

## Original Research Article

# Comparative evaluation of pre and post operative functional outcomes determined by Lysholm knee score of patients undergoing arthroscopic anterior cruciate ligament reconstruction

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### ABSTRACT

**Background:** The anterior cruciate ligament (ACL) is the primary stabilizer of the knee joint and prevents the knee against anterior translation. After ACL tears, most patients experience recurrent episodes of instability (give way), pain and decreased function. Purpose of our study was to comparative evaluation of functional outcomes of pre and post operative patients after arthroscopic ACL reconstruction by using Lysholm knee score and its complications.

**Methods:** This is a prospective interventional study which were included total 45 patients undergoing arthroscopic ACL reconstruction by using hamstring autograft. Postoperatively patients were followed up at 6, 9 and 12 months for functional assessment by using Lysholm knee score.

**Results:** After ACL reconstruction increment in mean Lysholm knee score during follow up from 69.33 to 96.03 at final followup ( $p < 0.001$ ) which indicate that significant improvement in functional status of patients.

**Conclusions:** Reconstruction of ACL leads the patient to return to a normal activity level and prevent the occurrence of associate meniscal injury and post-traumatic osteoarthritis. A regular followup based and well-organized rehabilitation program provide a key role in functional outcome of knee after ACL reconstruction.

**Keywords:** Arthroscopic ACL reconstruction, Lysholm knee score, Anterior cruciate ligament

### INTRODUCTION

Knee is the most common body part injured at present. Sporting activity and high velocity trauma has led to increase chance of ligament injuries around the knee. The function of ACL (anterior cruciate ligament) is to provide congruence and stability in the knee along with other associated ligaments, capsule, muscles and bones.<sup>1</sup> The ACL works with all other structures of knee joint is to control and restrict the motion and to support both static and dynamic equilibrium. ACL has also two essential roles: mechanical and proprioception.

In adult normal ACL is about 4 centimeter in length and 1 cm in diameter. Histologically it is a band of tough connective tissue that connects femur and tibia bone. This ligament is made of 150 to 250 nm diameter of collagen fibrils that form a composite network. It is viscoelastic and posses about 1760 N to 2160 N strength.<sup>2</sup> The origin of ACL is posterior part of medial surface of lateral condyle of femur and inserted in front of lateral to anterior tibial spine. A fold of synovial membrane surrounds it that come from posterior part of the knee and completely covers both ACL and PCL. Hence, these ligaments are extra synovial but they are intra-articular. Both cruciate ligaments work like a gear system and play important roll in kinematics of knee.

In femoral attachment, anteromedial (AM) bundle originates at the posterior most surface of the intercondylar notch and posterolateral (PL) bundle at distal part, close to the cartilage margin of the femoral condyle. On the tibia bone these two bundles have given their name as the AM bundle attached anteromedial and the PL bundle attached posterolateral on the tibia spine. The tibial attachment is slightly larger than the femoral attachment. Tibial insertion passes just under the anterior part of inter-menisal ligament. In the anterior part of the tibial attachment, physiological impingement occurs in which fibers change direction in around the anterior part of the intercondylar roof. The AM and PL bundles functions together during the full range of motion and play important role in controlling anteroposterior and rotatory stability. During ROM, the AM bundle is elongated with full extension and is more isometric than the PL bundle and gradually relaxes during knee flexion.<sup>3</sup> PL bundle exerts more forces at extension during anterior forces from outside as compared with AM bundle but during knee flexion, the opposite is seen. During both valgus movement and internal rotation, the AM bundle is exerts more forces overall, as compare to the PL bundle.

Prevalence of ACL injury in players is about 0.5-8.5%.<sup>4</sup> Athletic activity those involving contact like football, hockey, skiing and other sports can lead to ACL injury and also produces sudden stress to tear knee ligament. Road traffic accidents especially those involving motorcycles, often cause ACL injury. It may occur without direct injury when sudden, severe tension over the ligaments. In sport like Kho-Kho, kabaddi and wrestling (Indian traditional sports) are associated with a more chance of ACL tear. After ACL injury, patient experience pain, unstable and decreased function of affected knee joint. ACL injury is may be called as the 'beginning of the end of the knee'. Some of these can be treated conservatively by exercises, knee brace and modification of activity but severe injuries require reconstruction of the tear ligament. Reconstruction of ACL returns the patient to pre-trauma activity level and prevent the occurrence of associated meniscal injury and further osteoarthritis.<sup>5</sup> Knee stability is restored during reconstruction. Previous open arthrotomy and patellar tendon graft was used during ACL reconstruction. However, excision of more soft tissue led to increase complications. Complications like post operative stiffness of knee and long rehabilitation were led to invention of Arthroscopic ACL reconstructions. The advantages arthroscopic reconstruction were small incisions, reduce inflammatory response thus decrease post-op complications and delayed activity with full movement. Posterior part of knee joint is also better seen by the arthroscopy which was not seen during open arthrotomy. The Hamstring (Semitendinosus and Gracillis) graft have emerged a superior graft than patellar tendon graft due to reduce donor site morbidity and convenience of being able to configure them in different bundles easily in the former. Recently single bundle reconstruction technique has shown same kinematic control of knee movement to

