

Reconstruction of Anterior Cruciate Ligament Injury with Quadruple Semitendinosus Graft through Mini Arthrotomy

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Abstract

Original Research Article

ACL injury is one of the major causes of morbidity and disability in young adult people. It prohibits them from active participation of strenuous activities and compels them to modify their jobs. Conservative treatment failed to show desired expectations; rather it invites early complications of knee joint like osteoarthritis. Reconstruction of ACL by BPT gained popularity but donor site morbidity, anterior knee pain and stiffness are major drawback. For this reason hamstring graft can be a good alternative. Though it can be done arthroscopically but initial setup is highly expensive and technically demanding which cannot be provided everywhere in our country. In this context we are doing ACL reconstruction by mini-Arthrotomy using quadruple hamstring graft at NITOR for last few years. But we did not have any study regarding this technique. So, the purpose of my study is to evaluate the outcome after reconstruction of ACL injury by quadruple hamstring graft. A statistical survey was carried out at NITOR, Dhaka between July 2006 and June 2008 in the patients admitted with anterior cruciate ligament insufficiency. Effort has been made in this work to extract certain relevant facts in connection with ACL insufficiency and the mode of their management and finally to evaluate the outcome of reconstruction of ACL injury by quadruple hamstring graft using mini arthrotomy with the hope that it will impart us a better understanding of further treatment of ACL particular trauma in our country. This clinical study is the results of ACL injury reconstructed by quadruple semitendinosus graft on patients over a period of two years from July 2006 to June 2008 at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR) Dhaka. The objective of this study was to evaluate the outcome of ACL reconstruction. In this study purposive sampling method was followed irrespective of sex. ACL injury which had persisted at least 3 months and was not improved by conservative treatment and patient with no history of previous reconstructive surgery of ACL were included in this study. Data were collected by structured questionnaire which includes all the variables of interest. The test statistics used to analyze the data were descriptive statistics paired "t" test. "Result shows all the patients were male with mean age 24.30 (16.36) years. About half of the subjects were players. Right knee was affected in 60% and left knee in 40% patients. Associated meniscus injury was in 30% cases. Preoperative all patients had positive anterior drawer test. They had either grade II or grade III positive Lachman test. Pivot shift test was positive in 60% cases. Preoperative Lysholm score was 52.10 (55.13). Mean hospital stay after operation was 5 (11.45) days. Post-operative subjective outcome after 6 months of operation including influence of activity level, knee function, pain, recurrent swelling, and giving way improved significantly. Post-operative objective outcome including Lachman test, anterior drawer test and Pivot shift test were improved significantly. Preoperative versus post-operative Lysholm score shows a significant improvement ($p < 0.046$). Final outcome of this study shows 80% satisfactory and 20% unsatisfactory result. No patient was in poor category.

Keywords: Reconstruction, Anterior Cruciate Ligament, Quadruple semitendinosus graft, Mini Arthrotomy.

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INTRODUCTION

The knee is the largest joint in the body. Function and stability of the knee depend upon a complex interrelationship of bony and soft tissue anatomy [1]. The anterior cruciate ligament is composed of longitudinally oriented bundles of collagen tissue arranged in fascicular subunits within larger functional bands. The ligament is surrounded by synovium, thus making it extra synovial. The anterior cruciate ligament as a two-bundle ligament, consisting of a small anteromedial and a larger posterolateral bundle, originating from the posterior part of the medial surface of the lateral femoral condyle within the condylar notch well posterior to the longitudinal axis of the femoral shaft [2]. The anterior cruciate ligament inserts on the tibial plateau medial to insertion of the anterior horn of the lateral meniscus in a depressed area anterolateral to the anterior tibial spine. The tibial attachment site is larger and more secure than the femoral site. The ligament is 31 to 35 mm in length and 31.3 mm in cross section.

The cruciate ligaments provide both anteroposterior and rotary stability; they also help to resist excessive valgus and varus angulations. Injuries of these ligaments are common, particularly in sporting pursuits but also in road accidents where they may be associated with fractures or dislocations. They vary in severity from a simple sprain to complete rupture [3].

The importance of the anterior cruciate ligament (ACL) in the maintenance of stability of the knee is well-known. Active individuals who have a torn anterior cruciate ligament are frequently troubled by ironic instability and recurrent episodes of giving-Way, which often are associated with intra-articular injuries [4].

