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Functional outcome following arthroscopic anterior cruciate ligament reconstruction using quadrupled hamstring autograft

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Abstract
Background: Arthroscopic reconstruction of ACL is a well-accepted treatment of ACL injuries; however, no uniform consensus exists to decide type of fixation for arthroscopic anterior cruciate ligament reconstruction
Materials and Methods: A total of 30 patients underwent arthroscopic anterior cruciate ligament reconstruction with hamstring tendons using endobutton on femoral side and interference screw on tibial side. The evaluation methods were clinical examination, Lysholm and IKDC score. Patients were followed up at the end of 1 month, 3 months, 6 months and 8 months and their functional outcome was assessed
Results: In our study of sample size 30 with male preponderance (93.33%). The mean age was 26.46 years. Mean post-operative Lysholm score was 87.95, mean post-operative IKDC score was 79.88 at the end of 8 months. 25 patients (83.3%) were able to return to their pre-injury activity.
Conclusion: Arthroscopic anterior cruciate ligament reconstruction with hamstring tendons using endobutton and interference screw had good functional outcome.

Keywords: ACL, arthroscopy, hamstring graft, endobutton, knee injury

Introduction
ACL is the primary (85%) restraint to limit anterior translation of the tibia. The tensile strength of ACL is 2160N. Incidence being 1 in 3,000 amongst the general population [1]. They are common among sports injuries caused by brutal deceleration movements.
Galen [2] was the first to describe the ACL as being a structure that supports the joint and prevents abnormal knee motion. George K Noulis [3] precisely described the function of the ACL, in the year of 1875, in his thesis on "Knee sprains". He also stated that the integrity of the ligament should be assessed in knee extension. The test which was put forth by Noulis is identified to the one which is now known and used as the Lachman test, which is the most sensitive test for ACL tears. A.W. Mayo Robson [4] in 1895, executed the first ACL repair. ACL reconstruction has remained a treatment of choice for anterior cruciate ligament deficient knees, since majority of non-operative procedures have resulted in functionally unacceptable outcomes.

Anatomy
The ACL is a ligamentous structure composed of dense connective tissue, made of parallel rows of type 1 collagen and fibroblast [5]. It originates from the posterior and medial aspect of the lateral femoral condyle and inserts to the anterior and medial aspect of the medial tibial spine [6].
The ACL is composed of two principal parts: 1. Small anteromedial bundle (AMB) 2. Large bulky posterolateral bundle (PLB). During extension of knee, PLB tightens and AMB relaxes, however during flexion of knee, AMB tightens and PLB relaxes, hence producing a twist and untwist motion.

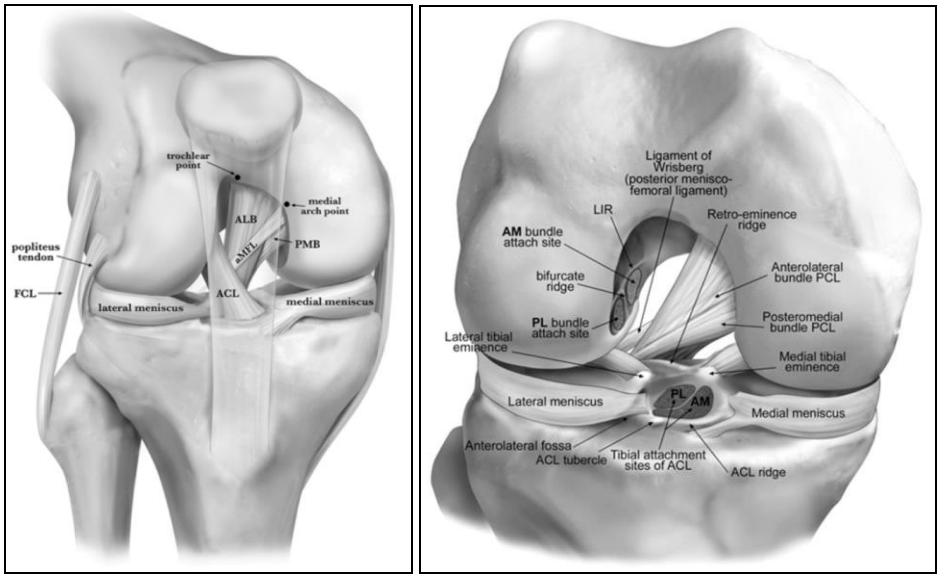

Fig 1: Anatomy of the ACL showing AMB and PLB foot prints on femoral and tibial ends

Objective

To evaluate the functional outcome of arthroscopic anterior cruciate ligament reconstruction using semitendinosus and gracilis autograft and to assess complications following the reconstruction.

Materials and Methods

This is a prospective cohort study of 30 consecutive patients who underwent arthroscopic ACL reconstruction using quadrupled semitendinosus tendon autograft during the study period, July 2016 to September 2018, in AJ Institute of Medical Sciences and Research Centre, Mangalore after obtaining ethical committee clearance.

