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Arthroscopic ACL reconstruction with extra-articular anterolateral augmentation

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ABSTRACT

Background: many techniques developed to overcome internal rotation instability associated with some cases of ACL injury , like changing techniques of tunneling from transtibial to more anatomical techniques, then double bundle reconstruction, recently the concept of adding the anterolateral reconstruction has been developed .

Purpose: to evaluate the knee functional outcome following combined ACL and ALL reconstruction using central strip of the iliotibial band for ALL reconstruction.

Study Design**:** case series

Methods: From October 2020 to July 2021, 30 patients with ACL tear associated with high grade pivoting underwent combined ACL and ALL reconstruction. Hamstring graft was used for the ACL that was fixed by adjustable loop on the femoral side and biodegradable interference screw on the tibial side and iliotibial band slip used for the ALL reconstruction. The follow up on regular basis for one year postoperative for the last case.

Results: the IKDC objective score was markedly improved from D in all case prop. to A to B with special concern to (Lachman test, anterior drawer test and the pivot shift test), IKDC subjective form mean score improved from 27.5 pre op. to 85 ,the lyshlom score pre operative was poor for all cases that improved to excellent to good.

Conclusion: It was found that this technique provide good reasonable solution for the internal rotation instability that is found in those patients with high grade pivot shift , with simple technique , easy learning curve, short time, good functional results

Keywords: *ACL reconstruction, anteroaletral ligament ,augmentation, pivot shift, rotational instability*

INTRODUCTION

Although the progress in the intra articular reconstruction of the ACL it was found that 20 to 30 % of patients still having internal rotation instability after the isolated ACL reconstruction .this leads to several problems like the meniscus and cartilage damage and degeneration .also difficulty in the sports that require pivoting and cutting activities and even re rupture(1) .

Many trials were done to overcome this persistent rotational instability like changing the tunnel drilling technique from the trans-tibial drilling that gives vertical graft so can't control the rotation to drilling through the antero-medial (AAM) portal for more anatomic femoral tunnel placement but still 20 % of patient complaints some degree of rotational instability(2)

This led to development of the double bundle ACL reconstruction. Series of patients that were operated by this technique was published for the 1st time by Muneta(3) .

But the operative techniques is complex and technically demanding and its degree of significance is still not clear(4, 5).

Dodds et al. in their study on 40 fresh-frozen cadaveric knees. They found that The ALL femoral attachment nearly 8 mm proximal and 4.3 mm posterior to the most prominent point of the lateral femoral epicondyle while its attachment on the tibia lies between the Gerdy's tubercle and the fibular head (6, 7).

Also many studies supported Dodds description (8). Marcacci used one of the strands of the hamstring graft to ALL reconstruction and triple stranded graft for the ACL reconstruction (9).

Aim of study

To evaluate the functional outcome of doing combined ACL reconstruction by hamstring autologous graft and ALL reconstruction using central slip of the iliotibial band

METHODS

Our study is case series

30 patients were operated from October 2020 to June 2021. Follow up on regular basis was done for one year postoperatively for the last case.

Patients were selected from the emergency department and the outpatient clinic according to the following inclusion and exclusion criteria after informed consent for each patient.

Inclusion criteria

Patients aged from 19 to 40 years with ACL injury and has one or more of the following criteria

1- athletes of sports with a high level of cutting or pivoting,
2- hyper laxity
3- Patients with grade 3 pivot shift
4-Cases of revision ACL

Exclusion criteria

1. Skeletally immature patients
2. osteoarthritic knee
3. Patients with multiple ligament injury
4. Open injuries

After History taking and proper examination general, Limb examination like the neurovascular status , limb alignment Routine knee examination (gait , inspection, palpation, range of movement and the special test with special concern to the special test of the ACL like lachman, anterior drawer and pivot shift.

Radiological assessment: Routine plain x ray A/P and lateral views, MRI which is the gold standard for diagnosis

Method of Evaluation

Data were recorded and demonstrated and evaluation was done according to the International Knee Documentation Committee objective and subjective form and the lysholm scoring systems

Surgical procedure

After Anesthesia, examination under anesthesia: pivot shift testing and its degree checked again and compared with the opposite side then routine Diagnostic arthroscopy to confirm the diagnosis before harvesting the graft (hamstring graft used for the ACL in the form of gracilis and semitendinosus tendons), the diameter of the graft was at least 8 mm in all cases , management of associated meniscus injuries by either meniscal suture or menisectomy .