The exact incidence of anterior cruciate ligament injuries is unknown; however, it has been estimated that 100,000 are torn each year, and 50,000 anterior cruciate ligament reconstructions are done each year in the United States. The controversy for managing these injury new centers more on the choice of graft selection for reconstruction: instead of whether surgery is necessary [5].

Reconstructions of the anterior cruciate ligament (ACL) are frequently performed procedures in knee surgery within a day. Looking at the history of ACL surgery since is advent in antiquity, it is amazing to see how long it for some diagnostic and management techniques to manage themselves. However since the early 20th century, there has been increasing awareness of and interest in the ligament and its [6].

Numerous (Leong *et al.*) authors have described successful reconstruction of the ACL with use of a myriad of donor auto graft (Patellar, hamstring or quadriceps) and allograft (Tendoachilles, patellar,

hamstring or tibialis anterior) tendons. United States, the bone-patellar tendon-bone autograft is the most commonly used graft in ACL HC reconstruction. However, concern regarding problems with the extension mechanism of the knee, loss of motion, patella infera, patellar fracture and the development of chronic anterior knee pain prompted surgeons to seek other graft materials for use in the ACL reconstruction. As such the gracilis and semitendinosus tendons represent an alternative autograft donor material that may be used for reconstruction of the ACL without disturbance of the extensor mechanism. Since then there has been an evolution toward the use of less invasive techniques of reconstruction of the ACL in order to minimize trauma to extensor mechanism and scarring in the knee. Open techniques have involved to the use of a small arthrotomy incision to preserve the attachment of the vastus medialis obliquus muscle to the patella. Arthroscopes have been used in an effort to further decrease trauma to the front of the knee, through use of a two-incision approach in which the femoral end of the graft is fixed endoscopically, however, both retrospective and prospective studies reported in the 1990s have revealed only minor short term differences in the subjective and objective outcomes of these different operative approaches. In general arthroscopically assisted procedures have had some minor advantages compared with mini Arthrotomy mainly in terms of resolution of symptoms; however, differences between various combinations of these approaches were not detectable after a two-year follow-up [7].

A statistical survey was carried out at NITOR, Dhaka between July 2006 and June 2008 in the patients admitted with anterior cruciate ligament insufficiency. Effort has been made in this work to extract certain relevant facts in connection with ACL insufficiency and the mode of their management and finally to evaluate the outcome of reconstruction of ACL injury by quadruple hamstring graft using mini Arthrotomy with the hope that it will impart us a better understanding of further treatment of iris particular trauma in our country.

Justification of the study

ACL injury is one of the major causes of morbidity and disability in young adult people. It prohibits them from active participation of strenuous activities and compels them to modify their jobs.

Conservative treatment failed to show desired expectations; rather it invites early complications of knee joint like osteoarthritis. Reconstruction of ACL by BPT gained popularity but donor site morbidity, anterior knee pain and stiffness are major drawback. For this reason hamstring graft can be a good alternative. Though it can be done arthroscopically but initial setup is highly expensive and technically demanding which cannot be provided everywhere in

our country. In this context we are doing ACL reconstruction by mini-arthrotomy using quadruple hamstring graft at NITOR for last few years. But we did not have any study regarding this technique. So, the purpose of my study is to evaluate the outcome after reconstruction of ACL injury by quadruple hamstring graft.

OBJECTIVE

To evaluate the outcome of the reconstruction surgery of ACL injury with quadruple semitendinosus graft through miniarthrotomy.

To see the improvement of the functional outcome in respect of:

- Pain
- Knee function
- Lachman, anterior drawer, pivot shift test and Lysholm score
- To find out co-existent meniscus lesion and articular cartilage changes.
- To study the complication of the procedure encountered by the patient.

METHODOLOGY

Study design: Prospective study

Study type

This Was a Quasi experimental study to evaluate the outcome of reconstruction of torn anterior cruciate ligament of knee.

Place of study

The study was carried out at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh.

Period of study

From July 2006 to June 2008

Study population

The study populations were the patients attending at the above place for the treatment of torn anterior cruciate ligament.

Sample size

A total of 10 patients met the following selection criteria were selected consecutively from the study population.

Patient selection

The technique of the sample selection was nonrandom. The modalities of treatment were discussed with the patients. The follow up and rehabilitation protocol were also explained to the patients. Those who accepted this protocol were included in this study.

