Egyptian Journal of Orthopaedic Research "*EJOR*"
An International peer-reviewed journal published bi-annually

Volume 2, Issue 2, Dec. - 2021: pp: 73-79 www.ejor.sohag-univ.edu.eg

Doi: 10.21608/ejor.2021.225619

Original Article

ANATOMIC FEMORAL TUNNEL PLACEMENT IN ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION USING HAMSTERING COMPARING RESULTS BETWEEN ISOLATED ACL INJURY AND ASSOCIATED MENISCAL INJURY

Shazly Mousa, Abd El-Rahman Hafez, Ahmed Fawaz, Emad El-Deen Abd-Elmotalb(*), Moustafa Elsayed, Mohamed Ali

Orthopaedic Surgery dept., Faculty of Medicine, Sohag Univ., Sohag, Egypt

*E-mail: em20101983@yahoo.com

Received 7/8/2021 Accepted 12/12/2021

Abstract

The aim of this study is to compare final outcome in short term follow up in patients with isolated anterior cruciate ligament injury (ACL) and those associated with meniscal injury. This was a prospective study of 30 cases of ACL injury in sohag university hospital divided into two groups , group A containing patients with isolated ACL injury and group B containing patients with associated meniscal injury both groups examined preoperative and postoperative for knee stability and meniscal injury, knee X-ray and MRI done preoperatively for all patient then anatomi csingle bundle ACL reconstruction hamstring tendon fixed by interference screws and partial meniscectomy for associated meniscal injury. All patient assessed by lysholm score preoperative and six months postoperative and result compared. Result showing negative significant effect of meniscal injury on final out comes.

Keyword: *Anatomic ACL reconstruction, Associated meniscal injury, Knee arthroscopy, knee injury, Hamstering tendon graft.*

1. Introduction

Rupture of the anterior cruciate ligament (ACL) is an injury that is frequently sustained in sport activities, and its reconstruction is essential for the patient to return to previous physical activities [1]. Femoral tunnel creation during anterior cruciate ligament (ACL) reconstruction has been performed through the previously reamed tibial tunnel. The transtibial (TT) technique, which can lead to the creation of a non-anatomic aperture with vertical femoral tunnel position [2]. By increasingly recognized importance of femoral tunnel position on restoration of native knee kinematics, use of the anteromedial portal (AMP) for establishment of the femoral tunnel is growing clinical and research interest. The AMP technique is meant to allow for more anatomic, lower placement of the femoral tunnel and better re-creation of the native origins of the anteromedial (AM) and posterolateral (PL) bundles on the femoral condyle [3]. Recently, several biomechanical studies showed that the single bundle ACL grafts placed in the center of their anatomic insertions can provide nearly normal knee kinematics comparable to double bundle reconstruction [4]. Sastre et al. [5] reported that single bundle ACL reconstruction in anatomical insertion site produced results comparable to those obtained using the

double bundle technique, as determined by KT-1000 measurements, International Knee Documentation Committee scores, and pivot shift test results. The hamstring tendon is an important source of autologous tendon grafts at present, and hamstring tendon harvesting is more convenient than are other methods and can achieve the same effect [6]. The critical biomechanical role of the meniscus in the knee has long been known and the development of osteoarthritis has been associated with meniscectomy [7]. Although it may be seen as an isolated injury, the ACL rupture may also be diagnosed as associated with meniscal, chondral or other ligamentous injuries [8]. Meniscal tears concomitant with ACL injuries have been reported by several authors to range from 50 to 70 % in the literature [9]. Treatment options include meniscectomy, repair or meniscal allograft transplantation [10]. Several authors have documented the influence meniscal injuries can have on outcome after ACL reconstruction [11].

2. Patient and Method

This is a prospective study of 30 patients who had Arthroscopic single bundle ACL reconstruction using semi-tendinosus and gracilis auto graft fixed with interference screw with anatomical femoral tunnel placement(10- o'clock position for the right knee or 2-o'clock position for the left knee) at the department of orthopedic surgery sohag university hospital. Comparing results in patients with isolated ACL injury and patients with associated meniscal injury.

