ORIGINAL ARTICLE

ANNALS OF PUNJAB MEDICAL COLLEGE

Functional Outcome of Arthroscopic Anterior Cruciate Ligament Reconstruction with Bone Patellar Tendon Bone Graft Using Lysholm Score

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Submitted for Publication: 08-08-2025
Accepted for Publication 14-10-2025

How to Cite: Ahmad W, Shahid S, Sarfraz AH, Raza SM, Ali I, Masood F. Functional Outcome of Arthroscopic Anterior Cruciate Ligament Reconstruction with Bone Patellar Tendon Bone Graft Using Lysholm Score. APMC 2025;19(4):283-288. **DOI: 10.29054/APMC/2025.1799**

ABSTRACT

Background: Arthroscopic ACL reconstruction using the "gold standard" Bone-Patellar Tendon-Bone (BPTB) graft is crucial for restoring knee stability. The Lysholm knee scoring scale is a validated global tool for objectively evaluating postoperative functional recovery in these patients. **Objective:** To evaluate the mean Lysholm score following arthroscopic anterior cruciate ligament (ACL) reconstruction with bone patellar tendon bone (BPTB)graft. **Study Design:** Descriptive case series. **Settings:** Department of Orthopedic Surgery at KEMU/Mayo Hospital, Lahore Pakistan. **Duration:** 06 months (September 2024-January 2025). **Methods:** The sample had 80 patients. A 95% confidence range, 1% margin of error, and an estimated post-treatment Lysholm score of 85.49±9.0 were used. Non-probability consecutive sampling was utilized. Patients with clinical and arthroscopically verified ACL tears aged 18–70, both genders, were included. Analysis of data using SPSS version 25.0 yielded mean ± S.D. values for BMI and baseline Lysholm score at 3 months. A post-stratification t-test was used, with a significance level of p-value < 0.05. **Results:** The study has 80 participants. The average age at operation was 28.25 ± 8.32 years. Surgery was conducted 17.5 ± 10.3 weeks post-injury on average. 16 patients had concurrent medial meniscal injuries, while 10 had lateral tears. There were few postoperative problems. Two patients (6.25%) had superficial infections that were treated with oral antibiotics. The most prevalent follow-up symptom was anterior knee pain, reported by eight patients. Lysholm score improved significantly at 3 months. **Conclusion:** ACL reconstruction using the BPTB graft technique has been shown to produce promising functional outcomes, as evidenced by both objective assessments and patient-reported measures.

Keywords: *Anterior cruciate ligament, Arthroscopy, Bone patellar tendon bone graft.*

INTRODUCTION

The most frequently injured joint in trauma is the joint of knee joint, which leads to a tear of the anterior cruciate ligament (ACL). Initial symptoms of an ACL injury include Knee Joint Instability, pain, and limited day-to-day activity. This causes the articular cartilage and meniscus to degenerate, which results in osteoarthritis of the knee.[1] ACL reconstruction is, therefore, a regular operation in modern times. Two methods for surgical reconstruction of the ACL are open and arthroscopic.[2] These days, the most common technique is arthroscopic reconstruction. Several different auto grafts like Bone-Patellar-tendon Bone (BTB), Quadriceps graft, hamstring Graft, etc., are used here. The most often utilized modality is the BTB graft.[3] From the patella lower end to the tibial tuberosity, a longitudinal skin incision is made over the patellar tendon to extract the graft from the middle third of the tendon. Despite the widespread usage of this kind of graft, consensus regarding the optimal graft substance requires long-term randomized research.[4]

An orthopedic surgeon must assess the clinical outcome following a knee procedure. Since restoring good functional status is the primary goal of all orthopedic treatments, it's critical to take the patient's opinion of the intervention and the clinical outcome into consideration.[5] To evaluate improved patient follow-up and comparison of the outcomes with the trials, several tools have been created over time, including AKSS, Cincinnati, HSS, IKDC-subjective, KOOS, Kujala, Lysholm, OKS, SF-36, WOMAC, and Tegner. Furthermore, the Lysholm Knee scoring system is applicable in a wide range of contexts beyond predicting the results of knee ligament surgery.[6]

