

ACL Deficient Knee with High Grade Pivoting: A Comparative Study of Combined Anterior Cruciate Ligament with Antero Lateral Ligament versus Isolated ACL Reconstruction

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Abstract

Introduction: Among orthopaedic injuries, ACL injuries are found to be the commonly seen. Compared with nonoperative treatment, patients undergoing reconstruction of ACL were associated with improved knee functions and related symptoms. This study intends to compare the clinical efficacy of combined reconstruction of ACL with Antero lateral Ligament versus Isolated reconstruction of ACL.

Objective: To compare the functional outcome of combined reconstruction of ACL with Antero lateral ligament to isolated reconstruction of ACL in knee.

Material and Methods: There were 62 patients selected for the study of which 31 patients (Group A) were managed by Combined ACL with Antero lateral Ligament reconstruction and 31 patients (Group B) with isolated reconstruction of ACL and were followed up.

Result: In this study the preoperative IKDC score was 41.83 ± 9.28 and 37.72 ± 7.54 for ACL group and Combined ACL with Antero lateral ligament groups, respectively. The post-operative IKDC score of patients in ACL group was 87.78 ± 2.65 while the post-operative IKDC score of those patients in Combined ACL with ALL group was 94.29 ± 2.58 ($P < 0.001$).

Conclusion: This study demonstrates improvement in functional outcome following combined ACL along with Antero lateral ligament reconstruction when compared with isolated reconstruction of ACL.

Keywords: Anterior cruciate ligament, ACL Reconstruction, Antero lateral Ligament Reconstruction.

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Introduction

Anterior and posterior cruciate ligaments are very dense and sturdy fibrous bands of the knee joint. These ligaments acts as direct

bonds for the union between structures above and below knee joint a thus helping in maintaining the stability of knee joint.

Arising from the anterior portion of tibia specifically in the intercondylar area the ACL goes upwards, runs backwards then laterally gets attached at the posterior portion of lateral condyle of femoral on the medial surface. Extension at knee joint will make the ligament stretched. [1]

ACL injuries are common following sports and trauma thus have been studied extensively. [2] The ACL acts as a major passive restrictor for the translation of tibia over femur anteriorly. Patients after an ACL injury presents with instability to the knee joint for which reconstruction of ACL is the current gold standard operative and surgical technique. [3] Many studies have documented residual rotational instability after ACL reconstruction and its been estimated in more than 25% of those patients.

A potential cause for this rotational instability was found to be due to injury of Antero Lateral Ligament (ALL) of the knee. [4] Few authors have stated a large number of supremacy of combined ACL along with Antero lateral ligament (ALL) reconstruction technique recently. Load sharing of ALL graft with that of ACL graft have been

attributed to these advantages. [5] Recently the antero lateral ligament has been found to behave as a stabilizer of knee laterally that helps in improvement of rotational instability. [2] The main role of this ligament is that it prevents the instability (rotational) of the knee in between 30° to 90° flexion. ALL ligament tear were found to show High Grade in Pivot shift test [6]. Reconstructive procedure of the ACL along with Antero lateral Ligament thus could be a way to improve the stability of the knee joint [7]. ACL injuries, chiefly when associated with accompanying meniscal injury or any other surrounding ligamentous injuries, makes the patient's knee joint susceptible to an increased threat of osteoarthritis in the future. [8,9]

Materials and Methods

A total number of 62 patients were included of which 31 (Group A) were managed by Combined ACL with Antero lateral Ligament Reconstruction and 31 (Group B) with isolated reconstruction Anterior Cruciate Ligament. An average period of 18 months was taken for follow up.

