RESULTS OF ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION USING THE ALL-INSIDE TECHNIQUE AT PHO NOI HOSPITAL: A RETROSPECTIVE STUDY

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Abstract

Objectives: To evaluate clinical and functional outcomes of anatomic anterior cruciate ligament (ACL) reconstruction using the all-inside technique. ***Methods:*** A retrospective study on 30 patients who underwent primary anatomic ACL reconstruction using the all-inside technique from January 2019 to January 2022 at Pho Noi Hospital, Hung Yen. The Lysholm score and International Knee Documentation Committee (IKDC) score were used to evaluate outcomes before surgery, at 6 months, and ≥ 12 months postoperatively. ***Results:*** Among 30 patients who underwent all-inside ACL reconstruction, the mean follow-up time was 26.5 months (13 - 50 months), the mean age was 32.43 ± 10.6, and the mean duration between the injury and surgery was 9.4 months. The mean graft diameter was 7.8 ± 0.5mm (6.5 - 9mm), the mean femoral tunnel length was 28.8 ± 1.7mm (25 - 35mm), and the mean tibial tunnel length was 30.5 ± 2.1mm (30 - 35mm). Functional outcomes: Preoperatively, the IKDC score was 55.2 ± 0.5, and the Lysholm score was 61.1 ± 4.5. At 6 months postoperatively, symptoms improved; at over 12 months postoperatively, the IKDC score was 91.5 ± 2.5. The rate of normal and nearly normal grades was 96.7% and the Lysholm score was 94.1 ± 2.5. The rate of excellent and good grades was 100%. ***Conclusion:*** The ACL reconstruction using the all-inside technique provides good functional outcomes and anteroposterior knee stability at short-term follow-up.

Keywords: Anterior cruciate ligament; Reconstruction; All-inside technique; Single bundle; Clinical outcome.

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INTRODUCTION

Anterior cruciate ligament tear is a detrimental event for every patient, and appropriate management is important to ensure patients return to pre-injury activity and to prevent long-term complications due to the knee injury. Surgical management of the ACL tear appears to be the answer for patients who wish to restore their pre-injury activity level. The all-inside technique is one of the surgical techniques that has many advantages in ACL reconstruction. An all-inside technique of anterior cruciate ligament reconstruction is defined as creating the bone socket from the articular side of the tibia rather than conventional full-length tunneling through the knee joint and outer cortex [1] (*Figure 1*). Following the evolution of the technique, the suspensory cortical button is mainly utilized as a graft fixation method. The advantages of combining the all-inside technique and suspensory graft fixation include biomechanically higher graft durability, greater preservation of flexion strength, and less bone tunnel widening in long-term follow-up [2, 3]. The purpose of this study is: *To evaluate clinical and functional outcomes of anatomic ACL reconstruction using the all-inside technique*.

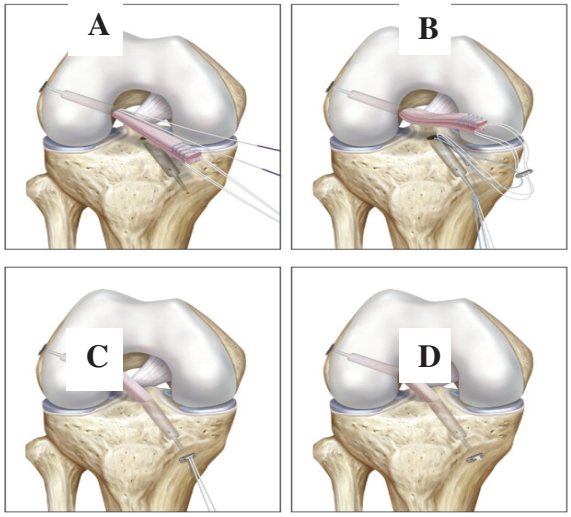

Figure 1. The all-inside technique of ACL reconstruction: In all 4 illustrations, the lateral femoral cortical suspensory button is flipped.

A. The tibial side of the graft loop is shown to be linked to ACL TR-RT;

B. Tibial ACL TR-RT passing sutures and pull sutures are passed into the tibial socket;

C. Emerging from the proximal AM tibial metaphysis (bottom right) is the ACL TR-RT pull sutures (white);

D. The tibial ACL TR-RT pull sutures have been tied and cut [1].

MATERIALS AND METHODS

1. Subjects

30 patients who underwent primary anatomical ACL reconstruction using the all-inside technique from January 2019 to January 2022 at Pho Noi Hospital, Hung Yen.

