for final assessment. The final assessment was performed by a single independent observer who had not performed the surgery. At final follow-up; clinical outcomes were measured by Lysholm Knee Scoring Scale, International Knee Documentation Committee (IKDC) subjective and objective knee evaluation, whereas knee laxity grading was assessed by manual posterior drawer test followed by kneeling stress x-ray (21). The radiological assessment included a plain radiograph of the knee, which was compared with the immediate post-operative, three, and six-month x-ray to assess the union of the fracture or failure of fixation [Figure 5].

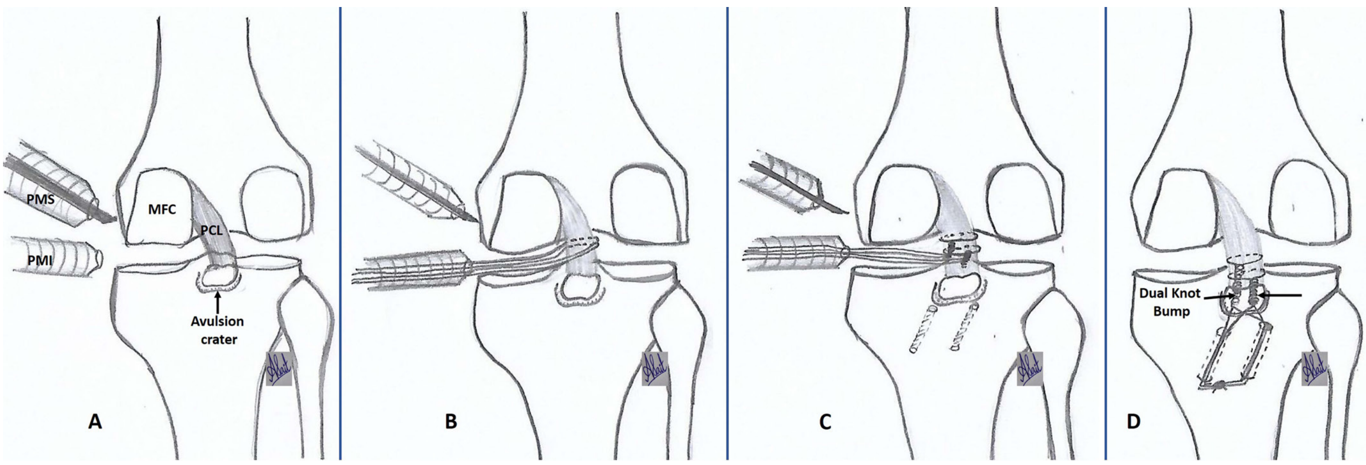

Figure 4. Illustrative image of PCL fixation with dual tibial tunnel dual suture knot bump.
4A: Two high strength sutures wrapped around the PCL bundle and retrieved through PMI portal. 4B: Knots tied over each pair of suture across the PCL bundle above the fracture fragment creating a dual knot-bump. 4C: The free ends of the sutures pulled out anteriorly through the tibial tunnels and tied over a bony bridge on the Tibia. 4D: Final arthroscopic image of PCL fixation with dual suture bump (colour contrast missing). PMI, Posteromedial inferior; PCL, posterior cruciate ligament.

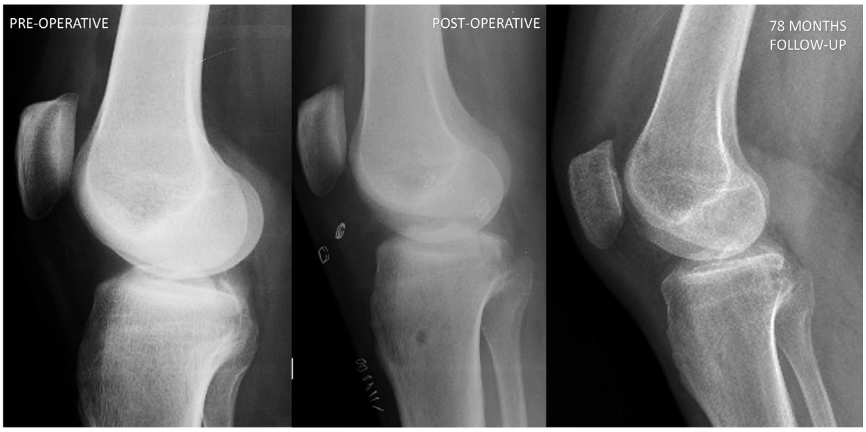

Figure 5. Lateral X-ray view of the knee joint showing - A. PCL avulsion injury. B. Immediate postoperative showing reduction in the crater. C. At final follow up, a healed fracture.