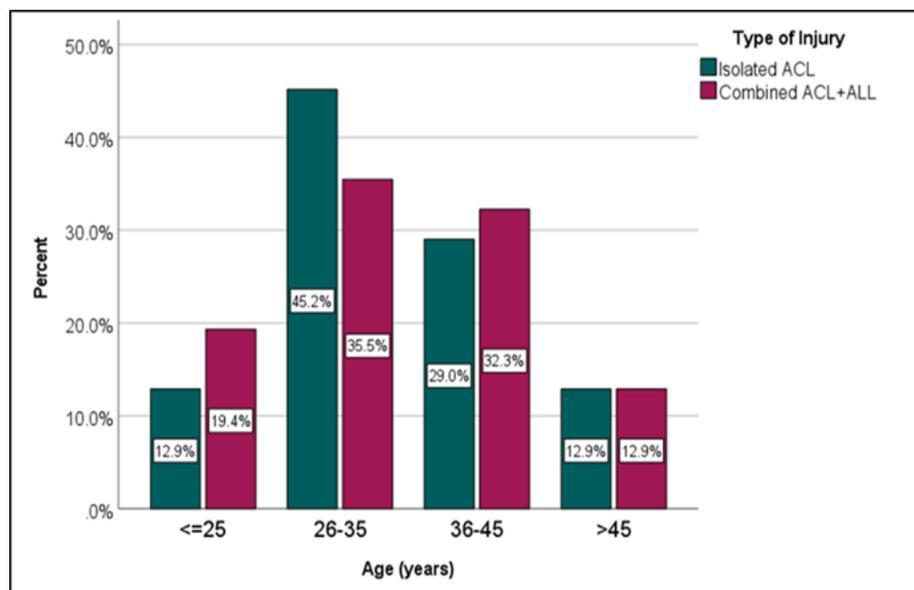


Figure 1: Age distribution as per type of injury

Table 1: Age distribution as per type of injury

Age (Years)	Type of Injury		Total	Chi-Square, p-value
	Isolated ACL	Combined ACL + ALL		
<=25	4(12.9%)	6(19.4%)	10(16.1%)	0.813, 0.846
26-35	14(45.2%)	11(35.5%)	25(40.3%)	
36-45	9(29.0%)	10(32.3%)	19(30.6%)	
>45	4(12.9%)	4(12.9%)	8(12.9%)	
Total	31(100%)	31(100%)	62(100%)	
Mean Age±SD	34.77±9.75	33.77±8.71	34.27±9.18	

Table 2: Sex distribution as per injury type

Age (Years)	Type of Injury		Total	Chi-Square, p-value
	Isolated ACL	Combined ACL + ALL		
Male	28 (90.3%)	26(83.9%)	54(87.1%)	0.574, 0.449
Female	3(9.7%)	5(16.1%)	8(12.9%)	
Total	31(100%)	31(100%)	62(100%)	

After general physical examination, ligamentous excursions were ruled out by examining the uninjured knee first after which knee that is affected was evaluated. Anterior Drawer, Lachman's and Pivot Shift Tests were done and documented. Associated structures in the knee were also examined with Valgus/Varus stress test, McMurray's test/ Apley grinding test and Posterior drawer test.

Following criteria's were considered for including patients into the study such as patients aged less than 60 and having high grade pivot shift test of the injured knee, No previous knee surgeries and no bony lesions. Patients with associated multiligamentous injury and having other organ injuries were excluded.

Pre-operative range of movements and strength were measured and documented.

**Figure 2: Pre-op ROM and Pivot shift test done after spinal anaesthesia**

Surgical procedure:

ACL Reconstruction Technique: Standard two portal arthroscopy was done and ACL tear was visualized in diagnostic arthroscopy. We chose quadruple bundled hamstring graft and graft preparation was done with non

absorbable suture. Two tunnels were used for ACL reconstruction, one for tibial and one femoral. The centers of these two tunnels correspond to the native sites of tibial and femoral attachments at the center respectively. The antero medial portal was used to make the femoral tunnel thereby

producing an anatomic tunnel position in the femur. Interference screw used to fix the