2.1. *Inclusion criteria*

The following patients will include: **1)** Clinical / radiological / arthroscopic evidence of ACL deficiency, with or without associated meniscal tear which is symptomatic even after conservative therapy of adequate duration. **2)** Young and middle aged, active, motivated patients involved in vigorous activities, unwilling to change their active lifestyle. **3)** The acute inflammatory phase of the injury has subsided with full range of motion and good quadriceps strength with no extensor lag. **4)** A normal contralateral knee.

2.2. *Exclusion criteria*

Any of the factors, affecting the result directly or indirectly (patients with other systemic diseases compromising their preanesthetic fitness, any other associated ligament injuries of the knee, open physis, articular cartilage lesion exceeding grade 3, and patients having remote infection that might have seeded in the joint)will be excluded from the study.

2.3. *Clinical examination*

The affected side was examined in comparison with the normal side regarding Pain, Knee effusion, Range of knee motion (active and passive), wasting of the thigh. Special tests of instabilit will be preformed for diagnosing anterior cruciate ligament deficiency: **(i)** Lachman test **(ii)** Anterior drawertest **(iii)** Lateral pivot shift maneuver. Injuries to the associated structures will be assessed by performing the following clinical tests: **(i)** McMurray's test (for menisci) **(ii)** Valgus/Varus stress test (for collateral ligaments) **(iii)** Posterior drawer test (for posterior cruciate ligament) **(iv)** Reverse pivot shift test (for posterolateral complex).

2.4. *Radiological evaluation*

Routine X-ray of both knees (anteroposterior and lateral views). MRI of the injured knee will be done to confirm ACL tear and demonstrate other knee injuries.

2.5. *Preoperative investigation and labs*

Routine preoperative labs including complete blood picture, PT, PTT and INR, Random blood sugar, Liver and Kidney function test and serology for (HBV-HCV-HIV).

2.6. *Surgical technique*

The patient was laid supine. A side support at the level of mid-thigh Distal foot rest is adjusted to maintain the affected knee at 90° of knee flexion Pneumatic tourniquet was applied, All patients were operated under general or spinal anesthesia. Antibiotic was given before tourni-

quet application. All knees were examined under general anesthesia. Findings were compared with the contralateral side and the previous preoperative examination, A thorough diagnostic arthroscopy done to confirm the diagnosis and evaluation of other pathological conditions, any meniscial tears was managed by partial meniscectomy before ACL reconstruction, then ACL stump depridment done trying to save some fiber in tibial side for proprioception. The tendons of the pes anserinus are palpated by gently rolling them under the index finger or thumb, a 4-cm incision is marked for the tendon harvest. The incision for the harvest is made and carried down through the subcutaneous fat layer, exposing the Sartorius fascia, a straight transverse incision is made in this fascia at the level of the proximal portion of the gracilis tendon. A right angled clamp is now placed under the tendon mass and scissors are used to dissect the hamstring tendons off of the tibia in an inside– out fashion. With the use of the Mayo scissors, release the fascial bands emanating from both tendons to free them before release with the tendon stripper. Grafted tendon given to assistant for preparation. Then knee was placed at 70-90° of flexion for drilling tibial tunnel. While viewing through the AM or AL portal, a director ACL tip aimer set at a 55° angle was inserted through the AM or AAM portal into the knee joint. Then tibial guide pin was drilled followed by reaming according to graft size. The tunnel length should be 30 to 35 mm to allow fixation near the articular surface. After selecting and confirming the desired location for the ACL femoral tunnel immediately behind the footprint of native ACL. (The landmarks for a correct placement of guide are the passage between the notch roof and lateral notch wall, and the superior border of cartilage of the posterior part of the lateral femoral condyle. The identification of these key points allows us to place femoral tunnel at 10- o'clock position for the right knee or 2-o'clock position for the left knee at level of native ACL), a micro fracture awl was used to mark the location along the lateral wall of the notch. A femoral aimer was inserted through the AAM portal and The knee was slowly flexed to 120° or more. The guide pin was slowly drilled through the lateral femoral condyle and the femoral socket was drilled that corresponds to the diameter of the ACL graft. A probe was used to assess the integrity of the posterior wall. The edges of the tunnel were chamfered to prevent wearing of the graft by sharp edg, Then a six strand sigle bundle ACL graft was passed into the knee joint using the graft passing sutures. Fixation in the femoral tunnel was accomplished with a bioscrew interference fixation technique using a screw equal to the diameter of the femoral tunnel. Tension was maintained for 3 minutes while cycling the knee from 0 to 90° for a minimum of 30 cycles before securing fixation distally with a bioscrew 1 mm larger in diameter than the tibial tunnel size. Final testing for full range of movement especially complete extension was done. Both Lachman and pivot shift tests were carefully done. Finally thorough irrigation of the knee joint. Clouser of sartorial fascia, subcutaneous tissue and skin for graft site. Skin clouser for arthroscopic portals over drain in the knee joint then dressing and crepe bandages were applied. Limb immobilization in long knee brace.

