

Clinical and Functional Outcome of Anatomical Trans-portal Arthroscopic Anterior Cruciate Ligament Reconstruction with Hamstring Tendon Graft: One Year Follow up at Civil Hospital Karachi

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ABSTRACT

Aim: To determine the clinical and functional outcome of anatomical trans-portal arthroscopic ACL reconstruction with quadruple hamstring tendon auto-graft.

Study design: Prospective study

Place and duration: Orthopaedic Department, Dr. Ruth KM PFAU Civil Hospital Karachi from 1st November 2016 and 31st October 2019.

Methods: A total 20 male and female patients > 20 years having ACL injury confirmed by clinical examination and MRI scan were included in this study. Patients detailed demography including age, sex, causes of injury and operative time were recorded after written consent. Lachman and Pivot-shift tests were performed before surgery and during follow up period. All patients filled subjective Lysholm Knee and IKDC score pro-forma before surgery and at final follow up. In all patient arthroscopic trans-portal technique was used for ACL reconstruction with HT auto-graft.

Results: There were 17 males and 3 were females. Right knee was injured in 13(65%) cases and left knee 7(35%) cases. At final follow-up, all patients achieved full ROM, 17cases (85%) had negative Lachman, and 3cases (15%) have Grade 1 laxity. Two case (10%) had developed 1+ Pivot shift while in remaining 18 cases (90%) no Pivot-shift was present. There was significant improvement in Lysholm and IKDC score. Functional knee score in 14 cases (70%) showed good, 4 cases (20%) showed excellent and 2 cases (10%) showed fair results at final follow up. Out of 20 patients, 3 patients developed complication.

Conclusion: Arthroscopic ACL reconstruction with quadrupled HT graft is a standard procedure for knee instability after ACL injury. Our study, trans-portal arthroscopic ACL reconstruction with quadruple hamstring tendon graft provide anatomical ACL reconstruction with less morbidity, stability in coronal & sagittal plan and excellent functional outcome with high knee score.

Keywords: Quadruple Hamstring Tendon, ACL, Lysholm Knee Score, Reconstruction

INTRODUCTION

Anterior cruciate ligament (ACL) is the major internal stabilizing ligament of the knee and its injury generates major instability. Anterior cruciate ligament is the most commonly injured ligament of all, making ACL reconstruction is one of the commonly performed procedures in orthopedic surgery^{1,2}. In Pakistan no exact data or registry available for knee ligament injuries but in America about 250000 ACL torn patients presented to hospital each year and about 100,0000 ACL reconstruction performed per year.^{3,4} ACL tear seriously affects the life of the patient by incapacitating in his daily life activities and also affecting directly his quality of life⁵. ACL is the primary (85%) restraint to limit anterior translation of the tibia. In full extension, ACL also serves as a secondary restraint to tibia external rotation. The mechanisms behind ACL injuries are sharp turn, sudden hyper extension, deceleration and rotation or a hit/blow from the side⁶. These injuries are most commonly associated with sports as there are more

sudden and abrupt movements during playing. The ACL is the weaker of the two cruciate (Anterior and Posterior) ligaments and therefore may be it get torn easier than the posterior cruciate ligament.⁷The reported incidence of ACL injuries in literature is 1 in 3500, resulting in 95,000 in India alone. The clinical outcomes of ACL reconstruction depend on so many factors like type of graft used, method of fixation, placement of graft and post-operative rehabilitation program^{8,9}. With the perfection of arthroscopic equipment, improvement of technology and advancement of basic research, arthroscopic ACL reconstruction has become a standard remedy for its favorable clinical effectiveness. However, the rear still disputes within the published literature over the last 20 years regarding graft selection^{10,11}. Anatomical placement of an anterior cruciate ligament graft is considered critical to the success and clinical outcome of ACL reconstruction. Anatomical ACL graft placement is defined as positioning the ACL femoral and tibial bone tunnels at the centre of the native ACL femoral and tibial attachment sites. Clinical studies have demonstrated that non-anatomical ACL graft placement (transtibial) is the most common technical error leading to recurrent instability following ACL reconstruction^{12,13}.

