National Journal of Clinical Orthopaedics

ISSN (P): 2521-3466
ISSN (E): 2521-3474

www.orthoresearchjournal.com
2024; 8(1): 27-32
Received: 07-11-2023
Accepted: 11-12-2023

Dr. Bilal Ahmad Lone
PG Scholar, Postgraduate Department of Orthopaedics, SKIMS medical College, Bemina, Srinagar, Jammu and Kashmir, India

Dr. Suheel Mushtaq
Senior Resident, Postgraduate Department of Orthopaedics, SKIMS medical College, Bemina. Srinagar, Jammu and Kashmir, India

Dr. Ishfaq Sadiq Mir
PG Scholar, Postgraduate Department of Orthopaedics, Govt. Medical College, Srinagar, Jammu and Kashmir, India

Dr. Inayat Rahim
Senior Resident, Postgraduate Department of Orthopaedics, SKIMS medical College, Bemina, Srinagar, Jammu and Kashmir, India

Dr. Shahid Shabir
Senior Resident, Postgraduate Department of Orthopaedics, SKIMS medical College, Bemina, Srinagar, Jammu and Kashmir, India

Corresponding Author:
Dr. Ishfaq Sadiq Mir
PG Scholar, Postgraduate Department of Orthopaedics, Govt. Medical College, Srinagar, Jammu and Kashmir, India

Assessment of outcome of arthroscopic assisted ACL reconstruction using bone patellar tendon bone auto-graft in Kashmiri population

Dr. Bilal Ahmad Lone, Dr. Suheel Mushtaq, Dr. Ishfaq Sadiq Mir, Dr. Inayat Rahim and Dr. Shahid Shabir

DOI: https://doi.org/10.33545/orthor.2024.v8.i1a.430

Abstract
Introduction: The surgical reconstruction of the anterior cruciate ligament with Bone - Patellar tendon - Bone auto-graft represents an attempt to re-establish knee kinematics. It has the added advantage of bone to bone healing and it does not sacrifice the knee stabilizers. The present study was carried out to assess the outcome of arthroscopic assisted ACL reconstruction using Bone Patellar Tendon Bone auto-graft in Kashmiri population.
Materials and Methods: This prospective study was carried on 30 patients with correlative findings of ACL injury on clinical examination and MRI analysis. All patients were managed with arthroscopic reconstruction using Bone Patellar Tendon Bone auto-graft. Postoperative evaluation was done on the basis of IKDC subjective score, Manual Lachman grading, Anterior Drawer value, Pivot Shifting grading and Lysholm scoring.
Results: In our study median pre-operative and post-operative Lachman grading value was 3 (range 1-3) and 0 (range 0-1) respectively. Median pre-operative and post-operative anterior drawer value was 3 (range 0-3) and 0 (range 0-1) respectively. Median pre-operative and post-operative pivot shift grading value in our study was 2 (range 1-3) and 0 (range 0-2) respectively. The mean pre-operative IKDC subjective score was 49.86 (49.9-52.8) while the mean postoperative score was 89.48 (87.9-91.2). According to Lysholm knee score 15 (50%) patients had excellent functional outcome while 10 (33%) patients had good outcome and the remaining 5 (17%) patients had a fair outcome.
Conclusion: Arthroscopic anterior cruciate ligament reconstruction with bone-patellar tendon-bone graft is an excellent treatment option for anterior cruciate ligament deficient knees and provides a stable knee with minimal complications.

Keywords: Anterior cruciate ligament (ACL), arthroscopic reconstruction, bone-patellar tendon-bone graft, outcome

Introduction

The anterior cruciate ligament (ACL) is an important structure in maintaining the normal biomechanics of the knee and is the primary restraint to anterior tibial translation (ATT), providing 85% of the total restraining force to anterior drawer [1]. The anterior cruciate ligament forms the pivot in the functional congruence and stability of the knee in association with the other ligaments, capsule, muscles and bone [2, 3]. It is also important in counteracting rotational and valgus stress.