double bundle techniques. Whereas ACL reconstruction by single bundle Single Bundle focuses on whole ACL as a single unit, however ACL reconstruction by double bundle involves reconstruction of each of the functional bundles i.e. AM bundle and PL bundle. A double bundle technique is an attempt to restore natural anatomy of ACL. The addition of PL bundle has been shown to contribute to rotational stability of the knee.<sup>6</sup> A routine follow up based and well organized rehabilitation plays a key role in functional outcome of ACL reconstructed knee. These include greater motion, increased muscular strength and enhanced function. Early rehabilitation can start with rigid intraoperative fixation of graft in bone tunnels<sup>7</sup>. The aim of our study is to evaluate functional outcomes and complications of ACL reconstructions using quadrupled hamstring tendon autograft (QHTG).

## METHODS

Patients between age 18 and 50 years, with a diagnosis of ACL tear was selected from Orthopaedics OPD at S. N. Medical college, Agra. This was a prospective study done on 45 patients presented with chronic ACL deficiency and patients of ACL tear reconstructed by quadrupled hamstring tendon graft between September 2018 to August 2021. Informed written consent was taken and study was approved by institutional ethical board (IEB).

### Inclusion criteria

Patients included in present study are; patients who presented with symptomatic chronic ACL deficiency, patients presenting with acute ACL injury who had complaints despite adequate rehabilitation, age 18 to 50 years and the acute inflammatory reaction of the injury has subsided and mostly 4-6 weeks after injury.

### Exclusion criteria

However, patients excluded in study were; acute ACL injuries which became treated after rehabilitation, patients with other systemic diseases compromising their preanaesthetic fitness, acute ACL injury associated with tibial spine avulsion fracture and ACL tears with radiographic evidence of significant knee arthrosis.

### Procedure

A detail history and valuable information can provide a high suspicion for chronic ACL tear after that patient is examined. At the time of injury a characteristic “pop” associated with these injuries and patient are usually unable to further normal. In long term patient will complaints of pain, giving way sensation with swelling and stiffness after movement. Clinical examination was done by using test like anterior drawer, pivot shift and lachman test. Injury of other structures were also assessed by following tests: Valgus and Varus stress test (for collateral ligament injury), McMurray’s test (for meniscal ruptures) and posterior drawer test (for PCL injuries).

MRI of the knee was done to confirm the findings of clinical evaluation. Routine X-ray of affected knee in antero-posterior (standing) view and lateral view was also done for assessment of bony injuries. Arthroscopically, the final diagnosis of ACL injury was confirmed and associated lesions and meniscal tears also diagnosed and treated. After arthroscopic ACL reconstruction was done by using hamstring graft under spinal or epidural anaesthesia physiotherapy is started from the day of surgery itself. The physiotherapy regimen is continued till at least 6 weeks post surgery, but it all depends on how the patient responds to the regimen. A detailed rehabilitation exercises is allowed to the patient depending upon his/her condition and capability.

In most cases, full weight-bearing is allowed from second day after surgery with the help of walker. If associated surgeries are done on other ligaments and meniscus then this may vary. A knee brace was applied for 6 weeks after procedure. The patients were followed up in OPD at 2nd week, then every 4<sup>th</sup> week interval to assess progress of rehabilitation. Preoperative and post operative Lysholm knee score, at 6 weeks, 9 months, and 12 months during follow up were compared using appropriate statistical tests and interpretation was made accordingly. The intra operative and post operative complications were also analysed. The results were presented in frequencies, percentages and mean±SD. The Chi-square test was used to compare categorical variables. The one-way analysis of variance was used to compare continuous variables. The  $p \leq 0.05$  was considered significant. All the analysis was carried out on SPSS 16.0 version (Chicago, Inc., USA).

## RESULTS

Our study included 45 patients diagnosed with ACL injury of knee joints. Youngest patient included in study was of 18 years however oldest one was of 51 years of age. Mostly patients were between 21-34 years and male.