2.7. *Post-operative care*

The patients stayed in hospital for an average of 24 hours the suction drainage was removed 2 days after the operation. All patients received the same type of antibiotic, which was 3rd generation cephalosporin injection for 3 days and oral broad spectrum antibiotic for 12 days.

2.8. *Rehabilitation program*

The accelerated rehabilitation program was used for the patients.

2.9. *Follow up*

All patients were followed up at 2 weeks, 6 weeks, 3 months and 6 months assess

patient progress in rehabilitation program and address any complication. At 6 months all patients evaluated using Lysholm score and results compared between patient with isolated ACL injury and patients with associated meniscal injury.

3. Result

Our study containing 30 patient 15 with isolated acl injury and 15 with associated meniscal injury divided in two groups. Group A containing patients with isolated ACL injury with mean age 24.6 ±3.07 years range from 20 to 31 There were 9 patients with left knee ACL tear (60%), while 6 patients had right knee ACL tear (40%). According to the mechanism of injury 12 patients had sport injury (80%), 3 patients were falling truma (20%). The time tell intervention was distributed as 5.4±2.29 with minimum of 2 months and maximum 9 months. Main symptoms in this group giving way in 14 patients (93.3%), locking in only one patient (6.7%). Group B containing patients with associated meniscal injury with mean age 30.67 ±4.78 years range from 23 to 40 There were 5 patients with left knee ACL tear (33.3%), while 10 patients had right knee ACL tear (66.7%). According to the mechanism of injury 8 patients had sport injury (53.3%), 4 patients were falling truma (26.7%) and 3 patient had RTA (20%). The time tells intervention was distributed as 10.8±6.03 with minimum of 3 months and maximum 23 months. Main symptoms in this group pain in 7 patients (46.7%), giving way in 5 patients (33.3%) and locking in 3 patients (20%) and. Preoperative Lysholm score mean in group A was 56.93±12.07 ranging from 39 to 79 while mean in group B was 46.33±10.74 ranging from 26 to 64 with P.value of significant difference between the two groups in preoperative Lysholm score (0.021). Postoperative(six months follow up) Lysholm score mean in group A was 90.4±5.07 ranging from 76 to 96 while mean in group B was 85.67±4.08 ranging from 74 to 90 with P.value of significant difference between the two groups in preoperative Lysholm score(0.002). In Group A their was 6 patients with excellent final outcome (40%), 8 good (53.3%) and one patient with fair final outcome (6.7%) in Group B there was no patients with excellent final outcome , 13 good (86.67%) and 2 patients with fair final outcome (13.33%).

