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Original Research Article

Evaluation of functional outcome of arthroscopic isolated anterior cruciate ligament reconstruction with quadriceps tendon

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ABSTRACT

Background: The anterior cruciate ligament (ACL) is one of the most important intra-articular ligaments in the knee joint. It is regarded as the main barrier preventing the tibia from anteriorly translating onto the femur. The greatest incidence occurs in 15 to 25-year-old participants of work and pivoting sports. This study aimed to assess the functional outcome of arthroscopic isolated ACL reconstruction with quadriceps tendon.
Methods: This was a prospective interventional study conducted in the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh during the period from March 2020 to August 2022. In our study, we included 30 patients with anterior cruciate ligament injuries who attended the orthopaedic department within the study period.
Results: The preoperative Lysholm score was found to be poor in all cases. Nine months after arthroscopic isolated ACL reconstruction with quadriceps tendon Lysholm score was found as excellent in 18 (60%) cases, good in 8 (26.7%), and fair in 4 (13.3%) cases. During the last follow-up of 9 months after arthroscopic isolated ACL reconstruction with quadriceps tendon, 26 (86.7%) patients were found as satisfactory results, and only 4 (13.3%) patients were found as unsatisfactory. A significant difference was observed between preoperative and postoperative functional outcomes.
Conclusions: In our study, we found that arthroscopic isolated ACL reconstruction with quadriceps tendon showed satisfactory functional outcomes for the treatment of ACL injury, and all the functions of the knee were improved in compared with their pre-operative status.

Keywords: Anterior cruciate ligament reconstruction, Quadriceps tendon, Lysholm score, Visual analogue scale

INTRODUCTION

The knee is a synovial hinge joint with an extensive network of ligaments and muscles. It is the largest and most complex joint with several internal structures. The anterior cruciate ligament (ACL) is one of the most important intra-articular ligaments in the knee joint. It is regarded as the main barrier preventing the tibia from anteriorly translating onto the femur. Additionally, it gives the knee joint rotational stability while walking normally and performing regular tasks.[1] Classically, ACL injuries affect people during their prime working hours. The greatest incidence occurs in 15 to 25-year-old participants of work and pivoting sports. Work-related injuries and accidents are also common. Consequences of ACL injuries include lost time from work and a lower quality of life.[2]

The treatment options for ACL deficient knee include non-operative and operative management. Operative

management includes repair of the anterior cruciate ligament either isolated or with augmentation and reconstruction with either autograft allograft or synthetic graft.[1] Current research supports the concept that under observance of several key factors, arthroscopic ACL reconstruction done with a biologic autograft significantly improves the stability and function of the knee in most ACL-deficient patients. The most common graft choices are the bone-patellar tendon-bone (BPTB) and the semitendinosus/gracilis (hamstring) tendon.[3]

Many different autograft options exist. Bone–patellar tendon-bone (BPTB) autografts are the standard autograft of choice in the United States.[4] Few studies have found patellar fracture, patellofemoral pain, increased donor-site morbidity, arthrofibrosis, and quadriceps weakness after surgery.[3,5,6] BPTB autograft also predisposes patients to a greater risk of knee osteoarthritis than other autograft types. Several studies reported that quadrupled-hamstrings (QHS) autografts have been used as an alternative to BPTB autografts.[6-10] However, QHS autografts have shown higher rates of failure than BPTB autografts and undersized grafts can be problematic in small-statured patients.[3]

The diameter of the graft is one of the most important considerations during ACL reconstruction surgery of the knee. The effect of the autograft diameter on the re-rupture and revision rate of the reconstructed ACL of the knee has been studied intensively and harvesting of small diameter graft can lead to a higher failure rate.[11] Grafts larger than 8 mm were found to reduce the failure rate and provide a protective effect.[12] However, in our country as well as in Asian countries, it is very difficult to get quadruple strands of hamstring graft with a diameter of 8 mm. In addition, it is also very hard to predict the diameter of the hamstring (HT) graft due to its inherent variability of size, length, and diameter. Nowadays the use of quadriceps tendon (QT) autograft has been steadily increasing for ACL reconstruction. This was due to significant surgical advances and reliable harvesting techniques for the all–soft tissue QT autograft. Additionally, the QT provides favorable anatomy with low donor-site morbidity and a decrease in anterior knee pain and numbness.[13,14] Cavaignac et al demonstrated benefits of QT for ACLR include stronger, stiffer tissue and preservation of knee-flexor strength which may allow for more aggressive post-operative rehabilitation.[13] Jennifer et al reported that the use of a QT graft in ACL reconstruction leads to equal or better functional outcomes than the use of an HT graft.[14] However, less published data are available in our country. Therefore, the present study has been designed to assess the functional outcome of arthroscopic isolated ACL reconstruction with quadriceps tendon.

