

EVALUATION OF ARTHROSCOPIC ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION WITH QUADRUPLED HAMSTRINGS TENDON GRAFT

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ABSTRACT

Objective: Treatment of rupture of anterior cruciate ligament (ACL) aims to restore normal/near normal stability and function of the knee, preventing further damage to other knee structures. We studied the functional outcome of arthroscopic guided ACL reconstruction using quadrupled hamstring tendon graft (QHTG) and evaluated the complications.

Methods: In this prospective study, evaluation parameters Lachman test, Pivot test, and hamstring strength were assessed pre- and post-operatively at months 3, 6, 12, 18, and 24; Lysholm test was assessed postoperatively. Intravenous ceftriaxone+tazobactam 1 g b.d × 2 days followed by oral cefpodoxime 200 mg b.d was prescribed till suture removal. Post-operative ACL rehabilitation protocol was followed for all patients.

Result: A total of sixteen male patients with a mean age of 26.5 years were evaluated. Injury due to road traffic accident (7) and sports activity (6) was a common cause. Preoperatively, all patients had positive Pivote and anterior drawer test, 4+ score of Lachman test, 4/5 muscle strength with restriction of movement to <10°. Mean±standard deviation Lysholm score at months 3, 6, and 12 were 81.19±10.21, 83.86±12.44, and 89.17±8.32, respectively. At month 3, negative Lachman test was seen in 75% (12/16) patients, 18.75% (3/16) had 1+ laxity, and only one had 2+ laxity. None had pivot shift test positive. At month 3, 81.25% (13/16) patients had normal range of motion of the operated knee; at month 6 and 12, 85.71% (12/14) and 91.67% (11/12), respectively, had equal range of motion compared to normal contralateral side. At months 3 and 12, 37.5% (6/16) and 100% (12/12) had a grade of 5/5 power in hamstring muscles. 12 post-operative complications were seen in 10 patients.

Conclusion: Autologous ipsilateral QHTG is a good choice in arthroscopic guided ACL reconstruction and is associated with fewer complications. Focus on regaining hamstring power is essential for a successful surgery.

Keywords: Anterior cruciate ligament tear, Hamstring strength, Lysholm score, Pivote test, Quadrupled hamstring tendon graft, Range of movement.

INTRODUCTION

Rupture of anterior cruciate ligament (ACL) is frequently seen in those who are involved in sports and in victims of road traffic accidents. Anterior knee instability associated with rupture of ACL is a disabling clinical condition. Surgical correction of ACL injuries is required to reduce pain, maintain stability, restore and limit further loss in the joint structure and function; untreated complete injury to the ligament results in progressive symptomatic instability leading to recurrent injury, damage to the menisci, articular cartilage, and early osteoarthritis [1-3]. Treatment aims to restore normal or near normal stability in the knee, restore the level of function, limit loss of joint function, prevent further injury or more damage to other knee structures.

Treatment option for the rupture of ACL of knee remains solely surgical, and reconstruction of the ACL is very crucial in maintaining the structural and functional stability of the joint movement and maintains the static and dynamic equilibrium of knee joint.

Arthroscopic reconstruction is preferred due to the advantages it offers over the open surgeries, hence, latter is very rarely performed. Autografts of hamstring or patellar tendon are preferred as chances or rejection is minimal. Problems with extensor mechanism of the knee, loss of motion, patellar fracture and development of chronic anterior knee pain with the bone-patellar tendon-bone autograft, prompted surgeons to seek other graft materials for use in ACL reconstruction. Gracilis and semitendinosus (Hamstring) tendon represent an alternative autografts donor material that may be used for ACL reconstruction to overcome the post-operative issues associated with patellar tendon graft [4,5].

Several studies were done to evaluate the flexor knee strength following hamstring tendon harvesting for ACL reconstruction. Data are limited in Indian population. Hence, we studied the functional outcome of arthroscopic guided ACL reconstruction using quadrupled hamstring graft and evaluated the complications in those with a history of repeated and episodic knee instability (ACL tear).

METHODS

This prospective study was conducted by the Department of Orthopedics, Katuri Medical College and Hospital, Chinakondrupadu, Guntur, from August 2011 to September 2013 after obtaining Institutional Ethics Committee's approval.

Patients aged 20-40 years, with a history of repeated and episodic knee instability, without evidence of clinical or radiological degenerative changes in the knee joint, who underwent arthroscopic guided ACL reconstruction using quadrupled hamstring (semitendinosus and gracilis) tendons graft were included in the study. The diagnosis was confirmed radiologically which included an X-ray and magnetic resonance imaging (MRI) scan.