It may be due to more participation of males in sport activity and road traffic accident. Most of the patients included in this study were having clinical symptoms indicating towards ACL tear of knee of 1 to 5 months duration (45.2%). Pain was the most common complain of patients (91.4%). Instability and give way in knee joint were second complain (94%). Others complaints were associated swelling, locking sensation and limping. Diagnostic arthroscopy was performed in all patients prior to ACL reconstruction confirmed the medial meniscus injury in 9 (20.00%) cases and Lateral Meniscus injuries in 4 (8.89%) cases. Rest of the 32 cases (71.11%) had isolated ACL injuries. There was no PCL injury included in our study. Various demographic data of patients included in this study were shown in (Table 1).

**Table 1: Demography of cases.**

Variables	Data	%
Mean age (years)	28.33	-
Male	41	91.11
Female	04	8.89
Right knee injury	21	46.67
Left knee injury	24	53.33
Mean duration of injury (months)	4.00	-
Mode of injury		
RTA	31	68.89
Sport injury	14	31.11
Isolated ACL injury	32	71.11
Associated injury (like medial or lateral meniscus)	13	28.89

The patients were followed up to evaluation of functional outcome at 6 weeks, 9 months and 12 months with preoperative condition. Lysholm knee score were increases in patients from pre op to follow up at 6 weeks which were significantly increases at 9 and 12 months during follow up. Functional outcomes in term of Lysholm knee score were shown in (Table 2).

**Table 2: Functional outcomes of patients determined by Lysholm knee score at pre and post op during follow up.**

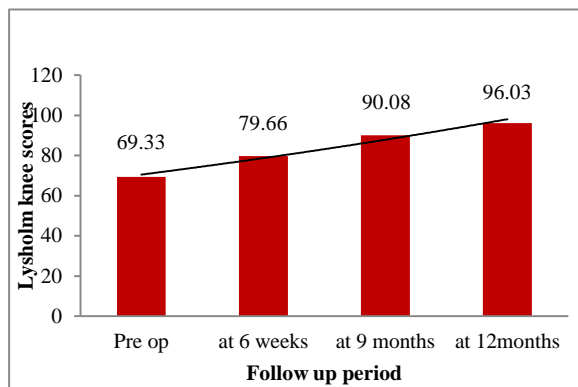
Lysholm knee score	Pre- operatively	Follow up at 8 weeks	Follow up at 9 months	Follow up at 12 months
Excellent ( $\geq 95$ )	0	2	10	26
Good (84-95)	2	39	33	18
Fair (65-83)	31	4	2	1
Poor ( $\leq 64$ )	12	0	0	0

Comparative analysis of functional outcomes of patients undergoing arthroscopic ACL reconstruction were done by mean Lysholm knee score which showed increasing trend during follow up in following (Figure 1). Using student's t test, we found that the improvement in Lysholm knee scores (follow up at 6, 9 and 12 Months) is statistically highly significant ( $p < 0.001$ ). In this study

post operative complications like pain, swelling and stiff knee develops in few patients which was actively managed by anti-inflammatory medications, proper rehabilitation and physiotherapy however infection was treated by good antibiotic coverage. Post-op complications present during follow up were shown in (Table 3).

**Table 3: Post operative complications were found at follow up.**

Complications	N (%)
Pain	5 (11.11)
Swelling	2 (4.44)
Stiff knee	3 (6.67)
Instability	0
Infection	1 (2.22)

**Figure 1: Increasing trend of mean Lysholm knee score during follow up.**

## DISCUSSION

ACL tear is a commonly found in these days due to increased involvement in sport activity and more road traffic accidents occurs. Although it was controversial whether all patients with ACL injury needed ligament reconstructions. Surgical reconstruction has become treatment of choice. The primary goal of this procedure is to restore the stability of knee and thereby, allow the patient to return to normal range of movement, including sports. Others are to prevent early arthritic changes and restoration of normal knee kinematics. At present time hamstring (semitendinosis and gracillis) tendon autograft is the choice for ACL reconstructions.