The knee joint is the most commonly injured of all joints and the anterior cruciate ligament (ACL) is the most commonly injured knee ligament. Injuries to the anterior cruciate ligament (ACL) are increasing over time, with younger women at elevated risk. After ACL injury, most patients experience recurrent episodes of instability, pain and decreased function. ACL tears have been termed as the 'Beginning of the end of the knee'. The incidence of associated cartilage damage in acute tears is reported at 15-40% whereas it increases to 79% in chronic tears [4]. Meniscus injury occurs in association with 50% of acute ACL tears, and this figure rises to 90% in ACL-deficient knees assessed 10 years or more after the initial injury.

Whilst some patients can be managed non-operatively with intense physiotherapy, bracing and modification of activity, severe symptoms may require reconstruction of the injured ligament.

Reconstruction of ACL allows the patient to return to a pre trauma activity level and delays the occurrence of associated meniscal injury and on-set of osteoarthritis [5, 6]. Reconstruction is also essential to restore the stability of the knee [7]. A stable knee in turn prevents worsening of existing chondral lesions as well as occurrence of newer lesions.

Arthroscopic reconstruction of torn ACL has become the gold standard in treating ACL tears [8]. Graft choices for ACL reconstruction include autografts, allografts and synthetic grafts. Allografts result in lower level of stability and higher failure rates than their autograft counterparts, besides risk of infection transmission [9]. Synthetic grafts are not in vogue due to their high rate of rupture and recurrent sterile knee effusions. Currently, commonly used autografts include quadrupled hamstring tendons, quadriceps tendon with or without bone and bone-patellar tendon-bone (BPTB). The disadvantages of hamstring graft may include a longer healing time and graft integration time within the bone tunnel because of the absence of bone plugs at the ends of the graft. Moreover, the lack of both hamstrings eliminates the protective and stabilizing action that these muscles exert on the knee during specific movements. The quadriceps tendon graft carries a higher risk of patellar fracture than a BPTB. Other disadvantages include persistent quadriceps weakness and higher revision rate.

The surgical reconstruction of the anterior cruciate ligament with Bone - Patellar tendon - Bone auto-graft represents an attempt to re-establish knee kinematics. It has the added advantage of bone to bone healing and it does not sacrifice the knee stabilizers [10]. The advantages are key hole incisions, less intense inflammatory response thus reducing the post-operative morbidity and early recovery to full range of motion and also less potential for functional imbalance. Clancy performed the first surgery using free bone patellar tendon bone graft. The patellar tendon was the most commonly used graft source for ACL reconstruction because of its biomechanical strength and stiffness, the availability of bone-to-bone healing at both ends and the ability to firmly secure the graft within the tunnels, allowing for an accelerated rehabilitation program. With this procedure, the replaced anterior cruciate ligament approximated the functions of normal anterior cruciate ligament while many of the problems of conventional anterior cruciate ligament surgery were avoided. The bone patellar tendon bone was the strongest of the immediately available substitute. Precise location of its tissue ends influences the joint kinematics. The tissue had strength, durability and elasticity. Surgically it could be accurately placed so that it performed isometrically both in its location and tension. The length of the tendon was also ideally suited for ACL reconstruction.

The purpose of this study was to assess the results of ACL reconstruction using bone patellar tendon bone graft.

Materials and Methods

This prospective study was conducted in the Postgraduate Department of Orthopaedics, SKIMS Medical College, Bemina Srinagar from November 2019 to July 2021. In this study a total of 30 cases clinically and radiologically confirmed with correlative findings of complete ACL injury. The inclusion criteria were both male and female patients of age 17-55 years of, chronic ACL tears with functional instability, ACL rupture associated with meniscal tears and/or grade 1 collateral ligament tears and normal Contralateral Knee. Patients with ACL injuries and associated intra articular fractures, osteoarthritic changes in X ray >grade 2, ACL injury associated with PCL rupture, MCL, LCL, posteromedial or posterolateral capsule tear, ligament injury to contralateral knee and mentally subnormal persons were excluded from study.

All patients were informed about the study in all respects after explaining the procedure, risks, benefits and the rehabilitation and written informed consent was obtained. The patients were assessed pre-operatively included: history and clinical evaluation, blood investigations, radiographs and MRI of the involved knee, Lysholm, IKDC score, pre anaesthetics check-up and demographic details as age, gender, weight, height, race, educational level, occupation and activity level.