Results

Of the 23 patients, there were 19 males and four females with a mean age of 34.43 years (range 18-54). The mean duration between injury and surgery was 9.43 days (range, 2-21 days), and mean follow up was 52.8 months (range, 36-94 months). The mean size of the fragment was 13 mm (range, 8.7-17 mm), and displacement of the fragment was 5.3 mm (range, 3-12 mm). Eight patients (34.8%) had comminution in the fragment. Table 1 summarises the details of all 23 patients.

At the final follow-up, the mean Lysholm score was 95.82 (range, 81-100), which was excellent. The mean subjective IKDC score was 82.71 (range, 65.5-100) whereas the objective IKDC grading revealed grade A (excellent) – 10 patients [43.47%], grade B (good) – 11 patients [47.82%] and grade C (fair) – 2 patients [8.7%]. On kneeling stress x-ray, 21 patients (91.3%) had grade 0 laxity, and the remaining two had grade I and grade II. 11 cases had associated other injuries [Table 1]. The fracture had united in all cases by the end of 12 weeks except one. 19 patients (82.6%) regained full range of movement at the knee while four patients (17.4%) had a loss of flexion range of movements (three cases had 10° of terminal flexion limitation, and one had 5° of limitation). No patient had any deformity or any other neurovascular complications. At the final follow up, 21 patients (except two) did not reveal any evidence of radiological diminution of joint space or development of osteophytes. One patient [case 21, Table 1] who developed OA of the medial compartment of the knee had medial meniscal tear, and grade II cartilage defect of medial femoral condyle and other one [case 4, Table 1] developed features of patellofemoral OA as he had grade II cartilage changes in the medial facet of the patella.

Discussion

With one of the highest follow-up period among all series, our study reveals sustained good to excellent clinical and radiological outcome with dual tunnel double suture knot bump technique for arthroscopic PCL avulsion fixation. Further, we also report that early fixation of PCL bony avulsion might prevent any development of osteoarthritis as we did not notice any deterioration in the knee joint after fixation such as diminution of joint space or development of osteophytes.

At present, by and large, there are two options available for the management of displaced, "small and or comminuted" PCL avulsion fractures: open reduction and suture bridge technique using suture anchors or arthroscopic suture pull-through technique (4, 5, 11-17). Both techniques have pros and cons with neither technique proven superior over the other. Factors such as displacement, fracture geometry, chronicity, and the expertise of the treating surgeon determine the choice of the technique. Larger fragments (>2 cm) can be better reduced and fixed with a single cannulated screw (6). Chronically displaced fractures (more than 4-6 weeks) are better reduced and fixed by open technique as retraction and fibrosis around the avulsed fragment jeopardize arthroscopic reduction and fixation in the crater. Regardless of the technique, restoration of normal anatomy and biomechanics of the PCL is crucial for the return of the function and stability of the knee while avoiding the late arthritis of the knee (22).

Since most of the PCL avulsions are due to two-wheeler related accidents, the associated injuries to the limb and other parts of the body are not uncommon as 11 out of 23 patients (47.8%) in our series had other injuries. Four out of 23 patients (17.4%) had meniscal tears, and three (13%) had grade I-II medial femoral condyle cartilage or patellar facet cartilage changes. Hooper *et al* in their systemic review of 28 studies on PCL avulsion, concluded that 16.8% of patients had meniscal tears, medial more frequent than lateral (23). Thus, the arthroscopic approach of fixing PCL avulsion fractures also has an advantage of the simultaneous management of associated intraarticular injuries (meniscal and chondral). Also, timely management of PCL avulsion perhaps prevents further deterioration of cartilage and meniscus as none other than two developed any features of osteoarthritis at the latest follow up.