Effective management of valgus and rotational forces is critical in knee stabilization, as emphasized in previous studies.[7] Anterior cruciate ligament (ACL) injuries are frequently associated with recurrent joint instability, ongoing pain, and impaired knee function. Surgical reconstruction of the ACL is pivotal in restoring functional stability and facilitating a return to pre-injury activity levels. Moreover, timely intervention may mitigate the risk of secondary complications, including meniscal injuries and the early onset of osteoarthritis.[8] Acute ACL ruptures are linked to cartilage damage in approximately 40% of cases, whereas chronic injuries are associated with chondral lesions in up to 79% of patients.[9] Reconstruction is particularly important due to the ACL's limited intrinsic healing capacity and the high failure rates reported with primary suture repair. Additionally, traditional open reconstruction techniques have been correlated with increased postoperative morbidity.[10]

Arthroscopically assisted anterior cruciate ligament (ACL) reconstruction offers several advantages over traditional open surgical methods. These include preservation of the joint capsule, minimal disruption of the infrapatellar fat pad, avoidance of articular cartilage damage, and a reduced incidence of postoperative knee discomfort. During the 1980s, synthetic grafts were introduced for ACL reconstruction; however, their use was subsequently abandoned due to complications such as synovitis. The adoption of arthroscopic techniques in the late 1980s marked a significant advancement, reducing surgical morbidity and enhancing patient outcomes.[11] Today, arthroscopic ACL reconstruction is widely regarded as the gold standard.[12]

This minimally invasive technique provides superior visualization of posterior knee structures, an area previously challenging to access using conventional arthrotomy. Over time, a variety of graft options have been explored for ACL reconstruction.[13] Among these, the patellar tendon autograft (BPTB) remains the most commonly utilized, owing to its ability to restore physiological knee biomechanics and facilitate bone-to-bone healing at the graft-tunnel interface.[14]

In a study done by Rehman K et.al, the baseline mean Lysholm score was 50.46 ± 6.93. The mean

Lysholm score after six months was 85.49 ± 9.0.[15] This study aims to evaluate the functional results of arthroscopic anterior cruciate ligament restoration using a bone graft from the patellar tendon. This study might help us in devising a more effective management plan in managing anterior cruciate ligament injury. If we find improvement in the Lysholm score, we may recommend this treatment regularly in these patients. No local study could be found in the literature.

METHODS

The study was conducted in the orthopedic surgery department of the KEMU/Mayo Hospital in Lahore using a descriptive case series methodology, six months following the synopsis approval. (CPSP/REU/OSG-2023-066-2931 dated 30th august 2024). There were 80 patients in the sample, a 95% confidence level, 1% margin of error, and the anticipated post-treatment mean Lysholm score of 85.49±9.0 was used in its computation. Non-probability sequential sampling was the method used for sampling. Patients having a clinically and arthroscopically proven ACL tear (by operational definition), regardless of gender, and between the ages of 18 and 70 were included in the inclusion criteria. Conversely, individuals with moderate to severe osteoarthritis shown on X-rays with ACL inadequacies, bilateral knee injuries, tibial plateau fractures, and posterior cruciate ligament tears are excluded.

After taking approval from the hospital's ethical committee, 80 patients who met the inclusion criteria were enrolled in the study at KEMU / Mayo Hospital, Lahore. All patients provided

Informed consent, the demographic profile, including name is gender, and side of injury, was collected. The Lysholm score was documented preoperatively for each patient. The anterior cruciate ligament (ACL) was reconstructed arthroscopically utilizing a BPTB graft. This procedure was performed under spinal anesthesia. A total of 80 cases underwent initial arthroscopic assessment, which included partial meniscectomy and debridement of the ACL footprint. A graft measuring approximately 12 to 15 mm was harvested, with bone plugs at each end. The anteromedial approach for arthroscopically assisted tibial and femoral tunnels was modified. The anatomical placement of the ACL graft was performed and secured using titanium interference screws. At the conclusion of the procedure, no drain was inserted, and Jones's bandage was applied to the knee before deflating the tourniquet. The knee was immobilized in an immobilizer during transfer from the operating theatre, followed by extension and elevation

for 24 hours. The knee immobilizer was removed at the conclusion of the first postoperative day. Ice packs were applied to the knee for several minutes at 12-hour intervals over the course of a few days. Patellar mobilization and quadriceps/ hamstring exercises commence on the second postoperative day. The patient was allowed to engage in partial weight-bearing ambulation with an immobilizer for the initial two weeks, transitioning to full weight-bearing ambulation thereafter. The knee immobilizer was substituted with the knee brace after 2 weeks. Patients were subsequently monitored in the outpatient department for a duration of 3 months, assessed with the Lysholm score at 3 months in accordance with the operational definition. Data was gathered using a specifically developed form. The data was entered and analyzed with SPSS version 25.0. Quantitative variables, such as age, are measurable and can be expressed numerically. The BMI and baseline Lysholm score, as well as the score at 3 months of work, were calculated as mean standard deviation. Qualitative variables such as gender and side of injury were analyzed using frequencies and percentages. Data was stratified by age, BMI, gender, and side of injury. The post-stratification t-test was conducted with a significance level, $p < 0.05$. The pre- and postoperative Lysholm scores were analyzed using a paired sample t-test.