Patients with ACL tear in age groups <20 and >40 years, partial tear of ACL, posterior cruciate ligament tear, bilateral ACL ruptures, ACL tears with associated injuries of tibial or femoral condyles, with tricompartmental osteoarthritis of knee joint and revision ACL reconstruction were excluded from the study.

Pre-operative investigations included clinical (physical, electrocardiogram) and laboratory investigations including

complete blood picture, liver and renal function test, bleeding and clotting time. Patients were considered for surgery only when they were certified fit for surgery and all these investigations were within normal limits.

Ligament laxity was assessed using Lachman's test (0-4 + grades) [6], anterior drawer's test [7], and pivot shift test [8]. The range of motion of the operated knee was noted and compared with the contralateral knee. Knee flexion strength (hamstring power) was assessed using Medical Research Council (MRC) grading [9].

All included patients underwent quadrupled hamstring tendon (semitendinosus and gracilis) autograft for ACL reconstruction under regional anesthesia. The graft was fixed proximally (femoral side) with a titanium endobutton to the mouth of the femoral tunnel. The distal (tibial) end graft anchored to the tibia with a titanium interference screw. Postoperatively intravenous ceftriaxone+tazobactam 1 g twice a day for 2 days, followed by oral cefpodoxime 200 mg twice a day was given till suture removal. Post-operative ACL rehabilitation protocol was followed for all patients.

All patients were evaluated periodically at months 3, 6, 12, 18, and 24. The standard protocol of Lysholm knee scoring system was used for the evaluation, of the results of surgery during follow-up. Subjective and objective evaluations were performed; latter included Ligament laxity (assessed using Lachman's test, anterior drawer's test, and pivot shift test), comparison of a range of motion of the operated knee with the contralateral knee, knee flexion strength (hamstring power) (assessed using MRC grading).

All patients were subjected to four phases (I-IV) of intense rehabilitation [10], starting from immediate post-operative period till 4-8 months, to restore the function and stability of the joint, gait, pain reduction, restore and enhance the strength and endurance through active physiotherapy.

Statistical analysis

This was a time bound clinical study. Data were captured on Microsoft Excel worksheet and analyzed. Descriptive statistics, frequency tables, mean, standard deviation (SD), and percent were used to portray the results.

RESULTS

About 16 patients were included in the study; all underwent unilateral arthroscopic ACL reconstruction with hamstring autograft. All patients completed their follow-up visit at month 3; however, only 14 came at month 6 and 12 came at month 12; only eight and four patients completed month 18 and 24, respectively.

Patients between 20 and 40 years were included in the study, with an average of 26.5 years. 10 (62.5%) patients were in the age group of 21-25 years (Fig. 1). All were men.

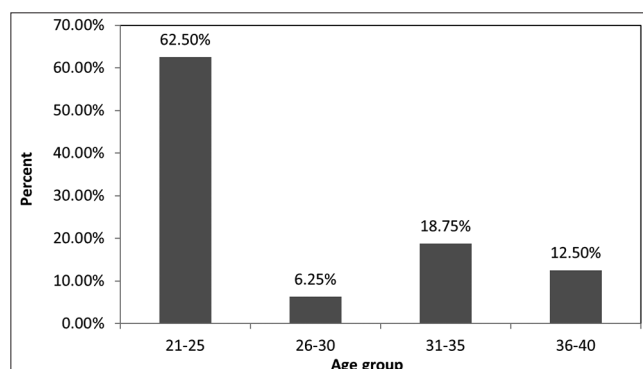


Fig. 1: Age-wise distribution of study population

Left knee was affected in 9 (56.25%) patients and right knee in 7 (43.75%). There was no significant difference in lateralization of the injury.

No patient in our study had isolated ACL tears, and all had injuries to ligaments or menisci in ipsilateral knee. 5 patients (31.25%) had associated lateral meniscal tears, 11 (68.75%) patients had medial meniscal tears.

About 7 (43.75%) patients had road traffic accident, 6 (37.50) had an injury due to sports activities, and 3 patients had twisting injury as a causative factor. All patients had chronic ACL tear.

Lachman test, anterior drawer test, Pivote shift test were used for objective evaluation, pre- and post-operatively. Preoperatively, all subjects had a positive anterior drawer and Pivote test, 4+ score of Lachman test. All patients had 4/5 muscle strength and range of movement in all patients was <10°.