Inclusion criteria

The patients with following criteria were included in this study. `

- Patients with ages ranging from 15 - 35 years.
- ACL injury leading to instability of knee which had persisted for at least 3 months and failed to respond to adequate conservative treatment.
- No evidence of osteoarthritis in either knee.
- In doubtful cases diagnosis confirmed by MRI.

Exclusion criteria

The criteria for exclusion of the patients were as follows

- Patients with a history of previous reconstruction of the anterior cruciate ligament (ACL).
- Patients who had a reconstruction for posterior, posterolateral or lateral instability of the knee.

RESULTS

This prospective study was carried out from July 2006 to June 2008 at NITOR. A total of 10 cases were selected for the study, all these patients were male and followed up for 6 months to 12 months. Ln this present series the following results were obtained.

Out of the ten patients with ACL injury the age range was 15-35 years. Among them 20% were more than 31 years of age and 30% were less than 20 years.

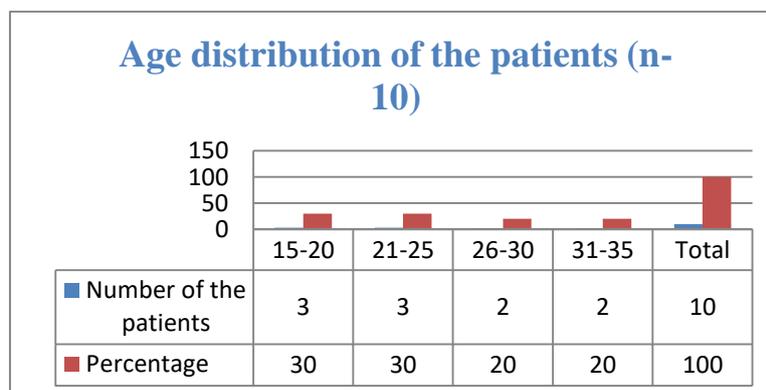


Fig-1: Age distribution of patients

Figure-2 describes the distribution of the subjects by occupation. About one third (30%) subjects were players, 60% were students, service holder and businessman (20% each). Only 10% were day labour.

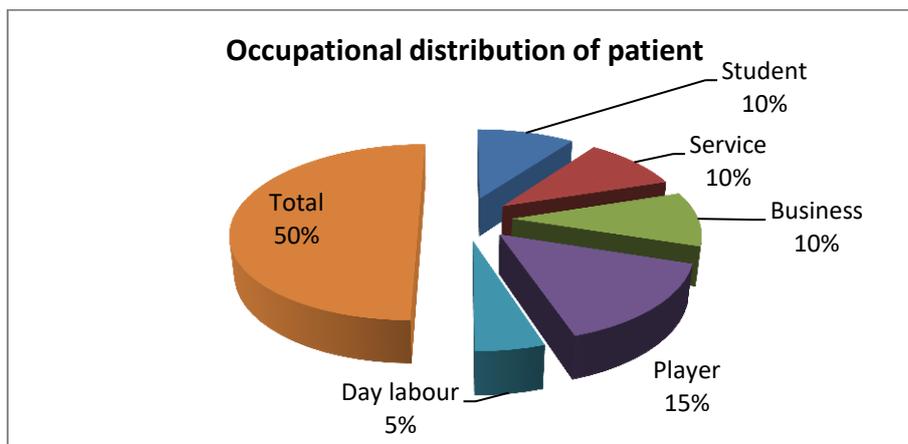


Fig-2: Occupation distribution of patient

This table 1 shows the distribution of the subjects by their affected knee. Right side involvement was 60% and left side involvement was 40%.

Table-1: Side involvement of the patients.

Side involvement	Number of the patients	Percentage
Right	6	60.0
Left	4	40.0
Total	10	100.0

This table 2 describes associated injury along with ACL injury. 40% were lateral collateral injury,

30% were medial meniscus injury and another 30% were medial collateral injury.

Table-2: Associated injury of the subjects.

Associated injury	NO. Of patients	Percentage
Lateral collateral ligament	4	40
Medial collateral ligament	3	30
Medial meniscus injury	3	30
Total	10	100

The outcome of ACL reconstruction greatly depends upon time interval between injury and operation. So duration of suffering was studied. Data shows 30% patients have been suffering less than 5

months and 10% patients were suffering for 21-25 months. Mean duration of suffering was 9.7 (15.77) months.