METHODS

This was a prospective interventional study conducted in the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh during the period from March 2020 to August 2022. In our study, we included 30 patients with anterior cruciate ligament injuries who attended the orthopaedic department within the study period.

Inclusion criteria

These are the following criteria to be eligible for enrollment as our study participants: patients aged 18 to 45 years irrespective of gender; patients with isolated ACL injury with no concomitant ligament injury; patients with unilateral ACL injury; and patients who were willing to participate were included in the study.

Exclusion criteria

Patients with any history of previous surgery to the affected knee; patients with fracture around the knee (femoral condyle, tibial plateau, patella); patients with meniscal injury; patients with knee osteoarthritis; and patients with any history of acute illness (e.g., renal or pancreatic diseases, ischemic heart disease, asthma, and COPD) were excluded from our study.

Data collection

Patients with the diagnosis of anterior cruciate ligament injury were selected based on inclusion and exclusion criteria. The patients were diagnosed clinically and radiologically. After taking informed consent, a detailed history and physical examination of each patient were performed. Tests like white blood cell (WBC) count, erythrocyte sedimentation rate (ESR), serum creatinine, HbsAg, anti-HCV, electroencephalography (ECG), and echocardiogram (ECG) were carried out routinely in all patients for anesthetic fitness and to support the diagnosis of injury.

A structured case record form was used to interview and collect data. The outcome of arthroscopic isolated ACL reconstruction with quadriceps tendon was measured by using the Lysholm score, and visual analogue scale (VAS). Follow-up was performed at 2 weeks, 6 weeks, 3 months, 6 months, and 9 months after surgery.

Statistical analysis

All data were recorded systematically in preformed data collection form. Quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. A paired student ‘t’ test and Fisher exact test were performed to compare preoperative and postoperative quantitative data and the Wilcoxon rank sum test was done to compare preoperative and postoperative qualitative data. A p value <0.05 was considered as significant. Statistical analysis was performed by using statistical package for social sciences (SPSS) 23 for Windows version 10. The study was approved by the Ethical Review Committee of Bangabandhu Sheikh Mujib Medical University.

RESULTS

Figure 1 shows that the majority (50%) of patients were 26-35 years of age. Out of 30 respondents, 10 (33.3%) were 18-25 years old, and only 5 (16.7%) were 36-45 years of age. The youngest and the oldest patients were 18 and 45 years respectively. The mean±SD age was 29.73±7.00 years.

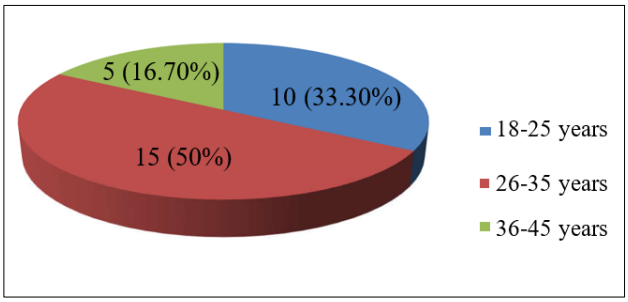

Figure 1: Distribution of study population according to age (n=30).

The pie chart in Figure 2 shows that the majority (90%) of the study subjects were male compared to female (10%). The male and female ratio was 9:1 in the study.

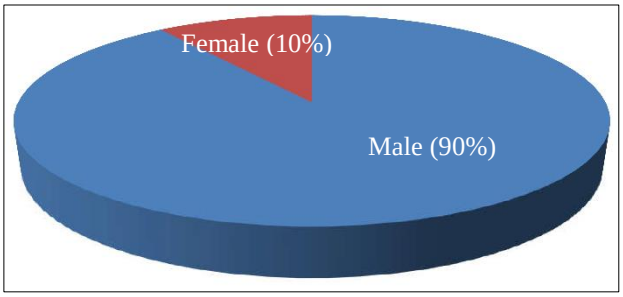

Figure 2: Comparison of Harris hip grading at 9 months between the two groups.