Procedure

All patients received two doses of prophylactic antibiotic (cefuroxime 1.5 gm.) 12 hour and 1 hour before surgery. The patients were placed supine on a standard operating table with the knee joint positioned slightly past the distal breakpoint of the table. The knee was positioned as such so that 120° knee flexion was possible. Spinal, epidural or combined spinal epidural anesthesia was administered.

Graft Harvesting: The skin incision was made vertically from the inferior pole of the patella to superior margin of tibial tubercle. Skin flap raised to enable full visualization of the tendon width. The paratenon was dissected from the patellar tendon. The middle third of the patellar tendon measured approximately 10 mm and harvested along with patellar and tibial bone plugs up to 25 mm long using oscillating saw and removed with osteotome. Just before separation two drill holes are made in the bone plug.

Graft Preparation: The bone plugs are trimmed to the desired width (8 mm - 11 mm). The width checked using appropriate sizer templates. The graft edges are smoothened and sutures passed through the drill holes. Graft was dipped in solution with vancomycin (Figure 1A).

Preparation of the intercondylar notch: The intercondylar notch was assessed for notch architecture, stenosis and intercondylar osteophytes. Remnants of the torn ACL were debrided using a mechanized shaver blade, and the tibial footprint identified. On tibial footprint, the ACL stump was sufficiently removed to avoid development of a Cyclops lesion. Notchplasty was not required in any of the patients. The over the top position was clearly visualized and confirmed with an arthroscopic probe.

Femoral Tunnel Preparation: The ACL footprint was visualised on the medial surface of the lateral femoral condyle in 90 degrees of knee flexion and the entry point was marked by identifying residents ridge. Then with the femoral offset aimer device inserted through the anteromedial portal, the entry point was drilled with a guide wire in 120 degrees of knee flexion. Back wall was preserved by selection of appropriate increment of aimer offset using Transportal Guide (TPG). The drilling was continued till the tip of the guide wire emerged on the lateral side of the distal thigh at the level of epicondyle of femur. Then the length of the tunnel was measured using a depth gauge. Then the femoral tunnel was reamed with a reamer corresponding to the diameter of the graft. The reaming was stopped 15-20 mm from the lateral cortex depending on the length of the graft. After the femoral tunnel was made, the guide pin with ethibond at its end was passed via the femoral tunnel to aid in easy passage of prepared graft (Figure 1B).

Tibial Tunnel Preparation: The posterior border of anterior horn of lateral meniscus and the medial and lateral spines were used for intra-articular tibial tunnel placement. The site was located in the anteroposterior plane by extending a line in continuation with the inner edge of the anterior horn of the lateral meniscus. This point was located 6 to 7 mm anterior to the anterior border of the PCL. The mediolateral placement of the tunnel center corresponded to the depression medial to the medial tibial spine in the mediolateral center of the ACL stump. With the tunnel center chosen, the patients' knee was flexed to 90 degrees, and the tip of the tibial drill guide was adjusted to create the desired tunnel length. The guide wire was drilled into place and its tip visualized as it entered the joint. The tibial tunnel was drilled using a cannulated drill bit, with diameter corresponding to the diameter of graft (Figure 1C).

Graft Passage: The graft now ready for implantation, was transferred from the master board to the operating table. The graft was marked at the graft insertion length with a sterile marking pen. A passing pin was advanced through both tunnels, and distal thigh with the knee flexed between 90 and 110 degrees. The passing thread was extracted proximally, bringing the sutures out through the distal thigh. The leading strand was pulled to pull the graft construct proximally into the joint (Figure 1D). The graft was viewed arthroscopically to ensure the bone plug was into the femoral tunnel.

Graft Fixation: The knee was flexed to 120 degree and using the guide pin the femoral fixation was done using the interferential screws. Appropriate sized screws were used to get the interference fit as screw diameter was an important consideration for fixation strength. Care was taken for the screw not to protrude into articular area. The knee was moved through a few cycles of motion to check for impingement. The knee was placed in extension and interference screws were placed at the cancellous side of the bone plug in tibial tunnel with the graft sutures pulled firmly under tension (Figure1 E and F).

