https://doi.org/10.48047/AFJBS.6.14.2024.10866-10873

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

A COMPARATIVE STUDY OF FUNCTIONAL OUTCOME OF ARTHROSCOPIC ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION ON USING TRANSPORTAL TECHNIQUE VS TRANSTIBIAL TECHNIQUE

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Volume 6, Issue 14, Aug 2024

Received: 15 June 2024

Accepted: 25 July 2024

Published: 15 Aug 2024

doi: 10.48047/AFJBS.6.14.2024.10866-10873

ABSTRACT

Background- Anterior cruciate ligament (ACL) injuries significantly impact the active lifestyle and sports participation of young individuals, necessitating effective surgical reconstruction techniques. Various methods, including traditional transtibial and newer transportal techniques, have been proposed for ACL reconstruction, aiming to restore knee stability and function. However, comparative assessments of these techniques are limited. **Material and Methods:** The study was conducted by, involving 60 patients undergoing ACL reconstruction. Patients were divided into two groups based on the surgical technique employed: transportal and transtibial. Functional outcomes were assessed using the Lysholm score and International Knee Documentation Committee (IKDC) score at postoperative intervals. Statistical analysis was performed using SPSS v24.0, with a significance level set at $p < 0.05$. **Results:** Both groups exhibited comparable demographic characteristics and preoperative clinical profiles. However, postoperatively, patients in the transportal group demonstrated significantly higher Lysholm and IKDC scores at 1 month and 3 months compared to the transtibial group ($p < 0.05$). Additionally, a higher proportion of patients in the transportal group reported no difficulty in functional activities postoperatively ($p < 0.05$). The incidence of complications was similar between the groups ($p > 0.05$). Notably, excellent functional outcomes were observed in 50% of patients in the transportal group compared to 20% in the transtibial group ($p < 0.05$). **Conclusion:** ACL reconstruction using the transportal technique yields superior functional outcomes and patient satisfaction compared to the traditional transtibial approach. The findings underscore the importance of anatomical graft placement and independent tibial tunnel trajectory in optimizing postoperative knee kinematics and functional rehabilitation. **Conclusion:** IM IL nailing is better in management of distal tibia fractures than LCP Osteosynthesis, in terms of early fracture union rates, early weight bearing, ease of procedure, functional outcome of lower limb and less complication rates.

Keywords: Anterior cruciate ligament, ACL reconstruction, transportal technique, transtibial technique, functional outcomes, knee kinematics, comparative analysis.

INTRODUCTION

Anterior cruciate ligament (ACL) injuries are among the most frequent ligament injuries to the knee joint. The majority of those impacted are young patients who have been in car accidents and sports-related incidents. This often leads to anterior knee instability and restriction of an active lifestyle and sports activity.[1]

The literature has described a wide range of ACL reconstruction and modification techniques.[2,3] Conversely, successful outcomes for traditional transtibial ACL reconstructions have been documented.[1]

The aim of a single bundle ACL reconstruction is to position the graft's tibial and femoral attachment sites from the center of the native tibial footprint to the center of the native femoral footprint.[4] When the two locations are chosen separately, the objective of tibial tunnel independent transportal reconstruction is easily reached. The location of the femoral tunnel center is determined by the trajectory of the tibial tunnel during transtibial ACL repair.[1]

The literature has described a wide range of ACL reconstruction and modification techniques. Although outcomes of traditional transtibial ACL restorations were found to be satisfactory, 11% to 30% of patients expressed dissatisfaction with the procedure, particularly when cutting motions were included.[2–7] The nonanatomic graft placement was cited as the reason for these disappointing outcomes.[8] In order to properly restore knee kinematics, several studies have recommended anatomic placement of ACL tunnels in their original footprint.[8]

In recent days ACL reconstruction has been done using transtibial and transportal here we are comparing the results and outcome between these techniques.[2,3]

A complete comparative assessment of the functional outcomes of the ACL reconstructive surgeries done in patients using the transportal technique vs transtibial technique was done here in our tertiary care hospital for the first time.