Table-3: Duration of suffering from injury to operation (in months)

Duration of suffering	Number of the patients	Percentage
<5	3	30
5-10	3	30
11-15	2	20
16-20	1	10
21-25	1	10
Total	10	100

Table shows 20% patient stayed in hospital after operation less than 4 days. 60% patients stayed 4-6 days and only 20% patients stayed 7-9 days.

Table-4: Hospital stays after operation (in days)

Hospital stay (days)	Number of the patients	Percentage
<4	2	20
4-6	6	60
7-9	2	20
Total	10	100

Early post-operative period was uneventful in 80% cases. One patient had infection at tibial screw site and the other patient had infection and endobutton slippage at femoral site.

Table-5: Complications of the patients

Complication	Number of the patients	Percentage
Nil	8	80
Wound infection at tibial screw site	1	10
Infection and Endobutton slippage at femoral site	1	10
Total	10	100

In the present series good to excellent result were achieved in 4 patients, fair to good results were achieved in 4 patients and fair result was achieved in two patients.

Table-6: Functional score and result (n-10) Distribution of patients according to Lysholm score

Case no.	Result	Functional score
1	Good to excellent	94
2	Fair to good	89
3	Fair to good	82
4	Good to excellent	94
5	Fair	71
6	Fair	74
7	Fair to good	89
8	Good to excellent	94
9	Good to excellent	94
10	Fair to good	84

Preoperative Lysholm knee score was 52.10+5.13 and post-operative score was 86.50+8.57. Pre-operative versus postoperative Lysholm scores showed significant improvement ($p < 0.046$).

Table-7: Comparison of pre-operative and postoperative Lysholm knee score

	Number of the patients	Mean SD	p value
Pre-operative	10	52.10+5.13	0.046*
Postoperative	10	86.50+8.57	0.046*

* Significant
Paired sample 't' test

Preoperative clinical evaluation showed that all patients had mild to moderate pain. Lachman test was positive in all patients among them grade II was 70% and grade three was 30%. All patients had anterior drawer test positive. 80% patient complained of giving Way. Pivot shift test was positive in 40% cases. Mc Murray test was positive in 30% cases. 60% patients

had less than 135° knee flexion and 40% had 130° flexion preoperatively. Postoperatively Lachman test improved significantly. Grade I Was in 80% cases and grade II was in 20% cases. Anterior drawer was positive in 20% cases. Pivot shift test was positive in only 10% cases. After operation 70% had 135° knee flexion and 30% had 130° flexion.

Table- 8: Outcome of the clinical evaluation after six months

Findings	Preoperative	%	Postoperative	%
Pain				
Mild	6	60	8	80
Moderate	4	40	2	20
Severe				
Swelling	8	80	3	30
Locking	3	30	0	0
Lachman test				
G1	8	80		
G2	7	70	2	20
G3	3	30		
Drawer test				
Positive	7	70	3	30
Negative	3	30	7	70
Pivot shift test				
Positive	4	40	1	10
Negative	6	60	9	90
Knee Flexion				
<130°	4	40	3	30
135°	6	60	7	70
McMurray test				
Positive	3	30	0	00
Negative	7	70	10	100
Squatting	7	70	8	80

Table-9: Distribution of patients by functional outcome (n=10)

Outcome	Number of the patients	Percentage
Good- Excellent	4	40
Fair- Good	4	40
Fair	2	20
Total	10	100

This table describes the distribution of post-operative outcome. Out of 10 patients 4 were categorized as good to excellent, 4 were fair to good and remaining 2 were categorized as fair. Good to Excellent ~ the patients were very satisfied about their

operation and had no pain in their knee. Fair to Good- in this category patients were satisfied, no limitation of their activities and had occasional mild pain. Fair- in this group there was moderate pain and some restriction in their activities.

Table-10: Final outcome of the patients

Final outcome	Number of the patients	Percentage
Satisfactory	8	80
Unsatisfactory	2	20
Total	10	100

This table demonstrates the final outcome of 10 patients, 8 (80%) were satisfactory and 02(20%) were unsatisfactory.