Wound Closure: After irrigation of the knee joint the patellar tendon and paratenon were closed separately. Tourniquet was removed and distal circulation checked. Assessment of knee joint was done for the anterior translation of tibia and any rotatory instability. Compression bandaging was done and hinged knee brace applied.

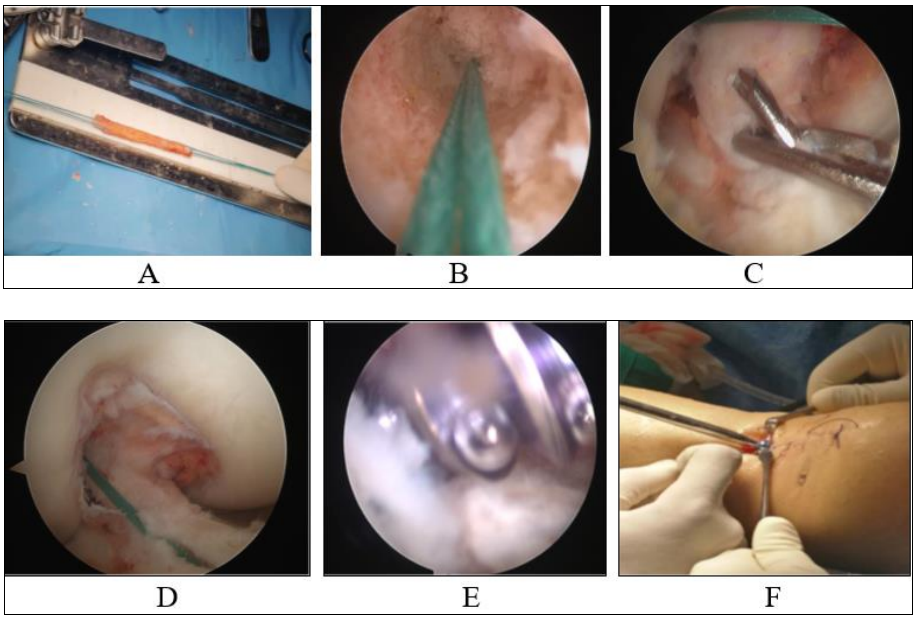

Fig 1: A (Graft preparation), B (Femoral tunnel preparation), C (Tibial tunnel preparation), D (Passing the graft through the femoral tunnel), E, and F (Fixing the graft in femoral and tibial tunnels with titanium screws)

Post-operative rehabilitation and follow-up

Regular follow up was done in all the patients for at least 6 months. All patients followed a post - ACL reconstruction rehabilitation protocol. The follow up was done at 1 week, 2 weeks, 4 weeks, 8 weeks, 12 weeks, 4 months, 6 months and a final follow-up at 9 months post-surgery. Postoperative evaluation was done on the basis of IKDC subjective score, Manual Lachman grading, Anterior Drawer value, Pivot Shifting grading and Lysholm scoring.

Results

The average age of the patients was 30 years (range 20-45) years. Most of the patients (37%) were in the age group of 18 to 30 years. Of the 30 patients included in our study, 26 (87%) were Male patients and 4 (13%) were females. The right side was more commonly injured (57%) than the left side (43%). The most common mode of injury in our study was sports injury and Motor vehicle accidents (40% each) followed by fall (20%). In our study, most of the patients (40%) presented 4 to 6months after injury. 80% of ACL injuries were complete tears followed by partial tears (high grade). 90% patients had tear in the middle one-third portion of the ACL followed by femoral site tear in 10% of patients. The most common symptom at presentation was knee pain (50%) followed by instability (30%). Both knee pain and instability were present in 10% of patients. Locking was present in 10% of patients. In our study, there was associated meniscal injury in 80% of patients. The most commonly injured was medial meniscus (50%) followed by injury to both medial and lateral menisci (20%). Isolated ACL tear was present in 20 patients (Table 1).