We used dual posteromedial portals, a technique first described by Zhao *et al* and later described by others (5, 14, 15). Dual posteromedial portal technique aids in simultaneous visualization of the fracture via superior

Table 1. Master chart of the case series

Case No.	Age (Yrs)	Gender	Injury mechanism	Side	Associated injuries	Duration between injury & surgery	Total follow up (months)	IKDC subjective Score	Lysholm Score	Posterior Laxity (Grade)	Complaints/ Findings at final follow-up
1	38	M	RTA	R	Nil	12 days	68	100	100	0	Nil
2	18	M	RTA	R	Grade I cartilage injury medial Femoral condyle	11 days	94	78.2	95	0	Occasional pain on exertion
3	37	F	Fall from stairs	R	Nil	13 days	60	95.4	100	0	Nil
4	54	M	Fall from stairs	L	Nil, grade 2 degenerative cartilage changes over medial femoral condyle and grade II patellar medial facet cartilage changes	10 days	40	65.5	88	0	10° terminal flexion limitation. Early patellofemoral arthritis features
5	27	F	RTA	R	Medial meniscus tear - repaired	4 days	36	85.1	91	0	Occasional pain on exertion
6	45	M	RTA	L	Nil	8 days	91	79.3	95	0	Nil
7	31	M	RTA	R	Opposite fibula shaft # with soft tissue laceration of leg, proximal phalanx little finger right hand #	21 days	91	95.4	100	0	Nil
8	30	M	RTA	L	Nil	18 days	88	77	94	0	Occasional pain at tibial tunnel entry site
9	30	M	RTA	R	Nil	11 days	36	85.1	91	0	Nil
10	45	M	RTA	L	Nil	17 days	80	94.3	95	0	Nil
11	19	M	Fall from stairs	L	Nil	4 days	54	95.4	100	0	Nil
12	30	M	RTA	R	Soft tissue laceration of ipsilateral leg	7 days	48	69	81	0	10° terminal flexion limitation.
13	20	F	RTA	R	MM tear - balancing	2 days	36	85.1	95	0	Nil
14	30	M	Fall from stairs	L	MM tear - balancing	3 days	37	85.1	95	0	Nil
15	45	F	RTA	L	Nil	6 days	38	86.2	100	0	Nil
16	23	M	RTA	R	Ipsilateral femur shaft # & laceration over ankle	2 days	36	79.3	95	II	*Non-union* PCL avulsion, no instability
17	45	M	RTA	R	Ipsilateral Great toe proximal phalanx # & thumb distal phalanx #	12 days	36	100	100	0	5° terminal flexion limitation.
18	25	M	RTA	R	Mild Head injury, ipsilateral tibia-fibula #	13 days	48	78.2	95	0	10° terminal flexion limitation
19	54	M	RTA	L	Nil	12 days	36	100	100	0	Nil
20	23	M	RTA	R	Frontal bone #, Leforte type III #	12 days	36	95.4	100	0	Nil
21	53	M	RTA	R	Medial meniscus tear - balanced, grade II cartilage change over medial femoral condyle-chondroplasty	11 days	42	95.4	100	I	Early medial compartment Osteoarthritis changes
22	31	M	RTA	R	Nil	5 days	44	77	94	0	Nil
23	40	M	RTA	R	Ipsilateral Middle phalanx index finger, middle and proximal phalanx middle finger #, base 4th 5th Metacarpal #.	3 days	40	95.4	100	0	Nil

RTA, Road traffic accident; M, male; F, Female; R, right; L, left; F/U, follow up; #, fracture portal and manipulation and reduction of the fracture, knot tying via inferior portal without compromising the view. Yoon *et al* utilised posteromedial and posterolateral portals to achieve similar objectives (18).