Our research was conducted to evaluate the clinical outcomes of patients undergoing ACL reconstruction pre and post operatively and also analyze complications of surgery. In our study patient's age ranges from 18 to 51 years with a mean of 28.33 years of age. The majority of patients were in active age group of 21-34 years. It is well documented in literature that females involve in sports are more prone for ligament injury due to anatomical, biochemical and hormonal factors. There were 41 male patients and 4 female patients in this study. Male dominance in acl injury may be due to the fact that they are more involved in outdoor activity and sports. Johnson et al in their series had patients whose age ranged from 17 to 48 years with the mean age of 26.3 years and median age of 25.0 years. Their study included 23 (92%) males and 2 (8%) females and most of the patients were between 15 to 25 years age. In our study road traffic accidents (68.89%) and sports (31.11%) were the

common modes of injury. Among the sport, athletic activity and running were the most common in our society. The difference in mode of injury may be seen due to higher incidence of road traffic accidents in our study, due to lesser road safety and lesser involvement in sports activities. In our study the duration of symptom ranged from 1-30 months. The mean duration of injury was 4 months. Li et al conducted a study on 25 patients with ACL deficiency, ranging in age from 17-43 years with an average of 25.8 years.<sup>9</sup> They included 17 patients (68%) caused by sports, 24% patients caused by accidental fall and 8% patients caused by RTA. The average time of presenting complaints was 3 months. In this study, out of 42 patients, 21 patients (46.67%) had right knee involvement and 24 patients (53.33%) had that of left knee joint. Brig et al in their study, total 60% of the cases had right knee injury.<sup>10</sup> In our study, the most common primary diagnosis was ACL tear. 13 patients (28.89%) had associated meniscal injury along with ACL tear. 10 cases (22.2%) had medial meniscus injury and 3 cases (6.67%) had lateral meniscus injury. Meniscectomy was done if meniscal tear found intraoperatively. Rest of 32 patients (71.11%) had isolated ACL injury. Patients with posterior cruciate ligament and collateral ligament injury were not included in this study. Kruger- Franke et al in their study of 107 patients seen that ACL ruptures associated with 55% of the lateral meniscus tear, 45% with the medial meniscus rupture.<sup>11</sup>

Lysholm Knee Score of our study were compared to the results of Lysholm et al study on 60 cases and had 88% excellent to good results, 8% fair results and poor in only 4%.<sup>11</sup> In our study, Lysholm score of most patients were ranged from 65 to 83 pre-operatively. The pre-operative mean score of patients was 69.33. After 6 months follow-up was done in 42 patients and their mean Lysholm score was 82.11. And at 6 months, around 41 patients reported excellent to good outcome. After 12 months mean Lysholm knee score improved to 96.03 from a mean of 69.33. Nellaiyappan did a prospective study of patients with ACL injury who underwent Arthroscopic ACL reconstruction using hamstring autograft.<sup>12</sup> 67% patients returned to pre-injury level. On comparison, our study showed good to excellent outcome on 12 months followed in 44 patients. Thus, the results of both the studies were comparable. In our study amongst the post op complications, knee pain was the most commonly, seen in 5 patients (11.11%) followed by stiff knee in 3 patients (6.67%) and post-operative infections in 1 (2.22%) patients. Superficial surgical site infection was treated with proper antibiotic coverage. Ibrahim et al and Marder et al published the result of meta-analysis of patients managed by hamstring tendon graft.<sup>13,14</sup> In both the studies anterior knee pain was found in 24% patients. Functional outcomes influenced by graft fixation techniques, bony tunnel placement and postoperative rehabilitation. After all discussion we found hamstring tendon graft is much superior than other grafts in terms of patient satisfaction, functional results and post operative complications like donor site morbidity.

### Limitations

Limitation of this study was the short period study and less number of patients included. Long follow up are essential to evaluate long term outcomes of this operative procedure. This study includes small sample size, the results could have been more promising if a large sample was taken. This study is based on single institution. This study include simple uncomplicated ACL tear and patients planned for arthroscopic ACL reconstruction.

### CONCLUSION

The study entitled “comparative evaluation of pre and post-operative functional outcomes determined by Lysholm knee score of patients undergoing arthroscopic ACL reconstruction and its complications” represents the study of 45 cases with sign and symptoms indicating towards ACL injury of knee joint. Patients who were young, active, motivated people with future interest in professional activity like sports or who were involved in vigorous activities, willing to change their active life style were selected for reconstruction. Reconstruction of ACL allows the patient to return to full normal activity and delays the onset of post injury osteoarthritis. Arthroscopic ACL reconstruction is also essential to restore the knee stability and movement. After ACL reconstruction improvement in Lysholm knee score (follow up at 6m, 9m & 12m) is statistically significant ( $p < 0.001$ ). A well-organized rehabilitation program plays a key role in functional outcome after ACL reconstruction. These include greater motion, increased muscular strength and enhanced function. For early rehabilitation requires rigid intraoperative fixation of graft in bone tunnels.

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