Table (1) Distribution of age

	Associated injury	
	Isolated (n=15)	**Associated meniscal injury (n=15)**
Age level		
<25	7(46.7%)	2(13.3%)
25-35	8(53.3%)	11(73.3%)
>35	0(0%)	2(13.3%)
Range	20 – 31	23 – 40
Mean±SD	24.6±3.07	30.67±4.78

Table (2) Time lapse to surgery

	Isolated (n=15)	**Associated meniscal injury (n=15)**
Duration		
<6 month	8(53.3%)	4(26.7%)
6-<12 month	7(46.7%)	5(33.3%)
>=12 month	0(0%)	6(40%)
Range	2 – 9	3 – 23
Mean±SD	5.4±2.29	10.8±6.03

Table (3) Mode of injury

	Isolated (n=15)	**Associated meniscal injury (n=15)**
Mode of injury		
SPORT	12(80%)	8(53.3%)
FALL	3(20%)	4(26.7%)
RTA	0(0%)	3(20%)

Table (4) Side affected

	Isolated (n=15)	**Associated meniscal injury (n=15)**
Side		
LT	9(60%)	5(33.3%)
RT	6(40%)	10(66.7%)

Table (5) Main symptom.

	Isolated (n=15)	Associated meniscal injury (n=15)
Main symptom		
Giving way	14(93.3%)	5(33.3%)
Locking	1(6.7%)	3(20%)
Pain	0(0%)	7(46.7%)

Table (6) Distribution of lysholm score

lysholm score	Isolated (n=15)	Associated meniscal injury (n=15)	P. value
Preoperative			
Range	39 - 79	26 – 64	**0.021***
Mean±SD	56.93±12.07	46.33±10.74	
Postoperative			
Range	76 - 96	74 – 90	**0.002****
Mean±SD	90.4±5.07	85.67±4.08	

*Used Mann-Whitney; **Statistically significant difference ($p<0.05$), ***Highly statistically significant difference ($p<0.01$).*

4. Discussion

In our study we try to show the effect of meniscal injury on final outcome after ACL reconstruction in our study result of Lysholm score showing significant difference between score in both groups in pre and postoperative assessment. The current study showed that anatomic single bundle ACL reconstruction significantly improve Lysholm score in both groups from preoperative to postoperative scoring with total of 6 patient had excellent result (20%) and 21 patients with good result (70%) and 3 patients with fair results(10%). In a prospective study by Kim et al [12], patients who had complete ACL tear were treated by anatomic single bundle ACL reconstruction, the Lysholm final score postoperatively, 19 patients (57.6%) had excellent score, 12 patients (36.4%) had good results, one patient (3%) had fair results and one patient (3%) had poor results. Shaikh et al. [13] reported that found excellent results (lysholm score >91) were reported in 36 patients (66.67%), good in 12 patients (22.22%) (Lysholm score 84-90) and fair or poor results in six patients (11.11%) (Lysholm score <83) using single bundle anatomic anterior cruciate ligament reconstruction. In our study Preoperative Lysholm score mean in group A was 56.93±12.07 ranging from 39 to 79 while mean in group B was 46.33±10.74 ranging from 26 to 64 with P.value of significant difference between the two groups in preoperative Lysholm score (0.021) indicating negative effect of associated meniscal injury even in preoperative assessment. Postoperative Lysholm score mean in group A was 90.4±5.07 ranging from 76 to 96 while mean in group B was 85.67±4.08 ranging from 74 to 90 with P.value of significant difference between the two groups in postoperative Lysholm score(0.002), indicating negative effect of associated meniscal injury in postoperative Score. Although anatomic single bundle ACL reconstruction using hamstring improve Lysholm score in both groups significantly but patients with associated meniscal injury presented with significantly more subjective worse complaints than those with intact menisci and isolated ACL injury. Jüri et al. [14] foundIn a multi-center study involving 412 patients, in which they assessed the medium-term results in patients who underwent concomitant partial meniscal resection at the time of ACL reconstruction (137 patients) in comparison to those who had intact menisci (275 patients) and found that the results were worse in patients who underwent concomitant partial meniscal resection at the time of ACL reconstruction. Melton et al. [15] advocate repair of meniscal tears during ACL reconstruction unless there is complex tear, radial tear or plastic deformation of the remaining meniscus. Shelbourne et al. [16] concluded that outcomes from meniscal repair were not superior to those from partial removal at a mean of 6–8 years follow-up. According to a prospective study conducted by Wu et al. [17] patients who had undergone ACL surgery with any degree of meniscal resection presented with significantly more subjective complaints and activity limitations than those with intact menisci Sofu et al. [18] found that Partial meniscectomy for irreparable medial meniscal