prepared graft over tibia and at the femur fixed using endobutton

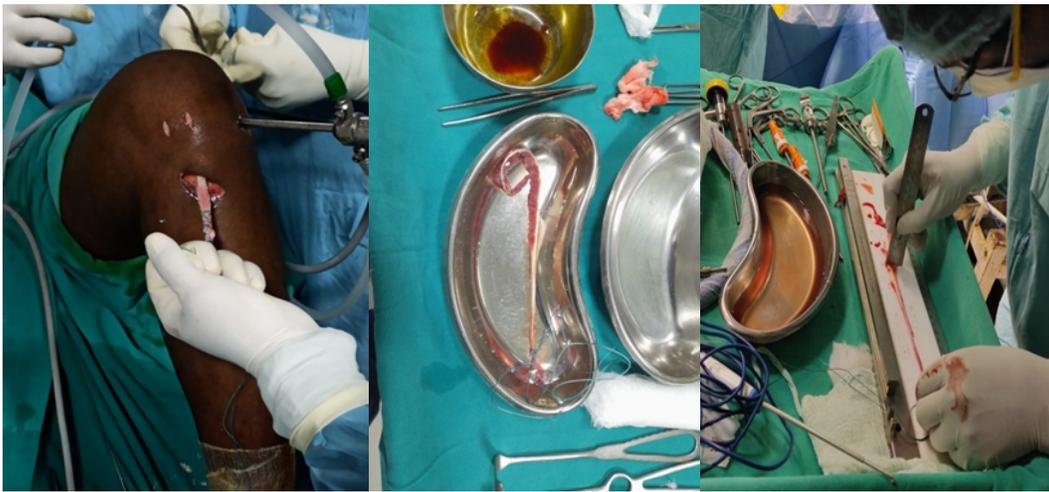


Figure 3: Hamstring Graft Harvest and Graft Preparation

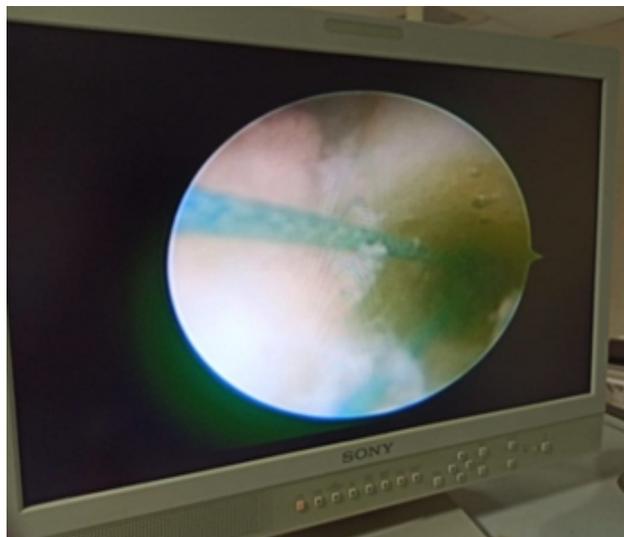


Figure 4: Femoral Tunnel prepared with cannulated drill bit

All Reconstruction Technique: Skin marking of the fibular head, Gerdy's tubercle on lateral aspect of tibia and the femoral lateral epicondyle done.

A lateral skin incision - hockey stick shaped incision is made for ALL reconstruction over the skin along ITB and the incision was distally extended after identifying the head of

fibula and Gerdy's tubercle. A long needle (spinal) can be taken for identifying the joint.

The ALL attachment at tibial site is then identified, which is equidistant between the centers of Gerdy's tubercle on tibia and fibular head – anterior margin, about 9.5 mm distally from the joint line.