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Preparing Femoral and tibial tunnel for ACl: The knee was then hyper flexed to 120°, 2.4 mm drill tip guide wire passed. Cannulated 4.5 mm drill bit was passed through the femur guided by the pin till breaching the lateral cortex, Then final drilling of the femoral tunnel, a drill bit of same graft diameter was used to make 20 to 30 mm deep tunnel according to tunnel length without breaking the lateral cortex. The tibial tunnel was carried out by the classic way using the ACL tip aimer that was positioned at 55°. then ACL Graft passage and Fixation, fixation of the grafts was done using adjustable end button for the femoral side and interference screw for the tibial side .

ALL reconstruction

iliotibial band graft harvest

Skin incision extends between gerdy's tubercle and point 6 cm proximal extending along the junction middle and posterior third of the ITB. Iliotibial band was exposed from the Gerdy's tubercle to approximately 10 cm proximally. We clearly palpate and identify The posterior edge of the ITB , then two incision lines are made 1st is the posterior line that is incised in the ITB leaving the posterior 1cm of the ITB intact to avoid interrupting the intermuscular septum attachment (fig .1). The 2nd incision is more anterior in the ITB with about 1cm. So strip of ITB which is 1 cm width and 10 cm in length freed from proximal but kept attached to the Gerdy's tubercle Fig.(2).

FIG 1: The 1st incision is the posterior line that is incised in the ITB leaving the posterior 1cm of the ITB intact

FIG 2: A strip of ITB 1 cm width and 10 cm in length freed from proximal but kept attached to the Gerdy's tubercle.

Routing the graft under LCL

Next we identify the lateral collateral ligament so we could pass the ITB graft to be routed under it. The site of fixation was cleared using sharp dissection or electro cautery but care should be given to avoid disruption of the end button used to fix the intra articular graft as it lies near this area .

Fixation of the graft proximally

Tunnel created at a point which is just proximal and posterior to the lateral femoral epicondyle with its direction from distal posterior to anterior and proximal (fig.3) , by this direction disruption of the previously placed intra-articular graft tunnel can be avoided .Then the ITB strip is fixed with interference screw . the foot/tibia should be kept in neutral rotation at the time of fixation and tensioning of the graft with the knee flexed 30degree (fig. 4).

FIG 3: With the knee in flexion. 30 degree, 2.4-mm guide wire is placed posterior and proximal to the lateral femoral epicondyle (LFEC) then drills over it about 30 mm for the screw placement.

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FIG 4: Fixation of the iliotibial band graft into the bone tunnel with the knee in 30degree flexion

Finally Irrigation of theknee with saline, cautery of any bleeding spots, drain insertion, closure of the wound.

Follow up

The average post-operative hospital stay was two days, Stitches removal at 10 to 14 days post op. Weight bearing from the 1st day as tolerated with aid of axillary crutches and physiotherapy program started from the 1st post-operative day. The sport activities were allowed mostly in the following sequence, running at 3 months postoperatively, while participating in pivoting sports at 6 months.

Follow up intervals were arranged as follow: at 2 weeks, 6weeks, 3 month, 6 months, 9 month, then finally at one year .

RESULTS

Our patient were 21 male, 9 female

18 left sided knee injury while 12 had right knee injury, age ranged from 19 to 34 y with mean age 25.9 years. Operative time ranged from 45-75 minutes with mean 60 ±15

Clinical evaluation of knee ligament injuries Was done according to Lysholm scale(10). The one page IKDC form (11) and International Knee Documentation Committee Subjective Knee (12).

According to IKDC objective assessment marked improvement in all the items as regard Ligament examination (Lachman test, Anterior drawer test and The pivot shift test), range of movement, Effusion and Single leg hop test.as the Final IKDC Objective score pre-operative was grade D for all the cases that markedly improved to A in 24 cases 80% and grade B in 6 patients 20% (Table1) .The final IKDC subjective score also improved from mean 27.9 preoperative to mean 83.3 at the end of follow up (Table2). Pre-operative lyshlom score was in the range that classified as poor That markedly improved at the end of the follow up where Six patients their score was classified as good score (20%) while twenty four patients (80%) have excellent score figure 5.

TABLE 1: Final IKDC objective score pre-operative and at 1 year follow up.

		Pre	Post	P value
		N=30	N=30	
final objective IKDC	A	0(0%)	24(80%)	<0.001*
	B	0(0%)	6(20%)	
	C	0(0%)	0(0%)	
	D	30(100%)	0(0%)	

TABLE 2: Pre and post-operative final subjective IKDC score.