Various surgeons used different techniques to engage PCL using single or multiple sutures for fixation; passing suture via the avulsed fragment, PCL substance or wrap the suture around the PCL (4-6, 14, 15, 17, 18, 24). We also used wrap-the-suture around the PCL technique using two sutures and a knotty bump over the fragment, which uniformly compresses the fragment over a larger area of the fracture crater and minimizes the possibility of displacement of the fragment during rehabilitation. The criticism of this technique is that it may jeopardize the circulation of PCL during the knot tying around the PCL. However, the excellent clinical results shown in various series defy the apprehension of strangulating the circulation (17, 24). Even though most authors had great results using either PDS or Ethibond, we used two high strength sutures instead of PDS or Ethibond as latter can lose strength if there is a cut in the suture, and that may jeopardise the fixation strength during the mobilisation and rehabilitation (5, 15, 17, 24, 25).

The fixation of sutures could be done using single or double tunnel. Few surgeons used a single tibial tunnel, Zhao *et al* used a 'Y' shape tunnel while others made dual tibial tunnel to retrieve and tie sutures over the Tibial metaphysis (5, 6, 14-18, 24). However, there was no clinical or radiological difference between any of the series. The dual tunnel has an advantage over the single tunnel as sutures are tied over the bone bridge between the two tunnels, whereas a button or screw post is required for the tying of sutures in a single tunnel. Hence, a dual tunnel helps in avoiding an additional implant and reduces the cost. Further, the dual tunnel also helps in diverging the four limbs of the two high strength sutures resulting in the wider spread of the compressive force of suture knot bump over the avulsed bone piece. Also, with diverging dual suture exiting from medial and lateral tunnels, the chance of slippage of suture-bunch on either side of the bony fragment is minimised as compared to the single central tunnel.

In 2014, Gwinner C *et al*. had described an arthroscopic technique of PCL avulsion fracture reduction using tightrope (Arthrex, Naples, USA) (26). Although the results in their series looked promising, there were few disadvantages with the technique such as the need for an image intensifier to confirm the guidewire placement, making a drill hole through the avulsed fragment, which could result in further comminution of the fragment and higher cost of the implant.

In our series, the avulsion fracture had completely united in all patients except one by the end of 12 weeks. Only one case was found to have non-union of the fracture with persistent grade II laxity. However, the patient refused any further intervention as he had no instability or any other complaint. There were no other complications like infection, neurovascular injury in our series. Most authors report healing of fracture by the end of three months.

Complications

In our series, four patients (17.4%) had a loss of flexion varying from 5-10^0. However, none of them opted for any intervention to regain knee movements as it did not hamper their daily activities. Gui *et al* also reported post-operative knee stiffness in 14.3% cases (15). Gui *et al* reported that these patients were from the rural area and could not follow the standard rehabilitation program (15). Hooper III PO *et al* in their systematic review of PCL avulsion noted that most frequent complication in both open and arthroscopic techniques was post-operative knee stiffness due to arthrofibrosis (23). Post-operative prolonged immobilization (>3weeks) was found to be one of the causes. We believe that factors such as thorough drainage of bone debris after drilling the tunnels, avoiding prolonged immobilization (> 2-3 weeks), and close monitoring of patients' compliance to rehabilitation would probably reduce the incidence of arthrofibrosis and subsequent knee stiffness.

Limitations of the study

Notably, one of the limitations of this study is the small sample size due to the relatively uncommon presentation. However, a significant mean follow-up of 56 months has helped to conclude that early arthroscopic fixation of PCL avulsion would end up in the excellent clinical and radiological outcome. Secondly, although we concluded that with a mean follow up of 53 months in 21 patients (except two) did not reveal early development of radiological osteoarthritis of the knee in those who had a normal knee, it would be prudent to wait for another five years to conclude the same emphatically. Thirdly, we did not compare the outcomes of arthroscopic fixation with other techniques such as screw fixation or suture anchors. However, the two techniques are commonly deployed in different situations.

Even though technically demanding, arthroscopic dual tunnel double suture fixation of displaced PCL avulsion fracture appears to be a reliable technique that restores the stability and function of the knee and might prevent the development of early osteoarthritis of the knee. However, the development of arthrofibrosis is a remote possibility in a small percentage of cases.

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