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Evaluation of the results of arthroscopic anterior cruciate ligament reconstruction by quadruple semitendinosus and gracilis tendon autograft fixation with biodegradable interference tibial screw and endobutton for femur

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Abstract

Introduction: Anterior cruciate ligament is often injured in physical activities especially contact sports and road accidents. ACL injury is a debilitating condition which may result pain, swelling and instability especially during activities involving side stepping and pivoting. Arthroscopic reconstruction of the ACL with central one-third of the patellar ligament and the hamstring tendon construct are most commonly used for reconstruction of ACL. Hamstring tendon graft using semitendinosus or semitendinosus-gracilis tendons either tripled for quadrupled form has evolved as an alternative for ACL reconstruction.

Materials and Methods: This was a quasi-experimental study (Prospective Study). This study was done from January 2015 to December 2016 at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Sher-E-Bangla Nagar, Dhaka. Patients presented with unilateral knee complaints and clinically diagnosed as ACL injury of both sexes at OPD of NITOR were included in this study. Due to time limitation and financial constrain 30 cases were selected during the study period. Purposive sampling (nonrandomized) was done according to availability of the patients and strictly considering the inclusion and exclusion criteria.

Results: Post operatively Lachman test improved significantly, 95% cases of grade I and grade II was in 5% patients. Anterior drawer was positive in 10% cases. Pivot shift test was negative in all cases. McMurray test negative in all cases. After operation 80% had 135° knee flexion and 20% had less than 130° flexion. Preoperative versus post operative Lysholm knee score in this series shows significant improvements ($p < 0.05$). Preoperative and postoperative Lysholm score were 67.57 ± 11.458 and 94.27 ± 5.656 respectively. Regarding final outcome, out of 30 patients, 29 (96.67%) had satisfactory (excellent + good), 1 (3.3%) had unsatisfactory (fair) outcome. Confidence interval (CI) at 95% confidence level is 87.21% – 102.79%.

Conclusion: Anterior cruciate ligament injury most commonly occurs in young adult especially during sporting activity. It hampers their daily activity and causes financial loss so early reconstruction is necessary for their return to daily activity.

Keywords: Anterior cruciate ligament, arthroscopic reconstruction, Lysholm Knee Scoring Scale

Introduction

Anterior cruciate ligament is an intra-articular structure in the central knee joint complex. It acts in concert with the other intra-articular structure to control and limit motion of the knee joint. Thus maintain both static and dynamic equilibrium. Anterior cruciate ligament is often wounded in physical activities especially contact sports and motorbike accidents [1].

ACL injury is a debilitating condition which may result pain, swelling and instability especially during activities involving side stepping and pivoting. So ACL reconstruction is advised to athletes for an active and competitive life without experiencing episodes of instability [2].

Surgical techniques for ligament injuries of knee have developed years. Now-a-days, ACL arthroscopic reconstruction with autogenous graft is commonly used.

The central portion of patellar ligament and the hamstring tendons construct are most commonly used for reconstruction of ACL [3].

The outcomes of ACL reconstruction using different grafts are debatable. Clinical and radiographic outcomes of ACL reconstruction using these grafts fixed with modern devices and proper surgical techniques and postoperative rehabilitation, those two grafts are an equivalent option for ACL reconstruction [4].

The bone-patellar tendon bone autograft is thought to be the "Gold standard" as because of direct bone to bone healing. This healing allows the patient for early rehabilitation with significant long term results [5]. But there are some problems with the BPTB graft such as donor site morbidity, anterior knee discomfort and pain on kneeling. Hamstring tendon graft using semitendinosus or semitendinosus-gracilis tendons either tripled for quadrupled form has evolved as an alternative for ACL reconstruction [6].

The fixation methods used in bone tunnels are mainly two types, aperture fixation and suspensory fixation. In aperture fixation graft fixed at the start of the bone tunnel as interference screws and in suspensory fixation sutures are attached to a femoral fixation tool as endobutton.

The clinical results using biodegradable screws or metal screws are statistically similar for ACL reconstruction [7]. These devices are used to provide secure fixation helping early motion exercise and weight bearing.

Materials and methods

This was a quasi experimental study (Prospective Study). This study was done from January 2015 to December 2016 at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Sher-E-Bangla Nagar, Dhaka. Patients presented with unilateral knee complaints and clinically diagnosed as ACL injury of both sexes at OPD of NITOR were included in this study. Due to time limitation and financial constrain 30 cases were selected during the study period. Purposive sampling (nonrandomized) was done according to availability of the patients and strictly considering the inclusion and exclusion criteria.

Inclusion criteria

- Clinically diagnosed unilateral ACL injury which was symptomatic after conservative treatment of adequate duration (4-6 weeks).
- Age between 15 to 50 years.
- In doubtful cases diagnosis confirmed by MRI.

