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RESEARCH ARTICLE

PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF ARTHROSCOPIC ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION WITH PERONEUS LONGUS AUTOGRAFT

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Abstract

Background The present study was designed to analyze the postoperative functional outcome of arthroscopic anterior cruciate ligament (ACL) reconstruction with peroneus longus autograft fixed in femoral tunnel using endobutton and in the tibial tunnel using interference screws.

Methods 39 patients of complete ACL tear underwent **arthroscopic ACL reconstruction using peroneus longus tendon autograft**. It was ensured that graft had a length of at least 7 cm and thickness of at least 8 mm. If either of these requirements were not met, then the graft was supplemented by Hamstring semitendinosus tendon. For functional assessment, international knee documentation committee (IKDC) knee score was taken and clinical tests for antero-posterior stability were done. In addition, the foot and ankle disability index (FADI) scores were used to evaluate the ankle donor site.

Results The average graft diameter was **8.74 mm** and average graft length was **9.12 cm**. There was significant improvement in post op IKDC score when compared with pre op score. There was **no antero-posterior instability** seen in any of the patients during follow up. No patients required an additional graft augmentation. There was **no complaint about weakness of the ankle joint** after surgery.

Conclusions Arthroscopic ACL reconstruction with peroneus longus tendon autograft is an excellent treatment option for ACL deficient knees. It gives excellent functional outcome without any detrimental effect on ankle function with minimal complications.

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Introduction:-

The knee is a modified hinge joint, a type of synovial joint, which is stabilized by various intracapsular and extracapsular ligaments. The ligaments surrounding the knee joint offer stability by limiting movements and, together with the menisci and several bursae, protect the articular capsule. The anterior cruciate ligament (ACL) is critically important as it prevents anterior translation of tibia over femur.

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The primary aim of ACL reconstruction is to restore the function of the ACL and native kinematics of the knee.¹ ACL reconstruction restores the stability of the knee joint and protects the menisci and joint surfaces from further damage, and prevents worsening of existing chondral lesions as well as occurrence of newer lesions. Reconstruction of the ACL may also alter the incidence of osteoarthritis in the longer term.²

Injury to ACL is most commonly linked with valgus, external rotation, hyperextension, deceleration and rotational knee movements. ACL rupture commonly results from non-contact, rotational or deceleration mechanism. The incidence is estimated to be about 32-40 injuries per 100,000 person years or 1 in 1,750 active people.³ ACL injuries are commonly associated with sports injuries and road traffic accidents. Patient will usually report an audible pop followed by pain, swelling and inability to continue further activity.

In the late 1980s, there was a shift from a two incision (rear entry guide) to a single incision (transtibial) technique. Anatomic studies clearly defined the ACL femoral insertion site to be on the lateral intercondylar wall and not on the roof, which is not achieved by traditional transtibial technique.⁴ Recent literatures have focused on the concept of “anatomic” ACL reconstruction^{5, 6} and popularized independent ACL femoral tunnel creation techniques like anteromedial portal (AMP), outside in (OI), retrograde drilling (RD), which result in more anatomically accurate ACL femoral tunnel placement.

ACL reconstruction can be single bundle (SB) - anteromedial or double bundle (DB) both anteromedial and posterolateral reconstruction. Double bundle ACL reconstruction is required only in patients with high athletic demands.

The purpose of this study is to evaluate clinical and functional outcomes of ACL injured knees treated with Arthroscopic ACL reconstruction with peroneus longus tendon autograft at our institute.

Methods:-

After obtaining approval from the institutional research board and informed patient consent, this study was conducted in the department of orthopedics at a tertiary care hospital in Gujarat from January 2023 to March 2024, on a sample size of 39 patients. Patients 18 years of age and above with ACL tear, as confirmed by clinical tests and MRI, were included in this study. Patients with fresh bony ACL avulsion injury, ACL tear associated with any fractures around the knee, revision ACL surgeries, previous knee surgeries, patients of ACL tear suffering from other significant internal derangements of knee except meniscal tears and patients with associated neuro-muscular disorders were excluded. A detailed history was taken, systemic examination was also done and along with routine blood investigations, X-ray knee and MRI scan of knee was done. A detailed physical examination of knee in general and specifically for ACL tear was done including Lachman test, anterior drawer test, and classic pivot shift test.