Inclusion criteria

- Anterior cruciate ligament tear confirmed either clinically or radiologically by MRI.
- Age between 18 – 45 years

Exclusion criteria

- Anterior cruciate ligament tear associated with bony injury around the knee.
- Any previously operated knees for any reason

Fig 2: Lachman Test

Fig 3: Anterior drawer test

Surgical Technique

All the surgical procedures were performed by the same surgeon. Tourniquet was used in all cases. Standard anteromedial (AM) and anterolateral (AL) portals were used. Diagnostic arthroscopy was performed, and ACL tear confirmed. A 3-4 cm incision anteromedially on the tibia to expose and harvest the hamstring tendons (semitendinosus and gracilis tendons). Graft quadrupled and prepared. Femoral tunnel and tibial tunnel prepared. Endobutton on to femoral side and interference screw on tibial side.

Post-operative protocol was standard for all the patients. Static quadriceps strengthening exercises, active knee bending with gradual increase of 10-20° of flexion per day, assisted SLRT, abduction and adduction exercises of thigh, hamstring strengthening exercises were started from day 1 to 7. Walking with knee brace by the end of 1st week. Closed kinetic chain exercises from 3-6 weeks. Ellipticals, treadmill walking from 6-12 weeks. Forward running, ladder drills, agility training from 3-6 months.

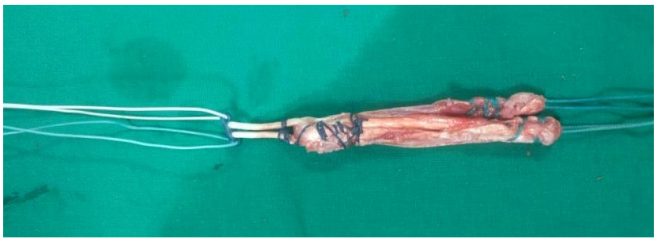

Fig 4: prepared and quadrupled hamstring graft

Statistical analysis

Descriptive statistics are reported (mean, median, minimum, maximum, standard deviation). Descriptive statistics like mean, standard deviation was computed for continuous variables and frequency and proportions for categorical data Association between two variables were found using Chi square test. Independent t test was done to compare the group means. P-value <0.05 was considered as statistically significant. The STATA 14.0 software was used. Microsoft Word and Excel were used to generate graphs and tables.

Results

The mean age in our study was 26.46 years. The maximum number of patients were in the age group of 21- 25yrs (46.6%). Out of 30 patients, 28 patients (93.33%) were males and 2 patient (6.67%) females. Right knee was injured in 19 patients (63%) and left knee in 11 patients (37%). Majority of the patients (46.6%) were from agricultural occupation followed by sports (33.3%) and 20% were into sedentary lifestyle.

Table 1: Distribution based on occupation of the patients

Occupation	Frequency (n=30)	Percentage
Agriculture	14	46.6%
Sports	10	33.3%
Sedentary	6	20%

Medial meniscal tear was the commonest associated injury (33.3%) detected by MRI followed by lateral meniscus (26.6%) and medial collateral ligament injury (6.6%). There was no lateral collateral ligament and PCL injury.

Table 2: Distribution of associated injuries

	Frequency (n=30)	Percentage
MM	10	33.3%
LM	8	26.6%
MCL	2	6.6%
LCL	0	0%
PCL	0	0%

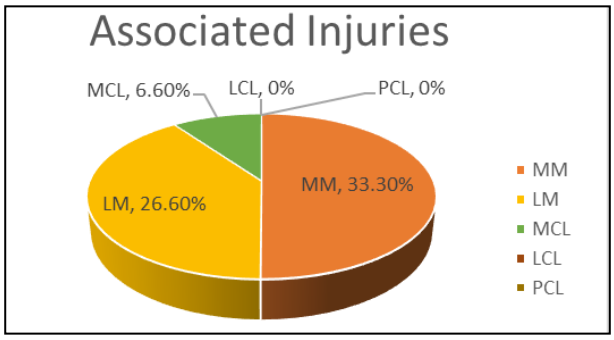

Fig 5: Distribution of associated injuries

6 patients (20%) had pain at the graft site at the end of 6 months. Early superficial infection of the site was present in 1 case (3.3%) with delayed wound healing and regaining full function. 14 patients (46.6%) had grade I laxity at the end of 6 months but with hard end point. No patients had deep infection and FFD following the surgery.