DISCUSSION

The importance of the ACL in the maintenance of the stability of knee is well known. Active individual who have a torn ACL are frequently troubled by chronic instability and recurrent episode of giving Way, which often are associated with intra-articular injuries [4].

To restore stability, reconstruction of ACL may be performed by a variety of procedures and follow-up studies have used a variety of methods to

assess their efficiency and success. In the present study, minimum and maximum ages Were 15 and 35 years respectively. Eriksson *et al.* made study over 164 patients. In his study age ranges were between 15 and 45 years which are comparable with present study. In the present study about one third (30%) of the patients were player. Students, service holder and business men were 20% in each group. Only 10% patients were day labour. Ay the cause of injury was sporting activity in 80% cases and 10% was due to accidental fall and 10% was due to road traffic accident.

Out of 10 patients right knee involvement was 6 (60%) and left knee involvement was 4 (40%). Similar result was found in Eriksson *et al.* Study Right knee involvement was 60.98% and left knee

involvement was 39.02%. In the present study 30% had medial collateral ligament injury, 40% had lateral collateral injury and 30% had medial meniscus injury. That patient who had meniscal injury and underwent partial menisectomy shows poor results. In my study mean duration of the suffering from the injury to operation were 9.7 (1 5.77) months ranging from 5 and 25 months.

In this study mean hospital stay after operation was 5 (11.45) days. Buss *et al.* [4] investigated 67 ACL reconstructions and found mean hospital stay was 5 days (range 3 to 8 days). Early post-operative complication reveals that one patient was suffering from Wound infection at tibial site which was managed by Wound dressing and appropriate antibiotics. Another patient had a history of infection and endo-button slippage from femoral site which was managed by removal of endobutton Wound dressing, antibiotics and three weeks immobilization of lower limb. Preoperatively all patient had either grade II or grade III positive Lachman test. Post operatively significant improvement was found. 80% were grade I and only 20% were grade II positive Lachman test. In Williams *et al.* study post-operative Lachman test was ne 89% patients after 28 months of reconstruction of ACL by four stranded hamstring tendon [8].

Pivot shift test was negative in 90% cases `Buss *et al.* (1993) also reported negative pivot shift test in 89% cases in his study. So present study is closely comparable with that of Buss study.

Preoperative versus post-operative Lysholm knee score in this series shows significant improvements ($p < .046$). Preoperative and postoperative Lysholm scores were 52.10 (15.13) and 86.50 *+et al.* also showed significant improvement of the Lysholm score in his study ($P < .001$). According, to Williams *et al.* (8.57) respectively. Wagner et al study mean Lysholm score improved from 55 points preoperative to 91 points after 2 year follow-up over 120 patients. This is comparable with present study [9].

In terms of knee flexion, 60% patients had 1350 flexion and 40% had less than 1300 flexion preoperatively. After operation 70% had 1350 flexion and 30% had 1300 flexion. Post-operative outcome showed that 40% were good to excellent (the patients were very satisfied about their operation and had no pain in their knee), 40% were Fair to good (patients were satisfied, no limitation of their activities and had occasional mild pain.) and 20% were fair (in this group there was moderate pain and some restriction in their activities). Regarding final outcome of the patients, present series shows out of 10 patients 8 (80%) were satisfactory and 2 (20%) were unsatisfactory result. No patient was in poor category.

In the 90s, hamstring reconstruction with double and quadrupled semitendinosus and gracilis tendons gained popularity as a result of decreased graft harvesting morbidity and smaller incisions. It was also shown that biomechanically, double and quadruple tendons have superior strength and stiffness compared with bone- patellar tendon-bone grafts and the native ACL [10].

This method of ACL reconstruction can be recommended in our population. Present study had several limitations. It was a small scale and short follow u stud post-operative supervision and meticulous physiotherapy were essential for the successful outcome of the patients.

CONCLUSION

ACL injury frequently occurs in young adult population, which reduces activity level and become economic burden. So, early reconstruction of the ACL is necessary to make them fit and return to their original activity level.

Graft choice is crucial in reconstruction of ACL injury. BPT graft gained popularity but considering morbidity, anterior knee pain and stiffness at donor side, surgeons looked alternative choices like semitendinosus graft. Quadruple semitendinosus graft has got advantages over other grafts in respect of strength, stability, less donor site morbidity and anterior knee pain. The procedure can be done by mini arthrotomy where adequate arthroscopic facilities are not available like our country.

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