Exclusion criteria

- Bilateral anterior cruciate ligament deficiency.
- Multiple ligament injury of the knee.
- Presence of fractures around the knee (tibial plateau, patella, femoral condyles).
- Patient previously operated for knee injuries.
- Age before 15 and after 50 years.
- Loss of knee motion due to acute injury/Stiffness.
- Osteoarthritis.

Ethical Issue

Prior approval of protocol was taken by Ethical Review Committee NITOR, Dhaka. The patients were informed about purpose and design of the study and right for withdrawing themselves from the study according to Helsinki declaration. Patients were informed about the procedure of treatment,

anticipated results, possible advantages, disadvantages, complications etc. Individuals who gave informed written consent voluntarily were involved in this research.

Data Collection

A data collection sheet was structured with the variables. Data was gathered by interview, observation, physical examination and radiological findings. In my study I had evaluated the results by using Lysholm Knee Scoring Scale and International Knee Documentation Committee (IKDC) knee examination and evaluation form.

Analysis

According to Lysholm knee score pre and postoperative (at 24 weeks) score was calculated. Comparison of mean preoperative and postoperative value was done to determine whether significant improvement was achieved or not. Again on the basis of individual postoperative value final outcome categorization was done. According to International Knee Documentation Committee (IKDC) knee examination and evaluation form subjective and objective outcome of the patient was evaluated.

Results

This prospective study was carried out from December 2014 to June 2013 at NITOR. The advantages of arthroscopy in the diagnosis and treatment of ACL injuries has been accepted for a decade now. A total of 30 cases were selected for the study. Follow up given for 6 months to 12 months and final outcome was recorded at 6 months. The following results were obtained.

Table 1: Age distribution of patients (n=30)

Age group	Number of patients	Percentage (%)	Mean± SD
15-20	6	20	25.8±5.261
20-25	9	30	
25-30	9	30	
30-35	5	16.7	
35-40	1	3.3	
Total	30	100	

Mean age was 25.8 years with 1SD = (± 5.261) years, age range was 18-36 years. Majority of the patients (60%) were from age 20 to 30 years.

Table 2: Distribution of patients according to sex

Sex	Number of patients	Percentage (%)
Male	27	90
Female	3	10
Total	30	100

Out of 30 patients male was 27 and female patient 3.

Table 3: Occupational distribution of patients (n=30)

Occupation	No. of Patient	Percentage
Cultivator	1	3.3
Housewife	2	6.7
Lawyer	1	3.3
Service	13	43.3
Student	11	36.7
Businessman	2	6.7

This bar chart describes the distribution of the subjects by occupation. None of them were sportsman, service holder 43.3%, 36.7% were student, and other were 20%.

Table 4: Side of involvement of the knee (n=30)

Side of involvement	No. of patient	Percentage (%)
Right Knee ht Knee	17	56.7
Left Knee	13	43.3
Total	30	100%

Right side involvement was 57% and left side involvement was 43%.

The cause of injury was sporting activity (Football & Cricket) 83.3%, RTA 10% and others 6.7% cases.

Table 5: Distribution of patients according to cause of injury.(n=30)

Cause of injury	No. of patient	Percentage (%)
Cricket	1	3.3
Football	24	80
RTA	3	10
Others/Accidental fall	2	6.7
Total	30	100

Table 6: Distribution according to associated injury of the knee (n=30)

Associated injury	Number of patient	Percentage (%)
Isolated ACL injury	14	46.7
ACL with lateral meniscus injury	8	26.7
ACL with medial meniscus injury	8	26.7
Total	30	100

Forty seven percent patients had Isolated ACL injury, 26.7% had ACL with lateral meniscus injury and rest are ACL with medial meniscus injury.

Postoperatively 100% patients regained normal to near normal knee function and knee stability. Significant improvement of pain and swelling also occurred.

Table 7: Postoperative hospital stay (in days) (n=30)

Hospital stay (days)	Number of patients	Percentage (%)	Mean±SD
<5	19	63.3	4.2+- 0.714
5-10	11	36.7	
10-15	0	0	
Total	30	100	

Table shows 63.3% patient stayed in hospital after operation less than 5 days. Mean hospital stay was 4.2days and SD±0.714 days.

Table 8: Postoperative complications. (n=30)

Complications	Number of patients	Percentage (%)
Pain	0	0
Infection	1	3.3
Displacement of the screw	0	0
Stiffness	0	0
Graft failure	0	0
Others	0	0
Total	1	3.3

In this series 96.7% patients had uneventful post operative period one (3.3%) had infection at knee.

Table 9: Subjective functional outcome evaluation after at 6 months (n=30).