Diagnostic arthroscopy was performed and any chondral or meniscal procedures are performed at this time. For harvesting of peroneus longus autograft, 2 cm skin incision over the posterior border of the lateral malleolus. A tendon stripper was used to harvest the tendon from the muscular part. This graft was then prepared on the ACL graft master (**Figure 1**). It was ensured that the double/triple graft had a length of at least 7 cm and thickness of at least 8 mm; since studies shows that graft of less than 8 mm is prone to fail.⁷

For preparing the femoral tunnel, any ACL remnant was removed using a shaver while noting the anatomical footprint on the femoral and tibial side for later reconstruction. A small portion of the footprint was left intact to permit proper identification of the ACL origin and insertion. The center of the femoral footprint was marked with a femoral offset with the knee flexed to 90°. This anatomical footprint was used as a guide for making the femoral tunnel. The femoral offset ensures that there is at least 2 mm bony margin between the tunnel wall and the proximal and posterior articular margins. We have used inside-out technique for femoral tunnel drilling. With knee in hyperflexion (>120°), a guide pin is placed through the femoral offset into the previously marked femoral tunnel center. The pin was then advanced through the lateral femoral condyle and out the lateral aspect of thigh. With the knee held in hyperflexion, a 4.5 mm cannulated drill was used to drill over the guide pin and through the lateral cortex. The drill and guide pin are then removed, and the femoral tunnel was measured with a depth guide. The pin was then reinserted through the tunnel, which was then over reamed using an appropriate diameter drill (accordingly to graft thickness) and planned depth (accordingly to the graft length). Drilling was done at least 7 mm further than the planned graft depth to allow room to flip the endobutton.



Figure 1:- Harvesting of PLT.

Tibial tunnel was made through the vertical 3-4 cm incision anteromedially on the tibia starting approximately 4 cm distal to the joint line and 3 cm medial to the tibial tuberosity was made. The tibial guide was set at 55° and placed at the ACL tibial footprint in line with the medial tibial spine roughly at the posterior aspect of the anterior horn of the lateral meniscus and approximately 15 mm anterior to the PCL. The external portion of the guide was seated flushed to the anteromedial tibia at about 1.5 cm medial to the tibial tuberosity and about 1 cm proximally to the pes anserinus. Next a 2.4 mm tibial guide pin was then advanced through the guide until the tip is visible protruding through the tibial footprint. Then a cannulated reamer of the appropriate diameter (accordingly to graft thickness) was advanced over the guide pin.

The graft was then passed through these tunnels and fixed on the femoral side using endobutton and on tibial side by interference screw of appropriate length and thickness. After wound closure, compression bandage dressing was done and long knee extension brace applied.

Patient was allowed knee mobilization exercises the same evening after surgery and was allowed to ambulate with knee brace. Full weight bearing with support was allowed as soon as the patients were comfortable and then discharged. The usual clinical follow-up included review at 10-14 days for wound inspection and suture removal and the brace was removed at 6 weeks. All the patients were put on postoperative ACL rehabilitation protocol on postoperative day 1. For functional assessment, patients were followed up after 6 weeks, 3 months and 6 months and IKDC knee score was taken and clinical tests for antero-posterior stability were done.⁸ FADI scores were used to evaluate the ankle donor site. The FADI is designed to assess functional limitations related to foot and ankle conditions, and a maximum FADI score of 136 means normal ankle function without any disability.