* *Inclusion criteria:* Single-bundle (SB) ACL reconstruction using the all-inside technique, age 16 - 60, minimum of 6 months of clinical follow-up, full medical records, pre-operation X-ray, and MRI.

* *Exclusion criteria*: Revision cases, multiple ligament injuries.

2. Methods

* *Research design:* A retrospective study.

* *Sample size*: A convenient sample size.

* *Research methodology:* All patients had their medical histories recorded, and were given a clinical examination and laboratory tests in accordance with the guidelines. The patient variables included sex, age. The operative variables included meniscus lesion, graft diameter, femoral tunnel length, tibial tunnel length.

All categorical variables are reported as frequency and percentage.

* *Outcome assessment:* Functional outcome measures, including the Lysholm score with 4 grades (excellent: 91 - 100 points; good: 84 - 90 points; fair: 54 - 83 points; unsatisfactory: ≤ 64). The IKDC score with 4 grades (A: Normal; B: Nearly normal; C: Abnormal; D: Severely normal) according to the criteria: Knee joint effusion, passive range of motion limitation, knee joint examination (Lachman's test and Pivot shift's Test), physical examination of the compartments, knee joint degeneration, single leg hop test. All criteria were used to evaluate outcomes before surgery, at 6 months, and ≥ 12 months postoperatively [4, 5].

* *Statistical analysis:* The software Microsoft Excel and SPSS 20.0 were used.

3. Ethics

Ethical approval was obtained from the institutional review board of Pho Noi Hospital, Hung Yen, Viet Nam. Informed consent was obtained from the patients included in the study. All procedures in this study were performed following the ethical standards of the 1964 Helsinki Declaration and its later amends or comparable ethical standards. The authors declare to have no conflicts of interest.

RESULTS

For all 30 patients who underwent all-inside ACL reconstruction, we achieved follow-up on all 30 patients at a minimum of 6 months. The mean follow-up time was 26.5 months (13 - 50 months). There were 20 males (66.7%) and 10 females (33.3%) with a mean age of 32.43 ± 10.6 (19 - 52 years). In 21 of 30 (70%) patients, ACL injury occurred during sports, the mean duration between the injury and surgery was 9.4 months (2 weeks - 8 years). 14 of 30 patients (46.67%) were without additional meniscal tears. The mean graft diameter was 7.8 ± 0.5mm (6.5 - 9mm). The mean femoral tunnel length was 28.8 ± 1.7mm (25 - 35mm), and the mean tibial tunnel length was 30.5 ± 2.1mm (30 - 35mm) (*Table 1*).

Table 1. Demographic characteristics.

Variables	Quantity (n)	Percentage (%)
No. of patients	30	
Follow-up	26.5 months (13 - 50 months)	
Sex		
Male	20	66.7
Female	10	33.3
Age (years)	32.43 ± 10.6	
Meniscus lesion		
Lateral	7	23.33
Medial	6	20
Lateral and medial meniscus	3	10
No meniscus injury	14	46.67
Graft diameter	7.8 ± 0.5 (6.5 - 9mm)	
Femoral tunnel length	28.8 ± 1.7mm (25 - 35mm)	
Tibial tunnel length	30.5 ± 2.1mm (30 - 35mm)	

A significant improvement of symptoms, pain, daily function, and sports activity level, assessment based on IKDC and Lysholm scores. The IKDC score

preoperatively was 55.2 ± 0.5, and the Lysholm score was 61.1 ± 4.5. At 6 months postoperatively, the symptoms improved; at over 12 months postoperatively, the IKDC score was 91.5 ± 2.5 and the Lysholm score was 94.1 ± 2.5 (*Table 2*).

Table 2. Clinical outcomes change over time.

Follow-up	IKDC	Lysholm
Preoperation	55.2 ± 0.5	61.1 ± 4.5
6 months	84.1 ± 2.1	88.1 ± 2.5
≥ 12 months	91.5 ± 2.5	94.1 ± 2.5

A B

Figure 2. 3 years postoperatively, the range of motion of the knee joint, including the knee flexion at 135° (A) and the knee extension at 0° (B).