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Trans-portal technique in which the ACL femoral tunnel is drilled through an anteromedial portal allows consistent anatomical ACL tunnel placement, which control both anterior tibial translation and rotatory movement of tibia occur during the pivot-shift phenomenon.¹⁴⁻¹⁶The purpose of this study was to evaluate the clinical and functional outcome of trans-portal technique for anatomic ACL reconstruction with Hamstring tendon auto-graft at a minimum of 12 months follow up.

MATERIALS AND METHODS

This prospective study was conducted in the Orthopedic Department Dr Ruth K.M Pfau Civil Hospital Karachi. A total of 20 male and female patients having ACL injury confirmed by clinical examination and MRI scan from November 2016 to October 2019 were included.

All male and female patients between 20 to 55 years of age having ACL tear with or without meniscal injury and duration of ACL tear more than 8 weeks were included. Patients having Multi-ligament knee injury, Bilateral ACL tear, previous ACL reconstruction surgery and concomitant distal femur or proximal tibia corrective osteotomy or fracture were excluded. Patients detailed demography including age, sex, causes of injury and operative time were recorded after written consent. In a relax and supine position, the uninjured knee was examined first to establish reference values after which the affected knee was examined. Lachman and Pivot-shift tests were performed for diagnosing ACL deficiency. The Lachman test was graded as 0(<3mm), 1(3-5mm), 2(5-10mm) and 3(>10mm). Pivot-shift test was graded as 0(negative), 1(mild or glide), 2(moderate or clunk) and 3(severe or gross subluxation). All patients filled subjective form Lysholm Score and IKDC score pro-forma before surgery and at final follow up (12months).

After spinal or epidural anesthesia, the patient was placed in supine position and injured leg was supported with lateral thigh post for arthroscopy. Before start of surgical procedure we examine the knee under anesthesia then marked the anterolateral and anteromedial portals, Patellar tendon, Patella and Hamstring tendon (HT) [Fig. 1a]. An oblique incision of 4-5 cm was made for HT graft, about 4 cm distal to the joint line and 3 cm medial to the tibial tuberosity. The same incision was used for the tibial tunnel preparation later on. Once the Hamstring tendon (HT) was identified, the Sartorius fascia was incised in the line of HT, both tendons the gracilis and semitendinosus separated from surrounding soft tissues and harvested with close tendon tripper [Fig.1b]. After harvesting, the graft was placed on graft master board for preparation and tension. An open end of both tendons were sutured using a number 2 vicryl and close end of both tendons making a quadruple loop secured with Tight rope RT (Arthrex) endobutton [Fig. 1c]. An anteromedial and anterolateral portals were made using no.11 blade. Diagnostic arthroscopy done, associated meniscus tear either repaired or excised (complex massive tear) before ACL reconstruction.

Transportal Technique for Femoral tunnel preparation [Fig 2].With a spinal needle, a low medial portal was made. Flex knee 110 to 120 degree and then femur 7mm offset

aimer guide was used, guide wire was placed at anatomical site of ACL attachment on femur which is just anterior to the anteromedial bundle. Over the guide wire create the femoral tunnel with reamer according to size of the quadruple HT graft at least 25 to 30 mm long and 8 mm wide for graft placement. This anatomical graft placement gives both sagittal and coronal stability to the knee.

Figure 1: (a) Portals and Hamstring tendon marking (b) Harvesting of hams tendons (c) Graft preparation