Table 1: Demographic characters of the enrolled population

Gender		
Male	26	87
Female	4	13
Age group		
18 – 30 Years	21	70
31-40 Years	7	23
41-50 Years	2	7
Side		
Right	17	57
Left	13	43
Mechanism of injury		
Road traffic accidents	12	40
Fall	6	20
Sports injury	12	40
Duration		
<4 Months	10	33
4-6 Months	12	40
7-9 Months	2	7
10-12 Months	5	17
>12 Months	1	3
Type of tear		
Partial (medium grade)	1	3
Partial (high grade)	5	17
Complete	24	80
Location of tear		
Femoral	3	10
Middle one third	27	90
Tibial	0	0
Symptoms		
Knee pain	15	50
Instability	9	30
Locking	3	10
Knee pain & Instability	3	10
Associated injuries		
Isolated ACL tear	17	57
Medial Meniscus	9	30
Lateral Meniscus	3	30
Medial & Lateral Meniscus	1	3

In our study median pre-operative and post-operative Lachman grading value was 3 (range 1-3) and 0 (range 0-1) respectively. Median pre-operative and post-operative anterior drawer value was 3 (range 0- 3) and 0 (range 0 -1) respectively. Median pre-operative and post-operative pivot shift grading value in our study was 2 (range 1-3) and 0 (range 0-2) respectively (Table 2). The mean pre-operative IKDC subjective score was 49.86 (49.9-52.8) while the mean postoperative score was 89.48 (87.9-91.2) (Figure 2).

Table 2: Median Lachman grading, anterior drawer value and pivot shift grading

Parameters	Pre-operative	Range	Post-operative	Range
Manual Lachman grading	3	1-3	0	0-1
Anterior drawer value	3	0-3	0	0-1
Pivot shift grading	2	1-3	0	0-2

In our study 26 patients (87%) achieved full ROM at the end of final follow-up while 4 patients (13%) had some motion deficit. In all patients the femoral tunnel was placed posterior and close to the posterior cortex on lateral view. All patients had the femoral tunnel in antero-posterior view within the 10'O clock and 11'O clock for the right knee and 1'O clock and 2'O clock in the left knee. In our studies all the patients had angled tibial tunnel in sagittal plane. In the antero-posterior view all the patients had tunnel placement between 35 to 45°.

In our study we encountered a few complications as tibial screw backout in 1 (3%) patient, anterior knee pain in 3 (10%) patients, Patellar articular surface fracture in 1 (3%), Flexion deficit of 15^0 in 1 (3%) patient, Extension deficit of 5° in 2 (7%) patients and Flexion deficit of 10° in 1 (3%) patient.

According to Lysholm knee score 15 (50%) patients had excellent functional outcome while 10 (33%) patients had good outcome and the remaining 5 (17%) patients had a fair outcome (Table 3).