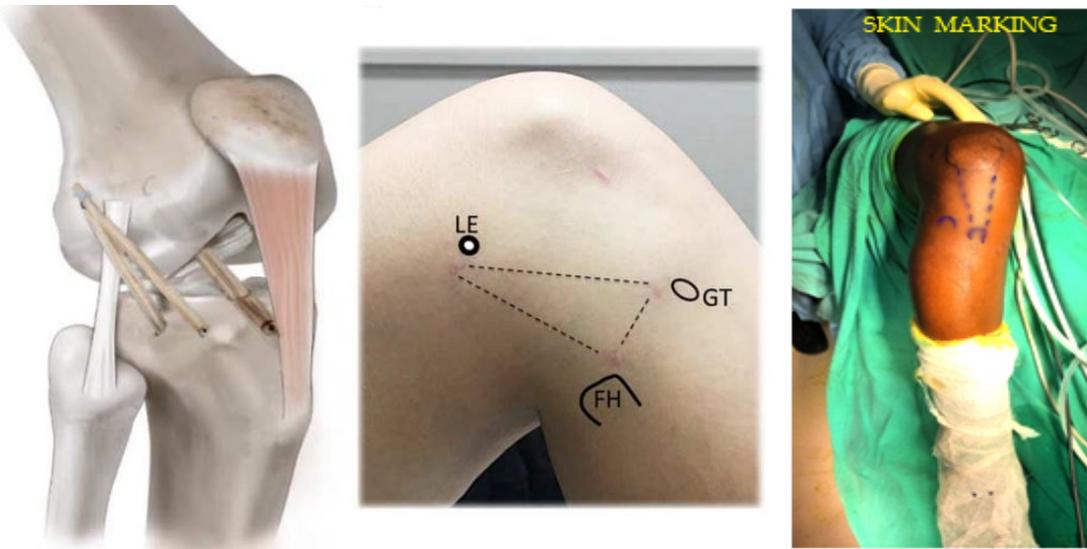


Figure 5: Fibular head, Gerdy's Tubercle on tibia, and the femoral lateral

Epicondyle marked for Incision

A 30 mm socket is prepared in distal anatomic insertion site of ALL with appropriate size reamer based on graft diameter. For passing the graft beneath IT band a soft tissue path is generated in outermost layer of the band taking care that graft comes out a bit posterior to attachment of proximal lateral collateral ligament. This site has been described 4.7 mm proximally and posteriorly to the insertion of FCL on femur. A tunnel is then made with appropriate diameter reamer, taking a depth upto 30 mm taking care to avoid the trochlea and also possible collision through ACL tunnel.

The graft was then fixed distally in tibia with the help of an Interference screw. The Graft is allowed to pass between outermost layer of the ITB and Lateral collateral ligament. With the help of passing sutures which was previously placed, it is then passed into

femoral tunnel and secured in 30 degrees of knee flexion.

Knee is finally assessed for full ROM once fixation is complete, and the rotational stability is finally tested by performing pivot-shift test in order to compare with preoperative state.

Post-operative management:

Immobilization using a knee brace and limb is elevated with pillow in the early post-operative period. IV antibiotics were given 3 days postoperatively. Serial inspection of wound was done on 2nd & 7th post-operative days. Sutures were taken out on 14th day post-operatively.

Evaluation: Post-operative AP and lateral radiographs were done for all patients to confirm the placement of tunnel and the correct placement of endobutton and interference screw. Patients followed regularly and assessed the functional outcomes.



Figure 6: 2 weeks follow-up x-ray and clinical images of patient managed by isolated

ACL reconstruction.



Figure 7: 2 weeks postop follow-up clinical images and x-ray managed by

Combined ACL+ ALL.

The IKDC 2000 score was used for the evaluation of all the patients.

The IKDC score was calculated by adding all the scores for the individual score and then converting those scores to a value that is ranging between 0 - 100.

The scores are interpreted in a way that higher the score represents higher the levels of activity and functions and lower the level of any symptoms.

Results

The Functional outcome of Combined ACL with Antero lateral Ligament Reconstruction is better than that of Isolated reconstruction of ACL.

The preoperative IKDC score was 41.83 ± 9.28 and 37.72 ± 7.54 for Isolated ACL group and combined ACL with Antero lateral ligament group, respectively. The post-operative IKDC score for those in Isolated ACL group was 87.78 ± 2.65 while the post-operative IKDC score for patients in combined ACL with Antero lateral ligament group was 94.29 ± 2.58 ($P < 0.001$).