Results:-

39 Patients of complete ACL tear were admitted in our institute from January 2023 to March 2024. All the patients were included in this study. The mean age in our study was 31 years, the youngest patient being 19 years and the oldest patient 60 years old. The maximum number of patients were in the age group of 21-25 years (28.21%) followed by the age group 26-30 years (23.08%). In our series of 39 patients, 36 patients (92.31%) were males and 3 patients (7.69%) were female. It may be because of the involvement of males in outdoor activities like sports, farming and road traffic accidents. Right knee was injured in 23 patients (59%) and left knee was injured in 16 patients (41%). Most of the ACL tears were caused by road traffic accidents (46%). Next common cause was sports activities like football, kabaddi and athletics like jumping, police physical training, etc. Some patients (23%) got

injured by slips and fall while doing daily activities or while walking/ climbing down stairs. All patients presented with complaints of giving way of the knee.

The mean graft diameter (thickness) in our study was 8.74 mm (range 8 to 10 mm). The mean graft length in our study was 9.12 cm (range 8.5 to 11 cm) after double/triple as shown in **Table 2**. No patients in our study had <8 mm of graft diameter. Ankle stability of these patients was assessed at 6 weeks, 3 months, and 6 months of follow up. All the patients had near normal FADI score at the end of 6 months with a mean of 135.7 (range 135-136).

In our study none of the patients had any clinical instability as checked by tests such as anterior drawers test, Lachman's test and pivot shift test at 6 weeks, 3 months and 6 months of follow up. The mean pre-op IKDC subjective score was 47.77 while the mean post op score (at 6 months) was 87.90. There was significant improvement in post op IKDC score when compared with pre op score ($p < 0.05$) as shown in **Table 3**.

Early superficial infection of the graft site was present in only 1 case (2.56%) which delayed wound healing. There was no deep infection. It was resolved by local wound care and oral antibiotics. No other complications were seen in any of the patients.

characteristics		N(%) or mean (range)
Age distribution (years)		31 (19-62)
Sex distribution	Male	36 (92.13)
	Female	3 (7.69)
Site of Injury	Right	23 (59)
	Left	16 (41)
Nature of Injury	RTA	18 (46)
	Sports Injury	12 (31)
	Fall	9 (23)
Associated Injuries on MRI	MM	14 (35.9)
	LM	09 (23.80)
	MCL	02 (5.13)
	LCL	03 (7.69)
	PCL	03 (7.69)

Table 1:- Demographic data (n=39).

Parameters	Mean OR N
Graft Diameter	8.74 mm (8-10 mm)
Graft Length	9.12 cm (8.5-11 cm)

Table 2:- Graft Parameters (n=39).

	Pre op mean (standard deviation)	Post op mean (standard deviation)	P value
IKDC Subjective score	47.77 (9.99)	87.9 (6.30)	0.00001

Table 3:- Comparison of pre- and post-operative result.

Discussion:-

Due to the increased occurrence of road traffic accidents and increased number of persons participating in sports activities, the number of ACL reconstructions being done has been increased. ACL ruptures if left untreated, lead to subsequent knee disability, which can be severe with potentially decimating long-term consequences. With improving results and increasingly reliable outcomes, patient and physician expectations have evolved to include the goal of return to activities and sports at normal or near normal levels. Arthroscopic reconstruction of the injured ACL has become the gold standard.⁹

The choice of graft has been a topic of great debate in recent years. The various options include bone patellar tendon bone graft, hamstring auto-graft, quadriceps tendon, peroneus longus tendon autograft, various synthetic grafts and allograft. The advantages of arthroscopic ACL reconstruction using peroneus longus autograft include decreased occurrence of patellofemoral adhesions and reduced incidence of anterior knee pain.¹⁰

In our prospective study, there was male predominance (36 male and 3 female). This may be due to the fact that males are more involved in outdoor activities like sports, farming and road traffic accidents. Most of the patients were in the age group of 21 to 25 years (28.21%) with a mean age of 31 years. In our study, 59% patients (n=23) had a right sided tear while 41% (n=16) had left sided. In 2009, Brown and others studied the incidence of sex and limb differences in anterior cruciate ligament injury and stated that even though females are prone for injury, due their less exposure to strenuous environment makes the incidence of males more than females.¹¹ They also concluded that limb differences have no influence either during injury or in the recovery period.