		Pre	Post	P value
		N=30	N=30	
Total subjective IKDC	Median IQR	27.5 (25-30.3)	85 (82.5-86)	<0.001*

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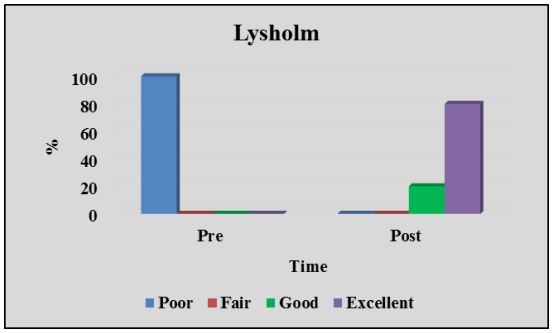

FIG 5: Lyshlom scoring of the patient's pre-operative and one year post-operative

We got very good improvement as regard the pivot shift as all the patients was graded D pre-operative that become A at the end of follow up(Fig.6):

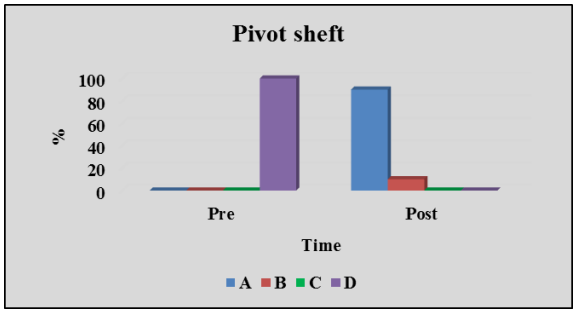

FIG 6: pivot shift before surgery and at 1 year follow up among the study sample.

Complications

Four of our patient had harvest site pain that was mainly in the form of some anterior knee numbness just

Assurance for the patients was done. This complains started to regress till six month post-operative the symptoms were insignificant.

One patient had mild discharge from the graft site. Culture sensitivity test was don, broad spectrum antibiotic given, patient got complete cure.

Two of our cases complained of painful knee swelling in the first follow up visit. They were managed by rest and ice therapy at home and limitation of the range of movement exercises until swelling resolved.

Three of our cases got some limitation of their range of movement that required extending the physiotherapy course.

Two patients complained of pain at femoral tunnel of reconstructed ALL, this may be due to formation of bursa over the screw. NSAIDS given oral and topical. They are improved at about three month of follow up.

DISCUSSION

Some techniques were described for the ALL reconstruction, from these techniques using strip of the iliotibial band as a graft (13).

In this study arthroscopic ACL reconstruction using hamstring graft for the ACL accompanied with extra articular ALL reconstruction using strip of the iliotibial band was done for the patients .

A simple technique for achieving the ALL reconstruction by using a strip of the iliotibial band was chosen to be the technique of the study. This method has the advantage of being simple, short time surgery, need fixation only on the femur side, easy learning curve

marked improvement in the IKDC objective and subjective scores and the Lyshlome scores was achieved which indicates improvement in the knee stability and function. with marked improvement in the pivot shift

That matches with the literature that shows the roll of ALL in internal rotation stability, thus it's now believed that the ALL injury is the cause of the rotational instability and the gross pivoting in a group of the ACL injured patients thus preventing the knee from restoring its normal biomechanics if isolated ACL reconstruction was done for these patients. It's also approved that the segond's fracture is a bony avulsion of the ALL(14) .

It's well approved that isolated ACL reconstruction for these patients does not give sufficient rotational stability of the knee and has high rate of cartilage and meniscus damage and even re-rupture rate(15, 16) .

Accurate Placement of the femoral attachment of the ALL graft is important to obtain appropriate isometry. Femoral attachment is debatable.

According to Kittl et al.(17) Isometric femoral insertion should be proximal to the lateral epicondyle.

Kennedy et al in there study approved that the femoral attachment of the ALL should be in the isometric point just proximal and posterior to the lateral femoral epicondyle(18) .

So in this study a point which is proximal and posterior to the epicondyle was used for femoral fixation.

In a study that was done by Sonnery-Cottet et al.(19, 20) where they carried out their study on 92 patients with follow-up 2 years . Where hamstring graft used for the ALL reconstruction, in those patients with grade 3 pivot shift, they reported Good to excellent improvement in the pivot shift

Mark Porter et al. (21) in a study that was done at Barton Hospital, Australia in 2020 they evaluated the pivot shift intraoperative after doing the ACL reconstruction then modified iliotibial band tenodesis was done for those with a residual pivot shift. It was found that adding MITBT reduced the risk of recurrent ACL ruptures in these patients.

CONCLUSION

So from the previous results of our study and the previously described studies we find that the anterolateral reconstruction using iliotibial band strip accompanying the intraarticular arthroscopic ACL reconstruction provide a good reasonable solution for the rotational instability that is found in those patients with high grade pivot shift , with simple technique with easy learning curve , short time and good functional results.

While the study still has some drawbacks like relatively small sample size, the follow up period not long enough to detect the long term results, also the absence of randomization.

We recommend further studies for this point with longer follow up period to document the long term results, also larger sample size.

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