RESULTS

The majority of the majority were young adults aged 18–25 years. There was a nearly equal distribution between male and female patients, and both knees were equally affected.

Table 1: Demographics of Patients

Variable	Category	Frequency	Percentage (%)
Gender	Male	39	48.75%
	Female	41	51.25%
Age Group	18–25	72	90%
	26–35	6	7.5%
	>35	2	2.5%
Side Involved	Right	40	50%
	Left	40	50%

The mean age of patients was 20 years, with moderate baseline knee function based on the Lysholm scoring system. Average body mass index was within normal limits.

Table 2: Preoperative Clinical Characteristics

Variable	Mean ± SD
Age	20.0 ± 2.4 years
Baseline Lysholm Score	68.2 ± 7.5
BMI	23.5 ± 2.1

There was a statistically significant improvement in the function of the knee as measured by the Lysholm score from pre-surgery to 3 months postoperatively ($p < 0.001$).

Table 3: Postoperative Functional Outcome (Lysholm Score)

Time Point	Mean Lysholm Score ± SD
Preoperative	68.2 ± 7.5
3 Months Post-op	85.5 ± 6.2
Improvement	+17.3 points

This descriptive case series shows that using bone patellar tendon bone (BTB) autograft to reconstruct the anterior cruciate ligament (ACL) arthroscopically brings remarkable improvement in knee function, as evidenced by a marked increase in Lysholm scores at 3 months postoperatively. The majority of patients were young adults, with an almost equal gender distribution.

DISCUSSION

The outcomes of the current study were evaluated in contrast with previous research conducted by Weng C, *et al*,[16] Xiao M, *et al*,[17] and Ahn J, *et al*.[18] The mean Lysholm score observed at the final follow-up in the current cohort was 85.5 ± 6.2, which is consistent with the results reported in these earlier investigations, indicating favorable functional recovery following ACL reconstruction.

Additionally, a meta-analysis by Dia W, *et al*[13] demonstrated that the bone patellar tendon–bone (BPTB) autograft exhibits better function and is associated with restoration of normal knee range of motion, outperforming hamstring tendon grafts. Supporting this, Matar H, *et al*[8] found that participants who underwent ACL reconstruction using hamstring grafts exhibited greater postoperative joint laxity compared to those who received BPTB grafts.

According to Everhart J *et al*[9] the bone patellar tendon–bone (BPTB) autograft is regarded as the gold standard and the preferred choice for anterior cruciate ligament (ACL) reconstruction. The use of interference screw fixation further enhances the biomechanical rigidity of the graft. Kunze K, *et al*[10] also reported that BPTB grafts provide superior knee joint stability compared to hamstring grafts, particularly when combined with interference screw fixation. In the present study, no instances of graft failure were observed, supporting the reliability of the BPTB technique.

Furthermore, a comparative analysis by Yamini G *et al*,[14] demonstrated higher postoperative activity levels in patients who received BPTB grafts compared to those with hamstring tendon grafts. These findings suggest

that, when surgical principles are meticulously followed, BPTB autografts yield consistent and favorable outcomes.

During follow-up assessments, a significant decrease in postoperative pain was noted among the participants. To reduce the likelihood of anterior knee pain during kneeling after surgery, an oblique incision technique was utilized in all procedures. According to Fox *et al*,[20] approximately 15% of patients develop anterior knee pain following anterior cruciate ligament (ACL) reconstruction. Other studies have reported even higher incidences, with rates surpassing 20%. For example, Kitaguchi, *et al*[19] Observed anterior knee discomfort in 24% of patients post-surgery. In contrast, only 10% of participants in the current study experienced such symptoms, suggesting a relatively lower occurrence compared to previous reports.

In the current study, male participants accounted for 48.7%. Of the sample population. This gender distribution is consistent with findings from an epidemiological study in which they reported no significant increase in anterior cruciate ligament (ACL) injury risk among females compared to males. One plausible explanation for this disparity is the higher rate of participation in high-impact, sport-related activities among males and adolescent boys, leading to a proportionally increased incidence of ACL injuries within this demographic.