METHODOLOGY

The study is a prospective 18-month investigation comparing the efficacy of two arthroscopic techniques for anterior cruciate ligament (ACL) reconstruction. Data collection will span 16 months, followed by 1 month each for data analysis and report writing. Using radiological investigations (X-ray and MRI) and expert clinical evaluations, including diagnostic arthroscopy, the study will assess the outcomes of ACL reconstruction using either the transportal or transtibial technique. A sample size of 60 patients, divided equally between the two surgical groups, was determined based on previous studies with a mean and standard deviation for Lysholm and IKDC scores, aiming for a 5% significance level and 80% power, with a 10% allowance for non-response. Inclusion criteria include patients aged 18-50 with ACL deficiency and associated meniscal injuries, while those with multi-ligament injuries, prior knee surgery, or significant co-morbidities are excluded. Outcomes will be evaluated based on postoperative complications, functional rehabilitation, and patient-reported outcomes, with all procedures conducted following institutional ethics approval and maintaining patient confidentiality. The study aims to identify the optimal ACL reconstruction technique to improve postoperative results and minimize revision rates in a tertiary hospital setting.

PROCEDURE DETAILS

Transportal Technique

Anterior Cruciate Ligament (ACL) reconstruction using the transportal technique involves a series of precise surgical steps to restore knee stability. Here is a detailed guide to the surgical steps involved:

- After tourniqueting the patient's thigh and positioning them supine on the operating table, administer general or regional anesthesia.
- Create anterolateral & anteromedial portals for the arthroscope and instruments. Conduct a comprehensive arthroscopic evaluation of the knee to determine damage and verify an ACL tear.
- Harvest the hamstring tendon (semitendinosus and sometimes gracilis) or a BPTB (Bone-Patellar Tendon-Bone) graft. Prepare graft to the desired length and diameter.
- Perform notchplasty if needed to increase space in the femoral notch and avoid graft impingement.
- Insert the femoral aiming guide through the anteromedial portal. Drill a guide pin through the guide to the femur's anatomical ACL footprint. To create the femoral tunnel, place a reamer over the guide pin.
- Using the anteromedial portal, position the tibial guide so that it points toward the ACL footprint on the tibia. After drilling a guide pin through the guide, ream the tibial tunnel over it.
- The graft should be passed through the tibial tunnel and into the femoral tunnel using a passing suture. Verify that the graft is properly positioned in both tunnels.
- Using an EndoButton, interference screw, or other similar device, secure the graft in the femoral tunnel. To secure the graft in the tibial tunnel, use an interference screw or other fixation device. Adjust the graft's tension.

- Assess the graft tension and knee range of motion with arthroscopic and manual techniques. Conduct stability assessments.
- Using steri-strips or sutures, close the arthroscopic portals, and cover the surgical sites with a sterile dressing.

Transtibial Technique

The Transtibial Technique "for Anterior Cruciate Ligament (ACL) reconstruction is a traditional method where both the femoral & tibial tunnels are developed through the tibial portal. The following is a comprehensive guide to the surgical procedures for ACL reconstruction utilizing the transtibial technique:

- Anatomical Transtibial Single-Bundle ACL Reconstruction: Step-by-Step Procedures GT and ST are collected. These two tendons are used to create a seven-stranded graft.
- The femoral tunnel, located in the center of the ACL footprint, is identified using a radiofrequency probe. The location is 5 mm ahead of and 5 mm ahead of the lateral wall of the lowest point of the femoral notch.
- Within 5 mm of where the femoral tunnel is supposed to be, there is a projection point on the femur. The tibial tunnel is formed, its inner aperture angling the tibial axis at about 50° and the sagittal plane at about 40° in the center of the ACL tibial footprint.
- The marked point of the femoral tunnel is where the K wire is adjusted after being drilled into the tibial tunnel. It shapes the tunnel of the femur.
- A 2- to 3-cm-long longitudinal incision is made on the lateral midline of the thigh to provide access to the underside of the quadriceps for the anterolateral femur.
- The graft is inserted into the femoral tunnel. The proximal suspension fixation is finished by tying the sutures on a miniature plate over the outer orifice.
- Interference screw fixation is first performed on the tibial side.
- The distal graft end sutures are tied at an adjustable loop through a transtibial ridge" tunnel.

Sample Size: (with calculation):

Based on the previous study with the mean and SD of the group operated 97.31+2.84 and 92.22+ 4.61, and with the following,

Level of significance 5%
Power of the study 80%
Non-response error 10%

Sample size derived is, 30 in each group
Total of 60 operated subjects for ACL.