Table 3: Between groups and Pre-post op Comparisons (IKDC Scores)

Pre/Post	Isolated ACL	Combined ACL+ ALL	Mean Diff	t-value	p- value*
Pre	41.83 ± 9.28	37.72 ± 7.54	4.1097	1.913	0.061
Post	87.78 ± 2.65	94.29 ± 2.58	-6.5161	-9.803	<0.001
Mean Diff	45.9516	56.57742			
t- value	28.771	41.34814			
p- value	<0.001	<0.001			

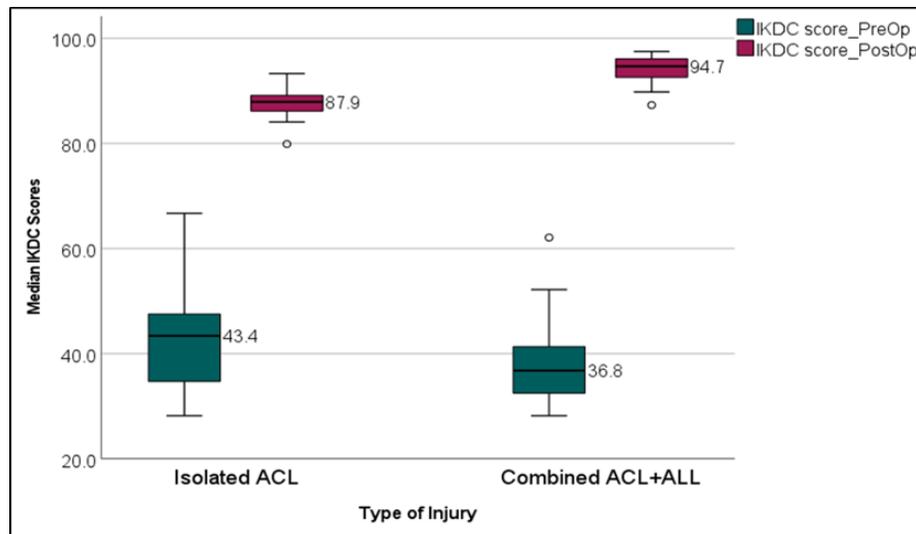


Figure 8: Between group and Pre-post Comparisons

Discussion

The aim of operative reconstruction of the ACL and ALL is to restore normal joint movements and kinematics, thereby abolishing the rotational instability of knee and the potential for associated harm to the menisci and articular surfaces.

A combined procedure is considered a useful option for patients with a high-grade rotational instability to the knee joint. The main finding from our study is improvement in rotational stability of ACL with Antero lateral ligament group when compared with Isolated ACL reconstruction group. The erstwhile alternative procedures for improving rotational stability i.e Lemaire extra-articular procedure and Macintosh procedure are not done nowadays due to the need for harvesting IT band which is also a lateral knee stabilizer. Immobilization in extension for a longer duration was also a drawback with these procedures Whereas combined ACL +ALL reconstruction avoids IT band harvest and also anatomical based. Rehabilitation is also standard like ACLR thus avoiding long duration of immobilization in extension. The foremost study included 92 patients managed by combined ACL with Antero lateral ligament

reconstruction published by Sonnery-Cottet *et al.* in 2015. A mean follow-up time of 32 ± 4 months showed subjective IKDC scores as significantly high ($P < 0.0001$); IKDC subjective score was found as $86.7 \pm 12.3.1$, whereas in our study we found that the preoperative IKDC score was 41.83 ± 9.28 for the Isolated ACL group and 37.72 ± 7.54 for Combined ACL+ALL groups, respectively. The post-operative IKDC score for patients in Isolated ACL group was 87.78 ± 2.65 while the post-operative IKDC score in the Combined ACL with Antero lateral ligament group was 94.29 ± 2.58 ($P < 0.001$).

Although none of the subjects in our study were professional athletes high grade pivot shift test was present in all of the participants. Return to pre-injury work status was significantly high in ACL+ALL group as evidenced by better IKDC score compared to Isolated ACL group. Since our study has limited number of participants and all of them are non-professional athletes, comparability is the main limitation. Higher Graft rupture rates and consequent re-operation rate is a known complication in ACLR done on High grade Pivot shift knee and our study is limited

to measurement of functional outcome by IKDC scoring which is a limitation.

Conclusion

ACL reconstruction performed in concert with Antero lateral ligament reconstruction allows to regain stable knee functions and thus prevent damage to the menisci and future predisposition of knee osteoarthritis.

This study demonstrates improvement in functional outcome after combined ACL with Antero lateral ligament reconstruction when compared with isolated ACL reconstruction.

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