Table 3. Lysholm score (n = 30).

Lysholm score	Pre-operation (%)	Post-operation (%)	
		6 months	≥ 12 months
Excellent	0	60	70
Good	0	36.7	30
Fair	76.7	3.3	0
Unsatisfactory	23.3	0	0

At 6 months postoperatively, the rate of excellent was 60%, at over 12 months it was 70%; good at 6 months was 36.7%, and at over 12 months was 30%.

Table 4. IKDC score (n = 30).

IKDC score	Pre-operation (%)	Post-operation (%)	
		6 months	≥ 12 months
A	0	66.7	73.3
B	0	30	23.4
C	30	3.3	3.3
D	70	0	0

According to the IKDC, there was improvement in knee function both before and after surgery. At over 12 months, the normal level was 73.3%, and nearly normal was 23.4%

DISCUSSION

The study found that primary anatomic ACL reconstruction using the all-inside technique provides good functional outcomes and anteroposterior knee stability at short-term follow-up. This study demonstrates an improvement in IKDC and Lysholm scores preoperatively compared to postoperatively (*Table 2*). The all-inside ACL reconstruction technique has been used in clinical practice for several years, and many studies have addressed the clinical outcome of this technique in the

literature. Genc (2023) [6] assessed over 20 athletes in various sports who underwent anterior cruciate ligament reconstruction using the all-inside technique. The patients were evaluated preoperatively and 6 months postoperatively. The preoperative IKDC score was 50.15 ± 8.8 and the Lysholm score was 72.5 ± 8.13. After 6 months, there was a significant improvement in the IKDC score (91.25 ± 6.23), and the Lysholm score postoperatively at 98.2 ± 2.66 with $p < 0.05$. Lubowitz (2013) [7] compared the clinical outcomes of the all-inside technique and the full tibial tunnel technique. The author found a difference in IKDC scores between baseline (47.4 ± 15) and over 12 months follow-up (86.5 ± 11.6) for the all-inside group, which is comparable with the findings of this study, with 55.2 ± 0.5 and 91.5 ± 2.5, respectively.

According to the IKDC assessment (*Table 4*), preoperatively, 9 of 30 patients (30%) were at level C, and 21 of 30 patients (70%) were at level D. After 6 months, there were 1 of 30 patients (3.3%) at level C, 8 of 30 patients (66.7%) at level A, and 9 of 30 patients (30%) at level B. According to the Lysholm scoring system (*Table 3),* preoperatively, all patients were at fair and unsatisfactory levels (76.7% and 23.3%, respectively). After 6 months post-surgery, patients reached excellent and good levels (60% and 36.7%, respectively). There was a significant improvement in knee function pre and postoperatively at 6 months, which is consistent with other studies [8]. In another study, Mohsen Hussen (2012) [9] retrospectively investigated the outcomes of anterior cruciate ligament reconstruction with the SB and double-bundle (DB) techniques; the mean Lysholm score was 93.9 ± 4.3 in the DB group and 93.5 ± 3.3 in the SB group at a mean of 30 months of follow-up, which is identical to the findings of this study 94.1 ± 2.5 at over 12 months of follow-up. The subjective IKDC score was 93.3 ± 5.9 in the DB group and 93.1 ± 5.2 in the SB group, which is found to be comparable to the results of the current study of 91.5 ± 2.5.

Surgical outcomes depend on factors such as graft diameter, femoral tunnel position, and tibial tunnel position. In the study by Do Quoc Cuong (2022) [10], it was found that graft size influenced knee joint function according to Lysholm scores. Snaebjörnsson (2017) [11] observed that increasing the graft diameter by approximately 7 - 10mm reduced the likelihood of reoperation by less than 0.86 times for

each 0.5mm increase. The positions of the femoral and tibial tunnels also impact postoperative knee function. Determining the correct tunnel positions, synonymous with accurately restoring the original position and orientation of the ligament, is crucial for successful reconstruction.

Limitations: More long-term studies are needed to assess the durability and long-term impacts of surgical intervention on patient's functional outcomes comprehensively.

CONCLUSION

The ACL reconstruction using the all-inside technique provides good functional outcomes and anteroposterior knee stability at short-term follow-up.

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