Table 3: Lysholm knee score

Results	No. of patients	Percentage
Excellent	15	50
Good	10	33
Fair	5	17
Poor	0	0

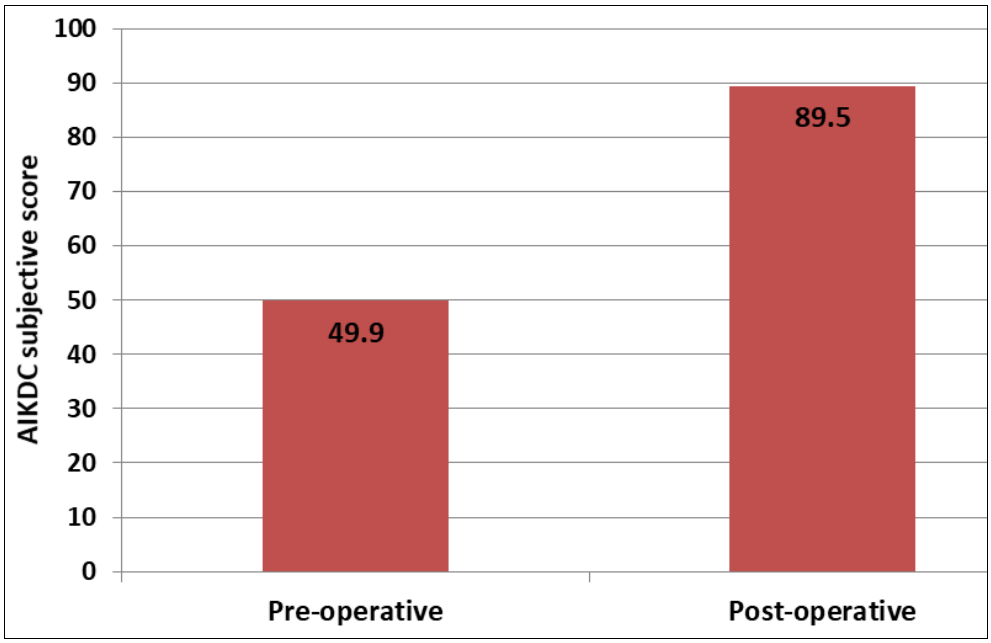

Fig 2: IKDC subjective score before and after surgical intervention

Discussion

The advantages of arthroscopically assisted reconstruction of the anterior cruciate ligament are that there is minimum injury to the synovial membrane of the joint and yet it achieves the goals accomplished by open operative technique. The theoretical advantage of arthroscopic surgery includes less injury to patellofemoral mechanism and possibly less frequent symptoms and contractures of the patellofemoral joint post operatively. The proper site for location of bone tunnels can be better identified by an arthroscope. In addition, the correct relationship of the graft with respect to the lateral wall of the intercondylar notch can be established.

At present the most commonly used grafts for ACL reconstructions are quadriceps tendon autograft, bone-patellar tendon-bone autograft and hamstring tendon grafts. We conducted this study to assess the functional outcome of arthroscopic reconstruction of ACL using bone-patellar tendon-bone autograft (BPTB) graft in Kashmiri population. The central one third of the bone patellar tendon bone graft was used because of its excellent biomechanical properties. It is the strongest of the immediately available substitute. Precise location of its tissues ends influences joint kinematics. The graft can be placed accurately during the surgery for it to act isometrically both in its location and tension. Bone to bone healing is more secure and rapid when compared to other grafts. It does not sacrifice the knee stabilizers. The bone-patellar tendon-bone graft is time tested and has lesser complications and less significant morbidity.

In our study, the most common mode of injury was Sports injuries and motor vehicle accidents (40% each). Among the sports injuries, football was the most common cause of ACL tear. Plaweski 2009 [11] reported that sports injury was the cause of rupture in all the cases. Reddy *et al*. 2009 [12] reported that 46% as sports related injuries with road traffic accident responsible for 50% injuries.

The most common symptom at presentation was knee pain (50% of patients). The other presenting symptoms were instability (30%), locking (10%) and 10% patients presented with both pain and instability were nearly equivalent to the results of the study studies of D Choudhary *et al*. 2005 [13]. Average age of patients at the time of surgery in the present study was 30 years whereas that of Johma *et al*. [14], Railey *et al*. [15], Mahir *et al*. [16] and Kumar *et al*. [17] were 26, 33, 24 and 27 years respectively.

The Right knee was involved in 17 (57%) of patients and left knee in 13 (43%) of patients were near about comparable to the study done by Mulcahey *et al*. 2014 [18] reported involvement of right side (51%) as compared to left side (49%).

D.W Lewis *et al*. [19], in their study on incidence of meniscal injuries at the time of ACL reconstruction found that 58% of patients had meniscal injuries and that medial meniscus was most commonly injured. They also concluded that meniscal repair or resection did not alter the final outcome. In our study, there was associated meniscal injury in 43% of patients. 57% patients in our study had isolated ACL injury. 30% patients had injury to the medial meniscus whereas 10% patients had injury to the lateral meniscus alone. 3% patients had injury to both the medial and lateral meniscus. The most commonly injured was medial meniscus which was in accordance with other studies.

The average Lysholm score at the end of the study of Jomha *et al*. [20] was 94, Railey *et al*. [21] was 91, Ashok Kumar *et al*. 2016 [22] was 90 and in our study average Lysholm score at last follow-up was 90.5 which was comparable with the above studies. In this study the mean post-operative IKDC score was 89.48, which is equivalent to the results of study done by Kumar *et al*. [17], where he get the mean IKDC score of 89.38.

The manual Lachman grading improved from a median preoperative value of 3 (range 1-3) to final median level of 0 (range 0-3). No patient had Lachman grading beyond 1. The Pivot shift grading improved from a median preoperative value of 2 (range 1-3) to final median level of to 1 (range 0-2). At the final follow-up one patient had Pivot shift grade 2. No patient had Pivot shift grade 3 at final follow up.