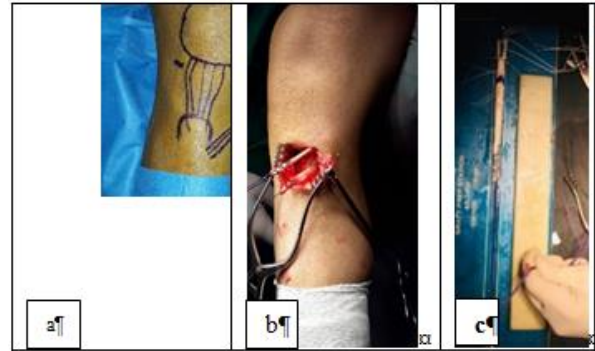
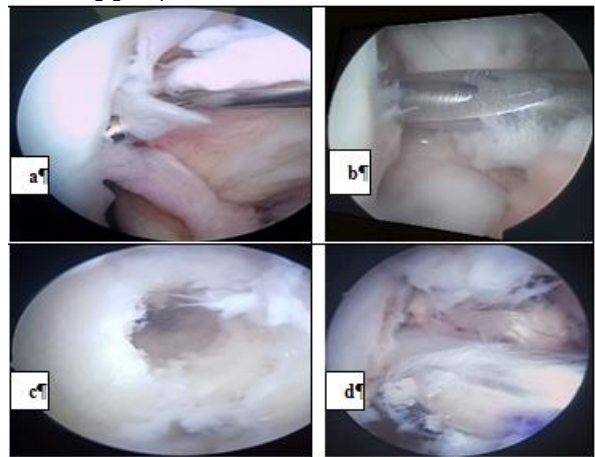


Figure 2: (a,b and c)Transportal technique for femoral tunnel (d) Hamstring graft placement inside femoral tunnel



Tibial tunnel preparation: With knee in 90° flexion, 55 degree tibial jig placed at tibial plateau surface about 7mm anterior to posterior cruciate ligament, close to medial eminence in coronal plan and at the anterior root of lateral meniscus in sagittal plan. Starting point of guide wire for tibial tunnel was approximately 1 cm proximal to pesanserinus and about 2 cm medial to tibial tuberosity. Create a tunnel with reamer according to size of the graft. Pass the HT graft with Tight rope endo-button through the femoral tunnel then cycling of the knee (flexion & extension) 10 to 15 times for graft tensioning and then pass the graft through tibial tunnel and fixed with bio-absorbable/titanium screw (Arthrex) in 20 degree knee flexion. At the end of surgery again knee was examined with scope for proper graft placement and tension. Wound was closed and aseptic dressing applied. The data was entered and analyzed through SPSS-20.

RESULTS

There were 17(85%) males and 3(15%) were females, right knee was injured in 13(65%) cases and left knee 7(35%) cases. The mean interval between ACL injury and surgery was 8.64 months and 7(35%) patients had associated meniscus tear (Table 1). After surgery all patients were followed at 2 weeks, 6 weeks, 3 months, 6 months and 12 months.

Table 1: Demography of the patients

Parameters	No. (%)
Gender	
Male	17(85%)
Female	3(15%)
Mean age (years)	33.2
Affected Knee	
Right side	13 (65%)
Left side	7 (35%)
Mean interval between injury & surgical procedure	8.64
Associated meniscus injuries	Present 7(35%)

Table 2 (a) Result of objective test at final follow up

Knee Test	Positive	Negative
Lachman test	3(15%)Grade 1 laxity	17(85%)
Pivot shift test	2(10%)1 + laxity	18(90%)

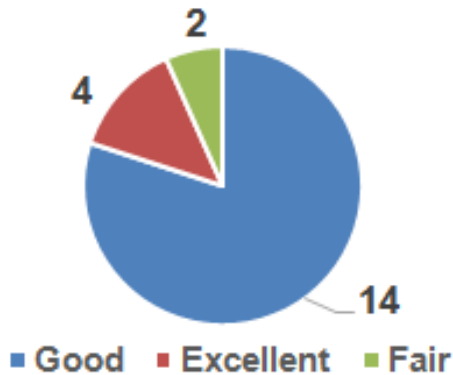
Table 2 (b) Subjective Lysholm& IKDCknee Score

Variable	Mean±SD	t-Test	P-value
Lysholm Score			
Pre-op	63±10.84	11.4	0.0001
Post-op(12 months)	91±3.04DC		
IKDC score			
Pre-op	48.0±10.96	16.23	0.0001
Post-op(12 months)	86.6±3.33		

