Assessment of Functional outcomes Following Arthroscopy-Assisted Anterior Cruciate Ligament Reconstruction Utilizing Autograft Bone-Patellar Tendon-Bone

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KEYWORDS

Anterior cruciate ligament, ACL reconstruction, bone-patellar tendon-bone autograft, knee stability.

ABSTRACT

Anterior cruciate ligament (ACL) injuries are prevalent in athletes and active individuals, necessitating effective surgical interventions for restoring knee stability and function. This study evaluates the outcomes of Arthroscopic ACL reconstruction using bone-patellar tendon-bone (BPTB). This prospective study conducted from March 2022 to August 2023 evaluated the functional outcomes of 21 patients undergoing ACL reconstruction with BPTB autografts. Clinical assessments, including the Lachman and Lysholm scores, were utilized to assess knee stability and function preoperatively and postoperatively. Significant improvements were observed postoperatively in clinical assessments, with mean Lysholm scores increasing from 51.74 preoperatively to 91.64 at the 12-month follow-up ($p < 0.001$). The study also highlighted the prevalence of associated meniscal injuries and postoperative complications. Despite study limitations, including sample size constraints, our findings support the efficacy of ACL reconstruction with BPTB autografts in restoring knee function and stability. Evidence-based decision-making and comprehensive patient care are crucial for optimizing surgical outcomes in ACL injuries. Further research with larger cohorts and long-term follow-up is warranted to validate these results and explore optimal management strategies.

1. Introduction

Anterior cruciate ligament (ACL) injuries are prevalent among athletes and active individuals, posing significant challenges to both patients and healthcare providers [1]. The ACL plays a crucial role in stabilizing the knee joint during activities involving cutting, pivoting, and sudden changes in direction. Consequently, its rupture can lead to functional limitations, instability, and predispose individuals to subsequent joint damage, such as meniscal tears and osteoarthritis. Among the various treatment modalities available, surgical reconstruction using a bone-patellar tendon-bone (BPTB) autograft has emerged as a gold standard for restoring knee stability and function [2,3,4].

Over the years, numerous studies have investigated the functional outcomes following ACL reconstruction with BPTB autografts [5]. These studies have explored various aspects, including postoperative knee stability, range of motion, muscle strength, return to pre-injury activity levels, and long-term joint health [6]. Understanding the functional outcomes associated with this surgical technique is paramount for optimizing patient care, guiding rehabilitation protocols, and informing surgical decision-making.

The rationale behind utilizing a BPTB autograft lies in its biomechanical properties and ability to mimic the native ACL. The patellar tendon provides robust mechanical strength, while the bone-to-bone fixation enhances graft stability and promotes osseous integration. Additionally, using an autograft reduces the risk of immune rejection and graft failure compared to allografts or synthetic materials. These factors contribute to the favorable outcomes observed with BPTB autografts and underscore their widespread adoption in ACL reconstruction surgeries.

Despite its efficacy, ACL reconstruction with BPTB autografts is not without limitations and potential complications. Patients may experience donor site morbidity, such as anterior knee pain, patellar

tendonitis, and decreased quadriceps strength [7]. Furthermore, issues related to graft healing, such as graft elongation, failure, or re-rupture, can impact long-term functional outcomes and patient satisfaction [8]. Therefore, meticulous surgical technique, appropriate patient selection, and comprehensive rehabilitation are essential for optimizing outcomes and minimizing complications [9,10]. In this study, we aim to contribute to the existing body of literature by conducting a comprehensive evaluation of the functional outcomes associated with knee ACL reconstruction using BPTB autografts. Through a retrospective analysis of patient data, including clinical assessments, functional tests, and patient-reported outcomes, we seek to provide insights into the efficacy, challenges, and long-term implications of this surgical approach. By elucidating the functional outcomes, we aim to facilitate evidence-based decision-making, enhance patient counseling, and ultimately improve the quality of care for individuals undergoing ACL reconstruction surgery with BPTB autografts.