DW Lewis et al in their study on incidence of meniscal injuries at the time of ACL reconstruction found that 58% of patients had meniscal injuries and that medial meniscus was most commonly injured.¹² They also concluded that meniscal repair or resection did not alter the final outcome. In our study 59% patient had an associated meniscal injury, of which medial meniscus (n=14) was more frequently involved then lateral meniscus (n=9) which is in accordance with other studies. Among these patients 8 were treated with partial meniscectomy and rest were treated conservatively. The functional outcome of patients with isolated ACL injury was comparable with that of the patients with associated meniscal injuries. This is in accordance with the study by DW Lewis et al who stated that the presence of meniscal injury does not alter the functional outcome.

The mean pre-operative IKDC score in our study was 47.77 whereas the post-operative score was 87.90. There was significant improvement in post-operative IKDC score when compared with pre-operative score ($p < 0.005$). The final IKDC score of this study were compared with the studies of Ashok Kumar et al 2016, Prasad et al 2017 and Aparajit et al 2016.^{13,14,15} The mean pre-operative IKDC score in the study by Kumar et al was 55.63, Prasad et al was 42.45 and Aparajit et al was 50.5 whereas the post-operative scores were 89.38, 94.33 and 86.03 respectively. In our study, none of the patients had any antero-posterior instability at any of the follow up visits, as assessed by clinical tests such as anterior drawers, Lachman's and pivot shift.

The IKDC score of these patients in whom peroneus longus tendon autograft used were similar with patients undergoing ACL reconstruction by hamstring graft. The harvesting of peroneus longus tendon autograft had no significant effect on ankle function post operatively as seen by the insignificant difference of FADI between the preoperative and postoperative values in all patients. Kerimoğlu et al evaluated the results of ACL reconstruction with complete peroneus longus tendon (PLT) grafts.⁷ The results were assessed after at least 5 years of follow-up and showed a mean Lysholm score of 83.7, with excellent or good results in 79.3% of the patients. No patients experienced ankle joint donor site dysfunction or difficulty in sports activities. Another short-term study of ACL reconstruction with a complete PLT graft also showed encouraging results and no donor site complications.¹⁶

The mean graft diameter (thickness) in our study was 8.74 mm (range 8 to 10 mm). The mean graft length in our study was 9.12 cm (range 8.5 to 11 cm). Various other studies have demonstrated that the average diameter of the graft to be 10 mm (range 7-12 mm) and average length of 9.3 cm (range 9 to 11 cm).^{17, 18, 19} These studies have recommended minimum graft thickness of 7 mm. The thicker the graft, stronger and stiffer the graft will be.

Early superficial infection of the graft site was present in only 1 patient (2.56%) in our study which delayed wound healing. There was no deep infection. It was resolved by local wound care and oral antibiotics. No other complications were seen in any of the patients. Williams et al in their study of 2500 cases of arthroscopic ACL reconstruction, reported an infection rate of 0.3%.²⁰

Several limitations should be taken in account firstly, small sample size ($n < 100$). Overestimation of treatment effect is more likely in small sample size compared to large sample size. Another limitation may be that the follow up time in the included study is up to 6 months due to time limitations; a longer follow up time is needed to evaluate some long-term complications and graft strength. Our study was not a comparative one; we have exclusively used peroneus longus tendon autograft for reconstruction of ACL. Further research is necessary, in order to evaluate which of this surgical technique in long term provides us with the safe and effective management options for ACL reconstruction.

Conclusion:-

Arthroscopic anterior cruciate ligament reconstruction with peroneus longus tendon autograft seems to be a good treatment option for anterior cruciate ligament deficient knees. It gives excellent functional outcome without any detrimental effect on ankle function with minimal complications.

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Conflict of interest:

None declared.

Ethical approval:

The study was approved by the institutional ethics committee.

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