Among 30 subjects, 17 (56.7%) patients had a history of sports injury, 7 (23.3%) patients had a history of road traffic accident, 4 (13.3%) patients had a history of falls from height, and only 2 (6.7%) patients had a history of domestic injury (Figure 3).

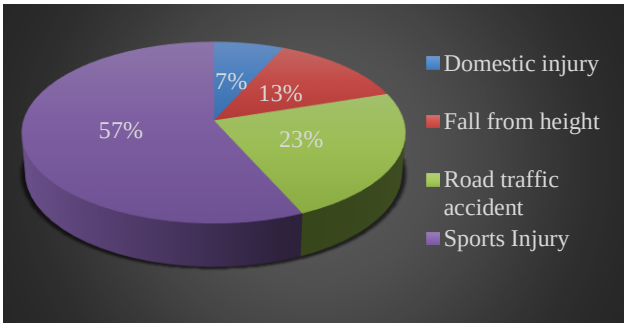

Figure 3: Distribution of study population by mechanism of injury (n=30).

The mean±SD duration of injury was 6.88±4.21 months (range: 2-18 months). In 14 (46.7%) cases, arthroscopic ACL reconstruction with quadriceps tendon was performed within 6 months of the occurrence of ACL injury and 16 (53.3%) cases were performed after 6 months of occurrence of injury (Figure 4).

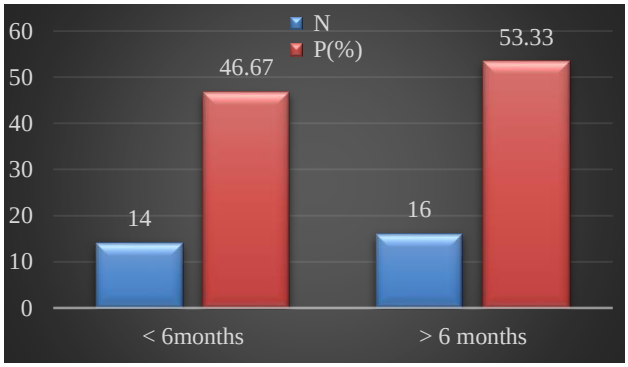

Figure 4: Distribution of study population by the time interval between injury and surgery (n=30).

The maximum thickness of the quadriceps tendon autograft was 10.00 mm and the minimum thickness was 9.00 mm. The diameter of the intraoperative quadriceps tendon was found 9 mm in 23.3% of patients, 9.5 mm in 26.7% of patients, and 10 mm in 50% of patients. However, the mean thickness of the quadriceps tendon autograft was 9.63±0.41 mm. In this study, donor site symptoms were tenderness (6.7%), irritation (16.7%) weakness (10%), and wasting (16.7%). Tenderness and irritation were the predominant complaints at the time of the last follow-up (Table 1).

Table 1: Intraoperative graft diameter and donor site symptoms of study subjects (n=30).

Graft diameter (mm)	Frequency	Percentage
9	7	23.3
9.5	8	26.7
10	15	50.0
Mean±SD (min-max)	9.63±0.41 (9-10)	
Variables	**Absent (%)**	**Present (%)**
Tenderness	28 (93.3)	2 (6.7)
Irritation	25 (83.3)	5 (16.7)
Weakness	27 (90)	3 (10)
Wasting	25 (83.3)	5 (16.7)

Table 2 shows that joint space reduction and osteoarthritic change were absent preoperatively, but postoperatively they were present in 2 (6.7%) and 3(10%) patients respectively. During the last follow-up at 9 months, no significant radiological changes were observed.

To determine the functional outcome of the study, excellent and good grades were regarded as satisfactory

however fair and poor grades were regarded as unsatisfactory according to Lysholm's score. During the last follow-up at 9 months postoperatively most of the patients (86.7%) were found to have satisfactory results. The mean preoperative vas score was 0.90±1.77, which decreased to 0.20±0.48 after reconstruction, and the p value was significant (0.001) (Table 3).

Table 2: Distribution of study population by postoperative radiological changes at last follow-up (n=30).

Variables	Preoperative (%)	Postoperative (%)	P value
Joint space reduction			
Absent	30 (100)	28 (93.3)	0.492[ns]
Present	0 (0)	2 (6.7)	
Osteoarthritic change			
Absent	30 (100)	27 (90)	0.237[ns]
Present	0 (0)	3 (10)	

NS: Not significant

Table 3: Distribution of study population according to functional outcome (n=30).