2. Methodology

In this study, we conducted a prospective evaluation of patients who underwent Arthroscopic ACL reconstruction using BTB autograft, from March 2022 to August 2023. Patients meeting the inclusion criteria were those willing to participate and follow up, with no history of prior knee surgery, and a normal contralateral knee. Diagnosis of ACL tear was confirmed by clinical evaluation, MRI, and arthroscopy. Patients with ACL injuries along with chondral and meniscal lesions were included. Exclusion criteria encompassed patients lost to follow-up, those with associated intra-articular fractures, multiligament reconstruction, revision ACL surgery, and individuals with poor compliance such as psychiatric disorders or severe addiction. A total of 21 patients were enrolled, and data were collected using a standardized proforma emphasizing preoperative and postoperative variables. Patients underwent periodic reviews at specific intervals for assessment.

Patients were categorized into four groups based on the time of surgery since injury and adherence to the physiotherapy protocol, which was assessed through a questionnaire. Subsequently, these patient subsets were statistically analyzed to determine if there were any effects on the Anterior Drawer test, Lachman test, Lysholm score, and extension loss. The study protocol was approved by the local medical ethical board, and informed consent was obtained from each patient, ensuring adherence to ethical standards.

Surgical technique involved arthroscopic confirmation of ACL tear, with management of associated chondral lesions and meniscal tears. The patellar tendon autograft was used, and anatomic tunnel placements were ensured. Postoperatively, a rehabilitation program including closed chain exercises and gradual mobilization was initiated. Patients were advised on quadriceps strengthening exercises, with specific milestones for return to activities and sports.

Physical examinations were conducted by two examiners, assessing range of motion and ligamentous laxity. Functional scoring scales such as the Lysholm Scoring Scale, Visual Analogue scale were utilized. Statistical analysis was performed using appropriate methods, including the Wilcoxon Signed Rank Test and Kruskal Wallis Test, with significance set at a P value less than 0.05. SPSS 17.0 version was employed for data analysis.