Subjective evaluation was done using Lysholm score, postoperatively. Mean±SD Lysholm score at months 3, 6, 12, and 18 was 81.19±10.21, 83.86±12.44, 89.17±8.32, and 93.50±3.93, respectively.

At 3 months follow-up, 15 (93.75%) patients had negative anterior drawer test, 12 (75.0%) patients had negative Lachman test, 3 (18.75%) patients had 1+ laxity, and only one patient had 2+ laxity. At month 12, Lachman test was negative in 9 (75%) patients (Table 1).

Table 2 compares Lachman test and pivot shift test postoperatively at month 3.

These patients had no instability during activities such as running or climbing up and down stairs, at 1 year follow-up. Two patients (12.50%) had 1+ laxity. These patients had no instability while walking. None of the patients had pivot shift test positive.

Range of movement

Of 16 patients, follow-up at month 3, 81.25% (13/16) had normal range of motion of the operated knee, at 6 months, 85.71% (12/14) patients had equal range of motion compared to normal contralateral side and at 1 year follow-up 91.67% (11/12) had equal range of motion compared to normal contralateral side.

Hamstring power

At 3 months follow-up, 37.5% (6/16) had a grade of 5/5 (MRC) power in hamstring muscles, and grade 5/5 power was noticed in all 12 patients. Post-operative complications (12 events) were seen in 10 patients (Table 3). Anterior knee pain (4/16), tunnel widening (3/16), and infection (2/16) were the frequent complication, which were managed accordingly.

DISCUSSION

Reconstruction of ACL tear has been performed with various structures, of which hamstrings offers advantages because of anatomical position and structure, faster recovery, less pain with movement of the joint and cosmetically acceptable to the patient. Studies have recommended this procedure [11]; it is the most adopted technique and the application of this procedure is increasing [12-14].

With the advances in the technology, of late, arthroscopic reconstruction is preferred due to the advantages it offers over the open method. Thus, we opted for this procedure in our patients for the ease of operation and benefit for the patients.

All our patients were men; most of the studies [15] have documented male preponderance though females are at higher risk [16]. Previous studies have documented the mean age as 24-25 years, and our study too supports this as mean age is 26.5 years. It could be attributed to the

Table 1: Comparison of assessments prior and postoperatively during follow-up

Parameter	Baseline (n=16)	Post-operative				
		3 months (n=16)	6 months (n=14)	12 months (n=12)	18 months (n=08)	24 months (n=04)
Lysholm score						
Mean±SD	-	81.19±10.21	83.86±12.44	89.17±8.32	93.50±3.93	97.00±1.83
Minimum		62	54	67	86	95
Maximum		98	95	98	98	99
Pivotal shift						
Positive	16	-	-	-	-	-
Negative	-	16	16	16	16	16
Lachman test (%)						
Negative		12 (75)	10 (71.42)	9 (75)	8 (100)	4 (100)
1+		3 (18.75)	02 (12.50)	2 (16.67)		
2+		1 (6.25)	1 (6.25)	1 (8.33)		
3+		-	1 (6.25)	-		
4+	16	-	-	-		
Hamstring test (%)						
4/5	16	10 (62.5)	4 (28.6)	0	8 (100)	4 (100)
5/5		6 (37.5)	10 (71.4)	12 (100)		
Range of movement (%)						
Full range		13 (81.25)	12 (85.71)	11 (91.67)	8 (100)	4 (100)
Nil		1 (6.25)	2 (14.29)	1 (8.33)		
Decreased movement						
Up to 20°		2 (12.5)	-	-		
Up to 10°	16					

SD: Standard deviation

Table 2: Comparison of Lachman test and Pivot shift postoperatively at 3 month follow-up

Lachman test	Pivot test		Total
	Negative	Positive	
Negative	12	0	12
1+	2	0	2
2+	1	0	1
3+	1	0	1
4+	0	0	0
Total	16	0	16

Table 3: Post-operative complications

Complications	n	Treatment
Anterior knee pain	4	Non-steroidal anti-inflammatory drugs
Infection (superficial)	2	Antibiotics (oral) – Cefpodoxime 200 mg b.d×5 days
Slippage of endobutton	1	Regular follow-up
Tunnel widening	3	Regular follow-up
Graft Failure	1	Lost to follow-up
Flexion restricted beyond 90°	1	Physiotherapy

More than one event was seen in few patients.

active involvement of this age group in sports activities; in our patients, it may also be attributed to the riding of two wheelers for commuting in this region.