Subjective outcome	Number of patients		
	Preoperative	Postoperative	
Knee function	Normal	0	26
	Near normal	25	4
	Abnormal	05	0
Pain	Mild	12	23
	Moderate	17	07
	Severe	01	0
Giving way	No	00	29
	Occasional or more	30	01
Swelling	No swelling	27	28
	Mild swelling	03	02

Preoperative clinical evaluation showed that all patients had abnormal knee function, mild to moderate pain. All patients complained of swelling and giving way.

Table 10: Objective functional outcome evaluation at six months (n=30).

Objective outcome	Number of patient		
	Preoperative	Postoperative	
Knee function	Normal	0	26
	Near normal	24	4
	Abnormal	06	0
Pain	Mild	12	17
	Moderate	16	13
	Severe	02	0
Giving way	No	00	29
	Occasional or more	30	01
Swelling	No swelling	24	25
	Mild swelling	06	05

Lachman test was positive in all patients among them grade II 75% and grade III was 25%. 100% patients had anterior drawer test positive. Pivot shift test was negative in 85%cases. Mc Murray test was positive in 55% cases. 70% patients had 135° knee flexion and 30% had less than 130° flexion preoperatively.

Post operatively Lachman test improved significantly, grade I in 90% cases and grade III was in 10% cases. Anterior drawer was positive in 10% cases. Pivot shift test was negative in all cases. McMurry test was negative in all casescases. After operation 80% had 135° knee flexion and 20% had less than 130° flexion.

Table 11: Comparison of pre-operative and postoperative Lysholm knee score.

Comparison	No. of the patients	Mean±SD
Preoperative	30	67.57±11.485
Postoperative	30	94.27±5.656

Preoperative Lysholm knee score was 67.57±11.485 and post-operative score was 94.27±5.656. Preoperative versus postoperative Lysholm scores showed significant improvement ($p<0.05$).

Discussion

This prospective study was carried out from January 2015 to December 2016 at NITOR. In our study mean age was 25.8

(± 5.261) years, age range was 18-36 years. Majority of the patients (60%) were from age 20 to 30 years. We had 30 patients, among them 27 was male and 3 female patient. None of the patients were sportsman, 43.3% were service holder, 36.7% were student, cultivator 3.3%, lawyer 3.3%, housewife 6.7%, none of the patients was professional sportsman. Right side involvement was 56.7% and left side involvement was 43.3%. The cause of injury was sporting activity in 83.3%, RTA 10% and accidental fall and others in 6.7% cases.

Forty seven percent patients had Isolated ACL injury, 26.7% had ACL with lateral meniscus injury and rest are ACL with medial meniscus injury. In this series Quadrupled Semitendinosus and Gracilis Autograft mean diameter was 7.07 with SD(± 0.691) and mean length 25.23 with SD(± 1.331). Mean duration was 17.37 months with SD (± 11.072) months. In this study 63.3% patient stayed in hospital after operation less than 5 days. Mean hospital stay was 4.2 days and SD ± 0.714 days. In this series 96.7% patients had uneventful post-operative period and one (3.3%) had infection at knee.

Preoperative clinical evaluation showed that all patients had abnormal knee function, mild to moderate pain. All patients complained of swelling and giving way. Postoperatively 100% patients regained normal to near normal knee function and knee stability. Significant improvement of pain and swelling also occurred.

Preoperatively, Lachman test was positive in all patients. Among them grade II injury was 75% and grade III was 25%. All patients had anterior drawer test positive. Pivot shift test was negative in majority of cases. McMurray test was positive in 55% cases. 80% patients had 135° knee flexion and 20% had less than 130° flexion.

Post operatively Lachman test improved significantly, grade-I in 95% cases and grade II was in 5% cases. In Williams, *et al.* (2004) study postoperative Lachman test was negative in 89% patients after 28 months of reconstruction of ACL by four stranded hamstring tendon. Anterior drawer was positive in 10% cases. Pivot shift test was negative in all cases. McMurray test negative in all cases. After operation 80% had 135° knee flexion and 20% had less than 130° flexion. Brown Jr, *et al.* (1993) also reported negative pivot shift test in 89% cases in his study. So present study is closely comparable with that of Brown Jr, *et al.* (1993) study.

Preoperative versus post operative Lysholm knee score in this series shows significant improvements ($p < 0.05$). Preoperative and postoperative Lysholm score were 67.57 ± 11.458 and 94.27 ± 5.656 respectively.

Regarding final outcome, out of 30 patients, 29 (96.67%) had satisfactory (excellent + good), 1 (3.3%) had unsatisfactory (fair) outcome. Confidence interval (CI) at 95% confidence level is 87.21% – 102.79%. So, among the population we will found satisfactory result by this procedure. It is quite acceptable outcome.

Conclusion

Anterior cruciate ligament injury most commonly occurs in young adult especially during sporting activity. It hampers their daily activity and causes financial loss so early reconstruction is necessary for their return to daily activity.

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