In this study full range of motion was achieved in 26 while 4 patients persisted with some motion deficit at final follow up. One patient had flexion deficit of 10 degrees and extension deficit of 5 degrees of the operated knee. 2 patients had extension deficit of 5 degrees and other patient had extension deficit of 10 degrees. Plaweski *et al*. 2009 [11] reported in a series of 105 patients that 4 patients had 5 degrees of extension deficit, 7 patients had mean flexion deficit of 7 degrees (range 3-10 degrees).

In all patients the femoral tunnel was placed posterior and close to the posterior cortex on lateral view. All patients had the femoral tunnel in antero-posterior view within the 10'O clock and 11'O clock for the right knee and 1'O clock and 2'O clock in the left knee. Sagepa [20] stated that it has been popular to place the femoral tunnel at the so called 11'0 clock position to replicate the origin of Antero-medial bundle of ACL. Scoop [23] in 2004 published that the best position for the femoral tunnel is between 10 and 11'0 clock in the right knee and between 1 and 2'0 clock in the left knee.

Howell [22] had stated that in Arthroscopic anterior cruciate ligament reconstruction, tibial tunnel position dictates the femoral tunnel position to a large extent. He added that ideally tibial tunnel must be angled in medial to lateral direction and in sagittal plane it should be angled posteriorly. In our studies all the patients had angled tibial tunnel in sagittal plane. In the antero-posterior view all the patients had tunnel placement between 35 to 45°.

In this study minor complications encountered are, superficial infection (stitch abscess) in one patient and it was controlled by oral antibiotics and dressings, 3 patients had Anterior Knee pain, 1 patient had Patellar articular surface fracture while harvesting the graft, which was fixed with sutures. In one patient there was a breach of posterior wall during screw insertion. The graft at the femoral side was fixed with a screw post. In that patient the tibial screw back out occurred. Screw was later removed. 4 patients persisted with some motion deficit at final follow up. One patient had flexion deficit of 10 degrees and extension deficit of 5 degrees of the operated knee. 2 patients had extension deficit of 5 degrees and other patient had extension deficit of 10 degrees. Plaweski *et al*. 2009 [24] reported in a series of 105 patients that 4 patients had 5 degrees of extension deficit, 7 patients had mean flexion deficit of 7 degrees (range 3-10 degrees).

There were some limitations of present study as small sample size and short follow up period of 12 months.

Conclusion

Arthroscopic anterior cruciate ligament reconstruction with bone-patellar tendon-bone graft is an excellent treatment option for anterior cruciate ligament deficient knees. Arthroscopic ACL reconstruction using bone-patellar tendon-bone auto graft provides a stable knee with minimal complications.