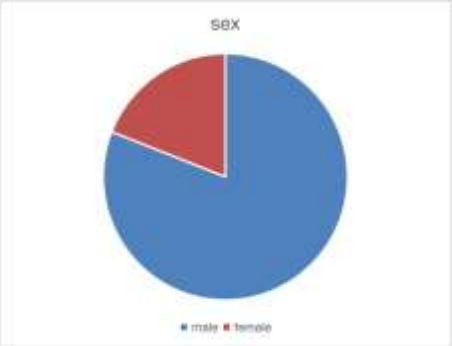

Figure 1.Sex Distribution

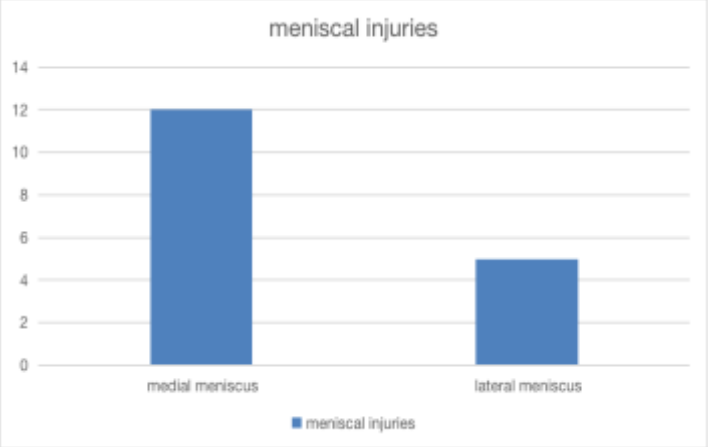

Figure 2. Associated meniscal injuries

3. Result and Discussion

This prospective study, comprising 21 patients, was conducted at Saveetha Medical College from March 2022 to March 2023. Among them, 18 were male, with a mean age of 28.5 years (ranging from 22 to 37), and 3 were female, with a mean age of 24.4 years. Thirteen patients underwent surgery on their right knee, while eight patients had their left knee operated on. Patients were followed up at 1, 3, 6, and12 months post-surgery. The most common mode of injury was road traffic accidents (RTA) in 12 patients, sports injuries in 7 patients, and falls in 2 patients. The time from injury to presentation was less than 1 month in 12 cases, 1 to 4 months in 5 cases, and 4 to 12 months in 4 cases. The predominant complaint was knee pain in 60% of cases, followed by a sense of giving way in 30% of cases. Clinical assessments were conducted using the Lachman test, anterior drawer test, and Pivot Shift test preoperatively and at six weeks post-recovery, with only two patients showing a positive Lachman test after surgery. The Lysholm scoring was performed on all patients preoperatively and at the 5th and 9th months postoperatively, revealing a mean Lysholm score of 51.74 ± 2.72 preoperatively, 83.56 ± 7.22 at the 6th month, and 91.64 ± 2.01 at the 12th month. The p-value calculated using paired student t-test between preoperative and post-operative Lysholm scores at the 6th and 12th months was found to be <0.001, indicating significance and rejecting the null hypothesis. The average operation time was 89.6 ± 16.2 minutes.Meniscal injuries were present in 13 patients. Medial meniscus tear in 8 cases, Lateral meniscus tear in 5 cases. Partial medial meniscectomy was done in 6 patients and partial lateral meniscectomy was done in 3 patients. Meniscal repair was done in other cases.5 patients had paraesthesia over the anteromedial portion of tibia which settled subsequently. One patient had a screw back out from the tibial site at the one year follow up and the screw was removed. All patients experienced uneventful recovery in the one year post-operative period.

Discussion

Anterior cruciate ligament (ACL) injuries are common among athletes and individuals engaged in physical activities, presenting significant challenges to both patients and healthcare providers due to their impact on knee stability and function [11]. Surgical reconstruction using a bone-patellar tendon-bone (BPTB) autograft has been widely adopted as a gold standard treatment for restoring knee stability and function post-injury [12].

The findings of our study add to the existing body of literature by providing insights into the functional outcomes following arthroscopy-assisted ACL reconstruction with BPTB autografts. Our results demonstrate favorable functional outcomes, as evidenced by improvements in clinical assessments, including the Lachman test, anterior drawer test, and Lysholm score [13]. These improvements suggest successful restoration of knee stability and function postoperatively, aligning with previous research advocating for the efficacy of BPTB autografts in ACL reconstruction [14].

Specifically, our study revealed a statistically significant improvement in the Lysholm score from preoperative to postoperative periods (mean preoperative Lysholm score: 51.74 ± 2.72, mean postoperative Lysholm score at 6 months: 83.56 ± 7.22, mean postoperative Lysholm score at 12 months: 91.64 ± 2.01; $p < 0.001$). This substantial increase in Lysholm scores indicates enhanced knee function and improved patient-reported outcomes over time, highlighting the efficacy of ACL reconstruction with BPTB autografts in facilitating functional recovery [15].

However, our study has limitations that warrant consideration. The relatively small sample size and single-center design may limit the generalizability of our findings. Additionally, the absence of a control group and long-term follow-up data restricts our ability to compare outcomes with alternative surgical approaches or assess the durability of results over time [16].

Furthermore, while our study focused on functional outcomes, additional measures such as patient-reported quality of life, return to sport rates, and radiographic evaluation of graft integrity could provide a more comprehensive assessment of surgical success [17]. Future research endeavors should aim to address these limitations and further elucidate optimal management strategies for ACL injuries. Large-scale multicenter studies with long-term follow-up are needed to validate our findings and evaluate the comparative effectiveness of different surgical techniques and graft types.

Moreover, investigating the impact of adjunctive treatments, such as biological augmentation or advanced rehabilitation protocols, may offer insights into optimizing outcomes and reducing the risk of complications associated with ACL reconstruction surgery. Our study contributes valuable evidence supporting the efficacy of ACL reconstruction utilizing BPTB autografts in restoring knee function and stability. While acknowledging the study's limitations, our findings emphasize the importance of evidence-based decision-making and comprehensive patient care in achieving successful outcomes following ACL reconstruction surgery

4. Conclusion and future scope

Our study confirms that ACL reconstruction using BPTB autografts is effective in restoring knee function and stability. Significant improvements in clinical assessments and patient-reported scores postoperatively underscore successful outcomes. Despite limitations such as sample size and single-center design, our findings advocate for evidence-based decision-making and comprehensive patient care in ACL reconstruction surgery. Further research with larger cohorts and long-term follow-up is warranted to validate these results and explore optimal management strategies for ACL injuries.

Conflict of interest

None

Reference

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