Table 3: Complications

	Frequency (n=30)	Percentage
Pain	6	20%
Superficial Infection	1	3.3%
Deep Infection	0	0%
Numbness	4	13.3%
Laxity	14	46.6%
Click	2	6.6%
FFD	0	0%

Table 4: Pre-operative Scores

IKDC	Lysholm
54.34367 +/- 3.656798	64.73333 +/- 4.266415

Table 5: Postoperative scoring and outcome

	IKDC	min	max	Lysholm	min	max	p value
1 month	62.40533	52	78.16	72.33333	64	80	<0.05
3 months	69.66667	58	86	80.2	69	87	
6 months	76.27	64	93.1	85.93333	72	92	
8 months	79.86667	70	96.6	87.95	76	94	

According to IKDC score, 90% of the patients graded their post-operative recovery as normal and 30% as near normal whereas 3 patients (10%) graded recovery as abnormal.
According to Lysholm scores, 7 patients (23.33%) fell under excellent recovery group. 20 patients (66.66%) had good post-operative outcome. 3 patients (10%) had a fair outcome. and no patients had poor outcome. Majority of patients fell in 84-90 category (good outcome).

Table 6: Post-operative grading according to IKDC

Score Category	Frequency (n=30)	Percentage (%)
Excellent (91-100)	7	23.33
Good (84-90)	20	66.66
Fair (65-83)	3	10
Poor (<65)	0	0

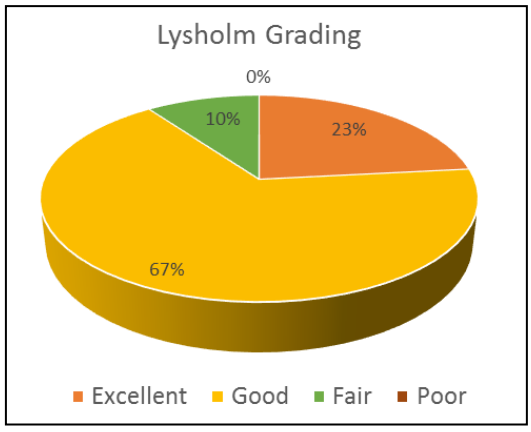

Fig 6: Post-operative distribution according to Lysholm

25 patients (83.3%) were able to return to their pre-injury activity including farming and to competitive sports. 5 patients (16.6%) were not satisfied with physiotherapy regimen and these patients were noncompliant to the protocol at the last months. But regained full flexion and could do daily activities.

Fig 7: A 27-year-old male patient with right ACL tear confirmed with MRI, achieved complete knee flexion following 8 months of arthroscopic reconstruction

Discussion

Anterior cruciate ligament (ACL) ruptures left untreated lead to subsequent knee disability, which can be severe with potentially devastating long-term consequences. With improving results and increasingly reliable outcomes, patient and physician expectations have evolved to include the goal of return to activities and sports at normal or near normal levels.

In 2009, Brown [7] and others studied the incidence of sex and limb differences in anterior cruciate ligament injury and stated that even though females are prone for injury, due to their less exposure to strenuous environment makes the incidence of males more than females. They also concluded that limb differences have no influence either during injury or in the recovery period.

In our study Medial meniscal tear was the commonest associated injury (33.3%) detected by MRI followed by lateral meniscus (26.6%). Vassilios S Nikolaou *et al.* [8] in 2008, after a retrospective analysis of MRI efficiency in diagnosing internal lesions of the knee, reported that the accuracy for tears to the medial, lateral meniscus, anterior and posterior cruciate ligaments and articular cartilage was 81%, 77%, 86%, 98% and 60% respectively. Williams *et al.* [9] in their study of 2500 cases of arthroscopic ACL reconstruction, reported an infection rate of 0.3%. In our study, one patient had superficial infection. The patient with superficial infection was managed with antibiotics alone and had good functional outcome at the end of 6 months.

Nebelung *et al.* [10] reviewed the results of twenty-nine anterior cruciate reconstructions with autogenous semitendinosus tendon and a femoral Endobutton. They graded 66% of the results as normal or nearly normal using the criteria of the IKDC. The Lysholm score improved from a preoperative mean (and standard deviation) of 55 ± 3 points (range, 15 to 100 points) to a postoperative mean of 91 ± 2 points (range, 55 to 100 points) ($p < 0.01$) as observed by Williams III RJ *et al.* [11] in 2004. Colombet, P *et al.* [12] in their study observed that IKDC subjective score Preoperative was 60.4 ± 15.0 (33.3 to 95.4) and 2-year postoperative improved to 87.6 ± 10.6 (43.7 to 100.0). Lysholm score Preoperative was 75.6 ± 13.0 (44.0 to 100.0) 2-year postoperative was 90.8 ± 9.3 (56.0 to 100.0) which is comparable with our study.

Conclusion

- In young active adults, anatomic single bundle reconstruction with quadrupled hamstring graft gives good functional results
- The absence of patellofemoral pain with the use of hamstring graft makes it a more desirable option for patients with patellofemoral cartilage disorders or those with chronic patellofemoral pain
- Hamstring graft fixation with endobutton and

interference screw gives good functional outcome
- Arthroscopic anterior cruciate ligament reconstruction with hamstring graft is an excellent treatment option for anterior cruciate ligament deficient knees

Limitations
- Small sample size.
- The results of the study were assessed using subjective scores and not based on objective assessment.
- Short duration of follow up.

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