Table 3: Postoperative complications

Type of complication	No. (%)
Painful swelling of operated leg	2 (10%)
Superficial wound infection	1(5%)

Fig. 3: Functional Knee Score



At each follow up we assessed knee Range of Motion (ROM), Lachman test and Pivot shift test and at final follow up functional outcome was assessed by using Lysholmand IKDC knee score. All patients strictly followed institutional rehabilitation protocol. At final follow-up, all patients achieved full ROM, 17cases (85%) had negative Lachman,

and 3cases (15%) have Grade 1 laxity. Two case (10%) had developed 1+ Pivot shift while in remaining 18 cases (90%) no Pivot-shift was present.[Table 2.a]. There was significant improvement in Lysholm and IKDC knee score[Table 2.b].Out of 20 patients, 3 patients developed complication [Table 3]. Two patients developed pain and swelling in the operated leg, Doppler ultrasound was done which was normal and patient managed conservatively by elevation of leg, application of ice pack 3 to 4 times in a day. One patient developed superficial infection at Hamstring graft donor site that managed by daily dressing and oral antibiotics. Functional knee score in 14 cases (70%) showed good, 4 cases (20%) showed excellent and 2 cases (10%) showed fair results at final follow up [Fig. 3].

DISCUSSION

A meta-analysis of sixteen studies concluded that the clinical outcomes of ACL reconstruction on knee laxity tests and knee functional outcome scales were better with the trans-portal than the trans-tibia tunnel technique.¹⁷ The graft bending angle between the femoral tunnel and lie connecting the femoral andtibial tunnel stress the graft, so higher the graft bending angle will lead to femoral tunnel widening but there is no significant change in the knee scores.¹⁸ The femoral tunnel drilling through a low antero-medial portal has +facilitated more anatomical tunnel that improve the normal knee kinematics.¹⁹ A comparative study conducted at Alexender University Egypt that concludes the anatomical single bundle ACL reconstruction is the standard technique but double bundle can achieve better antero-posterior and rotational stability, but that is statistically not significant.²⁰

Antero-medial portal and outside -in technique is collectively called independent drilling technique is efficient in the femoral tunnel placement in anatomical landmark.²¹ A prospective study of 30 male patients with ACL injury reconstructed with modified transtibial portal that results in improvedlysholm knee score system at 2 year follow-up showed 40% were excellent, 43.3% good, fair in 13.3% and poor in 3.3% but laxity test were improved. Postoperatively on lateral x-ray femoral tunnel in posterior quadrant of blumensat line in 26 patients and in middle quadrant in 4 patients.²² A cohort study was conducted on 556 patients , found that 8.7% overall revision rate with the conclusion of high antero-medial femoral tunnel placement was associated with 9.9%,central placement 9.2% and anteriomedial placement 4.5%ACL rupture.²³ The central aspect during ACL reconstruction is femoral tunnel placement but its orientation did not predict the functional outcome and osteoarthritis future risk. The femoral rotation is the reliable on lateral x-ray.²⁴Sukkur et al²⁵ conducted comparative study between transtibialvsanteromedial portal ACL reconstruction while in term of functional scores and stability tests no significant difference found between both groups but anteromedial portal is superior statistically in time to return normal life, reduced pain score and more accurate femoral tunnel placement at anatomical location.²⁵

CONCLUSION

ACL injury is the most common ligamentous injury of the knee especially young males are more prone to developed

ACL injuries as compared to females. In our country road traffic accident is the most common cause of ACL tear, followed by sports and fall. Arthroscopic ACL reconstruction with quadrupled HT graft is a standard procedure for knee instability after ACL injury. We concluded that ACL reconstruction with quadruple hamstring auto-graft, using arthroscopic trans-portal technique provides anatomical ACL reconstruction with less morbidity, gives stability in coronal and sagittal plan and excellent clinical and functional outcome with high knee score. The limitation of our study is small sample size and a single center study. A large multi-centric randomized control trials are required for further evaluation of the clinical and functional outcomes.

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