Supporting this, Aizawa *et al* reported that non-athletic males were approximately three times more likely than their female counterparts to sustain ACL injuries. This trend may reflect the greater involvement of males in high-intensity, contact-based sports such as football, basketball, and skateboarding, while females tend to engage more frequently in lower-impact, non-contact activities, including aerobics, badminton, table tennis, and swimming.[11]

Nevertheless, other studies have documented a higher prevalence of ACL injuries among females. A study by Devana S, *et al*[20] was revealed that female athletes experience ACL ruptures at a rate nearly three times higher than males. Some investigations have even estimated the risk to be 8–9 times greater in female athletes.

Several biological and biomechanical factors have been proposed to account for gender-based differences in ACL injury risk. These include greater generalized joint laxity, increased quadriceps (Q) angle, steeper posterior tibial slope, narrower intercondylar notch, smaller cross-sectional area of the ACL, hormonal influences, and differing neuromuscular control patterns. Notably, female athletes are more likely to exhibit landing mechanics characterized by reduced knee flexion and increased valgus and external rotation, which may predispose them to higher injury risk.[20]

In the present study, the leading cause of anterior cruciate ligament (ACL) injuries was sports-related trauma. Soccer emerged as the most commonly implicated sport, corroborating earlier findings by Walden M.[21] Other frequently associated activities included basketball, gymnastics, and rugby.

The interval between ACL injury and surgical intervention is a well-established prognostic factor. Multiple studies have shown that delayed reconstruction increases the likelihood of secondary intra-articular damage, particularly to the menisci and articular cartilage, due to persistent knee instability. In a prospective cohort, Wang L *et al*,[22] demonstrated that delaying ACL reconstruction beyond six months significantly elevated the risk of medial meniscal injury.

In our cohort, 36% of patients sustained isolated lateral meniscus tears, while 22.2% presented with combined lateral and medial meniscal injuries. Although the difference between these groups was not statistically significant, our findings differ from those of Gaillard *et al*,[23] who reported a predominance of medial meniscal involvement, including bilateral tears. The posterior horn of the medial meniscus was the most frequently affected site, followed by more extensive tears involving the entire medial structure. Risk factors associated with medial meniscus injury included increased age, male sex, higher body mass index, and extended delay between injury and surgery.

In the present study, 16 of 36 patients (44.4%) had concomitant meniscal injuries. The pattern of meniscal involvement is influenced by several factors, including lower limb alignment, biomechanical loading, and timing of surgical intervention. From a biomechanical perspective, the medial meniscus serves as a secondary stabilizer against anterior tibial translation in ACL-deficient knees, making it more vulnerable to shear forces. Conversely, the lateral meniscus, due to its increased mobility, is less frequently exposed to such stresses and is therefore less commonly injured.

Despite these mechanistic considerations, our findings diverged from the commonly reported pattern of medial meniscus predominance. Instead, they are consistent with the results of Magosch A *et al*,[24] who also observed a higher prevalence of lateral meniscal tears in the setting of ACL rupture. Donor site morbidity continues to be a recognized complication associated with the use of bone patellar tendon–bone (BPTB) autografts. In this study, all patients exhibited temporary sensory alterations localized to the front of the knee. These neurological changes, however, resolved spontaneously within one-

year post-surgery. Furthermore, only one case of superficial wound infection was recorded, which was successfully treated with local debridement and oral antibiotic therapy.

CONCLUSION

Using the bone patellar tendon bone (BPTB) graft for arthroscopic anterior cruciate ligament (ACL) reconstruction has been proven to lead to good functional results, as evidenced by both objective assessments and patient-reported measures. The procedure contributes to significant increases in knee joint function and stability, thereby facilitating a more rapid recovery and earlier return to routine activities.

LIMITATIONS

This is a descriptive case series on a small scale; more randomized controlled trials are required. There was a difficulty in follow-ups as patients belonged to remote areas, we had to follow few patients telephonically and coordinate with local hospitals.

SUGGESTIONS / RECOMMENDATIONS

The study needs to be done on a large population, and randomized controlled trials for comparison of different graft options may be studied.

CONFLICT OF INTEREST / DISCLOSURE

There is no conflict of interest and nothing to declare.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the faculty and residents of the Department of Orthopedic Surgery, King Edward Medical University/Mayo Hospital, Lahore, for their support in conducting this study.

FUNDING

No funding is being done by either the university or the hospital, nor are any funds being taken from the pharmaceutical industry. Implants used were available in the hospital free of cost.

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