RESULTS

In present study total 60 patients fulfilling inclusion criteria in study, with no significant difference in mean age between the group. The mean age of patients in transportal group was 33.8±7.1yrs and in transtibial group was 35.2±8.9yrs.

Table 1: Comparison of the pre-operative swelling and symptoms between the groups

		Transportal Technique		Transtibial Technique		p-value
		Count	N %	Count	N %	
Pre-OP swelling	Absent	5	16.7%	6	20.0%	0.95
	Mild	25	83.3%	24	80.0%	
Pre-Op giving away sensation	Present	30	100.0%	30	100.0%	-
Pre-Op giving away sensation	Present	30	100.0%	30	100.0%	-
Pre-Op difficulty in squating	Present	30	100.0%	30	100.0%	-

Table 2: Comparison of the pre and post-operative mean level of Lysholm knee score between the groups

	Transportal Technique		Transtibial Technique		p-value
	Mean	SD	Mean	SD	
Pre-OP Lysholm Knee score	47.1	1.9	46.1	1.8	0.4
Post-OP Lysholm score 1m	65.1	2.2	55.2	1.8	0.01*
Post-OP Lysholm score 3m	88.7	5.8	76.4	2.9	0.01*

Table 3: Comparison of the pre and post-operative mean level of IKDC score between the groups

	Transportal Technique	Transtibial Technique	p-value

	Mean	SD	Mean	SD	
Pre OP IKDC Score	27.2	1.8	26.6	1.6	0.177
Post-Op IKDC score 1m	56.3	2.2	45.6	1.8	0.01*
Post-Op IKDC score 3m	72.1	3.0	65.7	2.1	0.01*

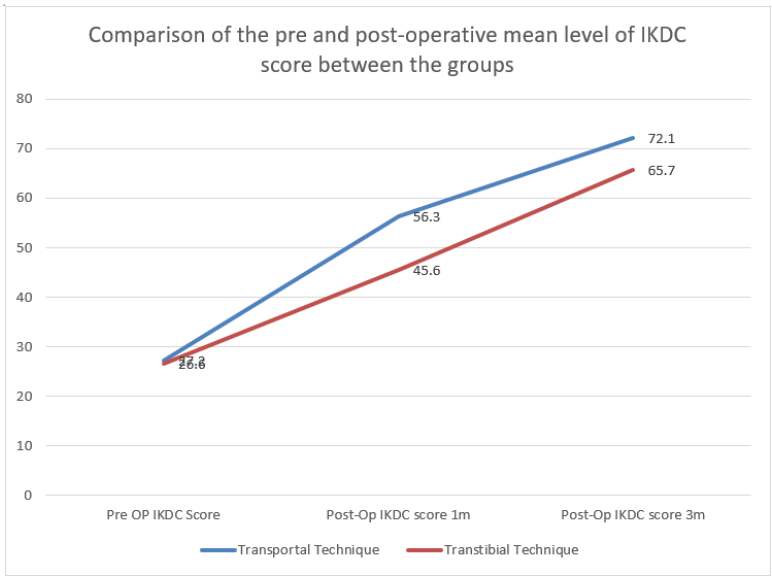

Figure 1: Comparison of the pre and post-operative mean level of IKDC score between the groups