Outcome	Lysholm score	Preoperative (%)	Postoperative (%)	P value
Satisfactory	Excellent + good	0 (0)	26 (86.7)	
Unsatisfactory	Fair + poor	30 (100)	4 (13.3)	<0.001[s]
	Mean± SD	48.57± 7.41	89.63± 4.18	0.001
Total		30	30 (100)	
	VAS score	0.90± 1.77	0.20± 0.48	0.001

S: Significant

DISCUSSION

In this study, the mean±SD age was 29.73±7.00 years. Similar findings were observed by Akoto et al. The mean age was 29±10 years in their study. Todor et al found the mean age was 30.64±8.71 years.[15] In the study conducted by Sofu et al found a mean age of 26.8 years.[16]

The current study observed that the majority (90%) of the study subjects were male. The male and female ratio was 9:1. The findings were similar to other studies.[1,15,17] However, Devana et al reported that females are at increased risk for ACL injury compared to males and they stated that biomechanical kinematic factors and hormonal factors were responsible for ACL injury in females.[18] In this study, 17 (56.7%) patients had a history of sports injury, 7 (23.3%) patients had a history of road traffic accident, 4 (13.3%) patients had a history of falling from height, and only 2 (6.7%) patients had a history of domestic injury. Mohtadi et al stated the most common mechanism of ACL tear is that of a sudden pivoting or cutting movement during sports, which is commonly seen in football, basketball, and soccer.[2] Work-related injuries and road traffic accidents are also common. However, a road traffic accident was a more common cause of ACL injury in a study conducted by Khana et al.[19]

Majority of the cases 16 (53.3%) in our study with torn ACL had undergone arthroscopic ACL reconstruction with quadriceps tendon after 6 months of the injury and 14 (46.7%) cases had surgery within 6 months of occurrence of ACL injury. Khana et al observed average time between injury and surgery was 12 months.[19] Similar findings were observed by Cavaignac et al.[13] The mean duration between injury and surgery was 10.2±8 months in their study and the mean±SD duration of injury and surgery was 6.88±4.21 months in the present study.

The mean thickness of intra-operative quadriceps tendon autograft was 9.63±0.41 mm (range: 9.00-10.00 mm), where the maximum thickness was 10.00 mm and minimum thickness was 9.00 mm. Todor et al reported that the average quadriceps tendon thickness was 8.57±0.56 mm.[15]

In this study, 28 (93.3%) patients were free from donor site symptoms. However, only a few respondents had discomfort such as tenderness (2; 6.7%), irritation (5; 16.7%), weakness (3; 10%), and wasting (5; 16.7%) at the time of the last follow-up. Akoto et al found no donor site symptoms in 90% of cases when asked to walk on their knees at the follow-up.[17]

Preoperative X-ray of the affected knee of 30 patients showed normal radiological findings. During the last follow-up at 9 months, no significant radiological changes were observed. No study was found to compare our findings.

In the current study, postoperative VAS score was significantly (p=0.001) decreased (0.90±1.77 to 0.20±0.48) at 9 months after surgery. Courtot et al stated that mean pain was significantly decreased after surgery and they were extremely satisfied after surgery.[20]

In our study, satisfactory results were found in 26 (86.7%) patients, and only 4 (13.3%) patients were found as unsatisfactory. A significant difference was observed between preoperative and postoperative functional outcomes. Todor et al found satisfactory results in 87.2% of cases.[15]

In our study, the preoperative Lysholm score was 48.57±7.41 and the postoperative score was 89.63±4.18 and the p value was statistically significant. Galan et al carried out a study of patients with ACL injury who underwent isolated ACL reconstruction and found that the postoperative Lachman showed significant improvement from their preoperative values.[21]

Limitations

Our study was a single-center study. We took a small sample size due to our short study period. After evaluating those patients, we did not follow up with them for the long term and did not know other possible interference that may happen in the long term with these patients.

CONCLUSION

After analyzing the results of the present study, we found that arthroscopic isolated ACL reconstruction with quadriceps tendon showed satisfactory functional outcomes for the treatment of ACL injury, and all the functions of the knee were improved compared with their pre-operative status.

So further study with a prospective and longitudinal study design including a larger sample size needs to be done to compare the functional outcome of isolated arthroscopic ACL reconstruction with quadriceps tendon with other different methods.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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