References

1. Butler DL, Noyes FR, Grood ES. Ligamentous restraints to anterior-posterior drawer in the human knee: a

biomechanical study. J Bone Joint Surg. Am. 1980;62(2):259-270.
2. Haimes JL, Wroble RR, Grood ES, Noyes FR. Role of medial structures in the intact and anterior cruciate ligament deficient knee. Limits of motion in the human knee. Am. J Sports Med. 1994;22:402-409.
3. Markolf KL, Wascher DC, Finerman GAM. Direct *in vitro*, measurement of forces in the cruciate ligament. Part II: The effect of section of the posterolateral structures. J Bone and Joint Surg. Am. 1993 Mar;75-A:387-394.
4. Curl WW, Krome J, Gordon ES. Cartilage injuries: A review of 31,516 knee arthroscopies. Arthroscopy. 1997;13(4):456-60.
5. Del Pizzo W, Norwood LA, Kerlan RK, Jobe FW, Carter VS, Blazing ME, *et al*. Analysis of 100 patients with anterolateral rotatory instability of the knee. Clin. Orthop. 1977;122:178-180.
6. Satku K, Kumar VP, Ngoi SS. ACL injuries. To counsel or to operate? J Bone Joint Surg. Br. 1986;68:458-61.
7. Howe, Johnson, Kaplan. ACL reconstruction using quadriceps patellar tendon graft. Part I. Long term follow up. Am. J of Sports Med. 1991;19:447-457.
8. Fu FH, Bennett CH, Ma CB. Current trends in anterior cruciate ligament reconstruction: Operative procedures and clinical correlation. Am. J of Sports Med. 2000;28:124-130.
9. Prodomos CC, *et al*. A meta-analysis of stability of autografts compared to allografts after anterior cruciate ligament reconstruction. Knee Surg. Sports Traumatol. Arthosc. 2007;15:851-856.
10. Aune AK, Holm I, Riseberg MA, Jensen HK, Steen H. Four strand hamstring tendon autograft compared with patellar ten-don bone autograft for anterior cruciate ligament reconstruction: A randomized study with two year follow up. Am. J Sports Med. 2001;29:722-728.
11. Plaweski S, *et al*. ACL reconstruction: Assessment of the hamstring autograft femoral fixation using the Endobutton CL. Orthopaedics and Traumatology: Surgery and Research 2009;95:606-613.
12. Reddy KJ, *et al*. Arthroscopic anterior cruciate ligament reconstruction using four strand hamstring graft-a prospective medium term study. Apollo Medicine. 2009 Mar;6(1):16-20.
13. Chaudary D, *et al*. Arthroscopic reconstruction of the anterior cruciate ligament using bone-patellar tendon-bone autograft. Experience of the first 100 cases. J Orth. Surg. 2005;13:147-152.
14. Jomha NM, *et al*. Arthroscopic reconstruction of the anterior cruciate ligament with patellar-tendon autograft and interference screw fixation. The results at seven years. J Bone Joint Surg. Br. 1999;81:775-779.
15. Williams RJ, *et al*. Anterior cruciate ligament reconstruction with a four-strand hamstring tendon autograft. J Bone Joint Surg. Am. 2004;86:225-232.
16. Mahiroğullari M, *et al*. Early results of reconstruction of chronic anterior cruciate ligament ruptures using four-strand hamstring tendon autografts Acta Orthop. Traumatol. Turc. 2005;39:224-230.
17. Kumar PK, *et al*. Functional outcome of arthroscopic reconstruction of anterior cruciate ligament tears. J. Evolution Med. Dent. Sci. 2016;5(10):427-432. DOI: 10.14260/jemds/2016/98.
18. Mulcahey MD, *et al*. Transtibial versus Anteromedial Portal Anterior Cruciate Ligament Reconstruction Using Soft-Tissue Graft and Expandable Fixation. Arthroscopy: The Journal of Arthroscopic and Related Surgery; c2014. p. 1-7.
19. Lewis DW, *et al*. Incidence of meniscal and chondral injuries at the time of ACL reconstruction, and their relationship with outcome at 2 years. Orthopaedic proceedings. 2012;94-b(6):41.
20. Sagepa AA, *et al*. Testing for isometry during reconstruction of the ACL. Anatomical and biomechanical consideration. J Bone Joint Surg. 1990;72(A):259-267.
21. Loh JC, *et al*. Knee Stability and graft function following ACL Reconstruction: Comparison between 11'O and 10'O clock femoral tunnel placement. Arthroscopy; c2003. p. 297-304.
22. Howell SM. Principles for placing the tibial tunnel and avoiding roof impingement during reconstruction of a torn anterior cruciate ligament. Knee Surg. Sports Traumatol. Arthroscop. 1998;6(1):S49-S50.
23. Scoop JM, *et al*. The effect of oblique femoral tunnel placement on rotational constraint of the knee reconstructed using patellar tendon autografts. Arthroscopy 2004;20(3):294-299.
24. Guglielmetti, *et al*. Anterior cruciate ligament reconstruction: A new cortical suspension device for femoral fixation with transtibial and transportal techniques. Journal of Orthopaedic Surgery and Research. 2014;9:110.

How to Cite This Article
Lone BA, Mushtaq S, Mir IS, Rahim I, Shabir S. Assessment of outcome of arthroscopic assisted ACL reconstruction using bone patellar tendon bone auto-graft in Kashmiri population. National Journal of Clinical Orthopaedics. 2024; 8(1): 27-32