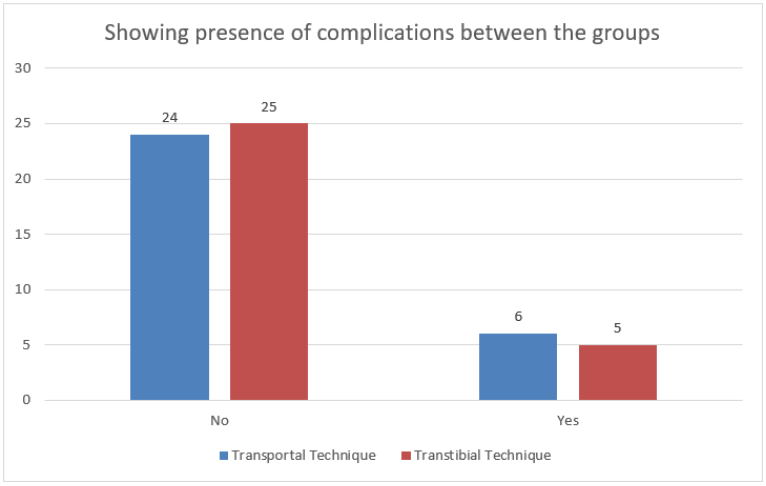

Figure 2: Showing presence of complications between the groups

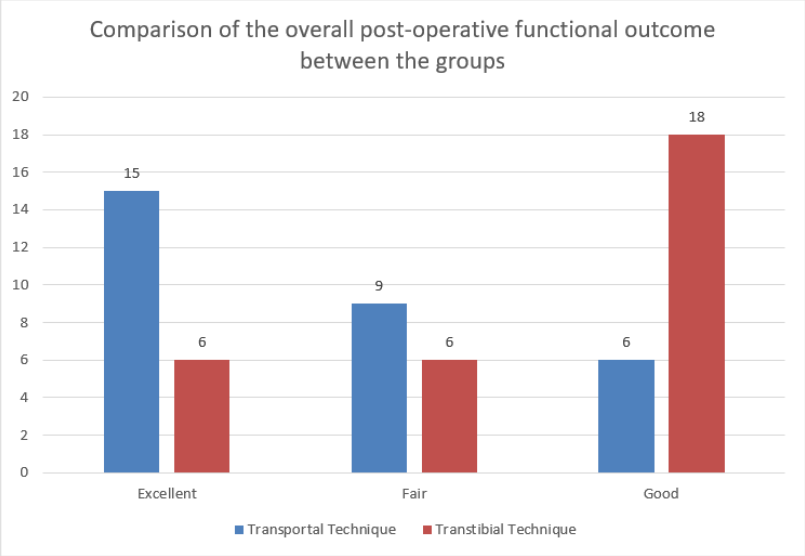

Figure 3: Comparison of the overall post-operative functional outcome between the groups

DISCUSSION

One of the mainstays of orthopedic surgery is arthroscopic anterior cruciate ligament (ACL) reconstruction, which is intended to stabilize & reestablish knee function after ligamentous damage. Over the years, several surgical techniques have been developed and refined to optimize outcomes, among which the transportal and transtibial techniques stand out as prominent approaches.

The choice between these techniques has been a subject of ongoing debate among orthopedic surgeons, with proponents and critics advocating for each method based on purported advantages in surgical precision, graft placement, biomechanical properties, and postoperative functional outcomes. Understanding the comparative functional outcomes of arthroscopic ACL reconstruction utilizing these techniques is crucial for informed clinical decision-making and ensuring optimal patient care.

The current study includes 60 patients who meet the inclusion criteria, and there is no discernible difference in the group's mean age. Patients in the transtibial group were 35.2±8.9 years old, while those in the transportal group were 33.8±7.1 years old. Gender distribution showed no discernible variation between the groups. In contrast to female patients, there was an overall preponderance of male patients. The distribution of left and right-sided injuries was equal when it came to the side of injury assessment. Seventy percent of the injuries were attributed to RTA in the transportal group and fifty percent to the transtibial technique. There was, nevertheless, no discernible difference between the groups.

According to a study by Sarwar S. *et al.*, the patient's mean ages were 28 and 29.4 years, and 86.7percent of them were males. The male-to-female ratio was 6.5:1. They documented most frequent mode of injury was sports-related and RTA.[51] According to Jin S. *et al.*, there was a preponderance of men, the patient's mean age was 38 years, & the groups were similar.[50]

The groups' mean age in a different study by Baymurat AC *et al.* was recorded as 25 and 26 years old, with no discernible difference between them. The study included a preponderance of male participants.[45]

When evaluating the functional outcomes and knee function of patients undergoing ACL reconstruction, the Lysholm & IKDC scores are useful instruments.

The Lysholm score is a well-liked subjective tool for evaluating different facets of knee function, which includes pain, instability, swelling, & the ability to carry out daily activities. Improved knee function & reduced discomfort are indicated by higher scores. The symptoms & functional limitations reported by the patient are used to calculate the score. In a similar vein, the IKDC score evaluates the general function and symptoms of the knee joint and is a validated outcome measure. It encompasses components such as symptoms, function in daily living activities, and sports activities, providing a comprehensive evaluation of knee function and stability. Regarding ACL reconstruction, the Lysholm and IKDC scores are essential for evaluating the efficacy of the surgical process and tracking the recuperation of the patient. These scores help clinicians track changes in knee function over time, compare outcomes between different surgical techniques or patient populations, and guide treatment decisions, such as rehabilitation protocols and return-to-sport criteria.