Sports and trauma are the well-established and documented causes of ACL. Road traffic accident accounted for 43.75% patients in our study. All our patients had unilateral ACL. In our study, the incidence of associated medial meniscal tears was more when compared to associated lateral meniscal tears. Associated meniscal injury was seen in patients as observed in previous studies [17], lateral meniscal injury (46.88%) was more frequent in previous studies [18].

Preoperatively, all our patients had positive Pivote and anterior drawer test; Lachman score of 4+ indicating complete ACL tear clinically, further confirmed radiologically by MRI. All patients had decreased muscle strength (4/5) and range of movement (<10°) before surgery which improved subsequently post-surgery.

Lysholm test is used for subjective evaluation of ACL reconstruction. Our study has documented a gradual increase in the score from 81.19±10.21 to 97.00±1.83, indicating improvement. Previous studies too documented similar observations of improvement in Lysholm score postoperatively [17-22].

Lachman test is the most sensitive maneuver for eliciting the ACL disruption in an acute setting, when the knee is swollen and painful, in which considerable knee motion is too painful to be tolerated. All patients had 4+ score before surgery and negative in 75% of patients at 1 year follow-up. However, previous studies have noted the higher proportion of patients having negative Lachman test [17,20-22]. This difference could be due to the less number of patients evaluated in our study.

Negative pivot shift was noted in all (100%) our patients postoperatively. Previous studies [20-22] have recorded greater proportion (96% and 82%) of patients having negative pivot shift.

All our patients had decreased or restricted range of movement preoperatively and a full range of motion was attained in 85.71% (12/14) patients followed-up for 6 months and in 91.67% (11/12) patients followed-up for 1 year. Full range - 100% motion range was observed by Ali *et al.* [17]. Postoperatively, no patient in our study had pivot shift positive.

There was a significant improvement in hamstring muscle strength at long-term follow-up with good rehabilitation program even after both the tendons were used for the graft.

We did not observe a significant difference in the Lachman score, hamstring test, and range of movement after 12 months of follow-up.

ACL results in restriction of knee function and reconstruction aids in restoring it to near normal resulting in a satisfactory clinical

outcome. Previous studies [23,24] and our results have supported this finding.

Complications of this procedure are an infection, deep vein thrombosis, bleeding, injury to nervous and/vessels, rupture of the graft, swelling, pain and instability, knee stiffness, hamstring-related issues and foreign body reactions due to screws, buttons. Superficial infection was the most common post-operative complication seen in previous studies too [17]. Studies have noted less anterior knee pain with the use of hamstrings compared to bone patella tendon [25,26].

Anterior knee pain (25%) and superficial infections (12.50%) were more frequently reported complications in our patients. Pain over the anterior part of the leg persisted up to 6 months postoperatively, which is attributed to the implant used for our patients. Pain subsided with non-steroidal anti-inflammatory drugs and physiotherapy. Heijne *et al.* have concluded that mild anterior knee pain is associated with good clinical outcome [27]. Previous studies have concluded that surgical site infections are more frequent with hamstring tendon autografts [28-30].

We noted that the proximal femoral endobutton and distal titanium interference screw provided good primary ACL graft fixation, which enabled immediate negation of anterior drawer and pivot shift tests and hence are one of the good choices for ACL graft fixation.

Harvesting of hamstring (semitendinosus and gracilis) tendon weakened the ACL agonists which resulted in initial less hamstring power and also mild laxity patterns in the initial 6 months of post-operative period. Regaining of hamstring power negated the mild laxity pattern in the post-operative follow-up period. Knee stability was restored postoperatively in our patients. Our findings are in line with the available data which used endobutton [31].

Graft failure was noted in only one patient; however, we could not take any further action as the patient was lost to follow-up. No patient required reoperation, and there was no mortality.

Our study had few limitations; we had only 16 patients of which only four patients came for 2 years follow-up. This number is too small to compare with other studies which had a considerable number of patients. Though our study does not derive a concrete conclusion, it is our effort to add to the limiting data available in our population.

CONCLUSION

Autologous ipsilateral quadrupled hamstring tendon graft is a good graft choice in arthroscopic guided ACL reconstruction and associated with fewer complications. ACL rehabilitation protocol concentrating on regaining hamstring power is essential in the success of ACL reconstruction surgery.

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