The pivot shift test “revealed no statistically significant differences between the groups.($p>0.05$) When comparing the mean Lysholm score between the groups after surgery, the patients in the transportal technique group had a significantly higher score than those in the transtibial technique group at the one-month and three-month marks. ($p<0.05$). However, the baseline measurement of the Lysholm knee score was comparable between the groups. When the IKDC was compared between the groups, the patients in the transportal technique group had a significantly higher” mean IKDC score three months and one

month after surgery than those in the transtibial technique group. ($p<0.05$). However, the baseline measurement of IKDC score was comparable between the groups.

Similar to the present study Sarwar *et al.*, documented a significantly higher mean score of Lysholm and IKDC among the patients treated by the transportal technique compared to patients in the transtibial technique. [51] Another study by Jin S *et al.*, documented improvement in the Lysholm score during the post-operative period compared to the preoperative period, and the mean score was higher in the transportal technique group in comparison to the transtibial technique group.[50]

According to Bhimani R *et al.*, the mean IKDC and Lysholm score of patients in the transport group was significantly higher in the sixth month of follow-up than that of patients in the transtibial group, which is consistent with the current study. concluded that the functional outcome obtained from the transportal technique provided superior outcomes after surgery.[47]

In another study by Sud A *et al.*, a study documented that the mean Lysholm score improved significantly compared to the preoperative period. The mean Lysholm score did not, however, differ significantly between the methods. Concluded that the ACL reconstruction surgery using ST quadruple graft with TT and TP techniques provided a similar functional outcome at 1 year of follow-up.[46]

According to Mandal A *et al.*'s current study, the transportal group demonstrated a significantly higher IKDC score, greater anteroposterior knee stability as measured by the Lachman test, and a shorter recovery period following surgery.[41]

The results of the study by Jin S. *et al.* indicated that the TT and TP techniques provided sufficient efficacy for ACL reconstruction. [50] In another study, Rahimnia A. *et al.* did not find any indication that the mean level of the pivot test and the Lachman test result differed significantly. Additionally comparable across the group was the mean Lysholm score. The study concluded that there is no significant clinical difference found between the two techniques and hence both techniques are good with clinical outcomes.[48]

On the assessment of complications. 20% in the transportal technique and 16.7% in the transtibial technique showed with presence of complications with no significant difference. On the assessment of post-operative functional outcome, 50% in the transportal technique group showed excellent results, and 20% in the transtibial technique group. In comparison to the transtibial technique group, the outcomes in the transportal technique group were noticeably better. ($p<0.05$)

One patient in each group experienced complications in the study by Sarwar S. *et al.*, but no discernible difference was seen between the groups.[45]

Greater functional outcomes and knee stability following ACL reconstruction using the transportal approach are indicated by higher post-operative Lysholm and IKDC scores in the transportal technique group as compared to the transtibial technique group in the study. These scores provide valuable insights into the effectiveness of the surgical technique and its impact on patient-reported knee function and symptoms.

CONCLUSION

The study included a total of 60 patients meeting the inclusion criteria, with no significant difference in mean age between the transportal and transtibial groups. The majority of patients were male, and there was an equal distribution of left and right-sided injuries across both groups. Road traffic accidents (RTAs) were the most common cause of injury, with 70% in the transportal group and 50% in the transtibial group. Pre-operative symptoms such as swelling, giving away sensation, and difficulty in squatting were prevalent in over 80% of patients in both groups. The pivot shift test showed no significant difference between the groups.

However, significant differences were observed in post-operative functional outcomes. Patients in the transportal group demonstrated higher mean Lysholm and IKDC scores at post-operative 1 month and 3 months compared to the transtibial group. Additionally, a higher percentage of patients in the transportal group reported no difficulty in sitting post-operatively. Complication rates were comparable between the two techniques, with 20% in the transportal group and 16.7% in the transtibial group experiencing complications.

To conclude, the study findings suggest that the transportal technique may offer superior post-operative functional outcomes compared to the transtibial technique, as evidenced by higher Lysholm and IKDC scores and a greater percentage of patients reporting excellent results. However, complication rates were similar between the groups.

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