tears applied during the same surgery with anterior cruciate ligament reconstruction negatively affects the clinical outcomes in the short-term follow-up. Although objective instrumented laxity measurements or IKDC score improvements do not significantly differ with respect to the presence of concomitant partial meniscectomy in ACL reconstruction patients, the negative effect of partial medial meniscectomy on the participation of a person in sports activities after ACL reconstruction surgery is significant.

5. Conclusion

Anatomic single bundle ACL reconstruction using hamstring tendon is an effective technique for restoring knee function and improving lysholm score in short term final out come inpatient with or without associated meniscal injury. Partial meniscectomy for meniscal tears associated with anterior cruciate lig-ament reconstruction negatively affects the clinical outcomes in the short-term follow-up. Although Lysholm score improve from pre-operative to postoperative but it is still inferior to that of patients with isolated ACL injury.

References

[1] Marcacci, M., Paladini Molgora, A., Zaffagnini S., et al. (2003). Anatomic double bundle anterior cruciate ligament reconstruction with hamstrings. ***Arthroscopy***. 19: 540-546.

[2] Robin, B., Lubowitz, J. (2014). Disadvantages and advantages of transtibial technique for creating the anterior cruciate ligament femoral socket. **J. Knee Surg**. 27: 327-330.

[3] Lim, H-C., Yoon, Y-C., Wang, J-H., et al. (2012). Anatomical versus non-anatomical single bundle anterior cruciate ligament reconstruction: A cadaveric study of comparison of knee stability. ***Clin Orthop Surg***. 4: 249-255.

[4] Kim, H., Seon, J., Jo, Ah. (2013). Current trends in anterior cruciate ligament reconstruction. ***Knee Surg Relat Res***. 25 (4): 165-173.

[5] Sastre, S., Popescu, D., Nunez, M., et al., (2010). Double-bundle versus single-bundle ACL reconstruction using the horizontal femoral position: A prospective, randomized study**.** ***Knee Surg Sports Traumatol Arthrosc***. 18: 32-36.

[6] Demirağ, B., Ermutlu, C., Aydemir, F., et al. (2012). A comparison of clinical outcome of augmentation and standard reconstruction techniques for partial anterior cruciate ligament tears. ***Eklem Hastalik Cerrahisi***. 23 (3): 140-144.

[7] Johnson, R., Kettelkamp, D., Clark, W., et al. (1974). Factors affecting late results of meniscectomy**.** ***J Bone Joint Surg Am***. 56: 719-729.

[8] Tzurbakis, M., Diamantopoulos, A., Xenakis, T., et al. (2006). Surgical treatment of multiple knee ligament injuries in 44 patients: 2–8 years follow-up results. ***Knee Surg Sports Traumatol Arthrosc***. 14 (8): 739-749.

[9] Noyes, F., Barber-Westin, S. (2012) Treatment of meniscus tears during anterior cruciate ligament reconstruction. ***Arthroscopy***. 28 (1):123-130.

[10] Verdonk, R., Volpi, P., Verdonk, P., et al. (2013) Indications and limits of meniscal allografts. ***Injury***. 44 (Suppl 1): 21-27.

[11] Wu, W., Hackett, T., Richmond, J. (2002). Effect of meniscal and articular surface status on knee stability, function, and symptoms after anterior cruciate ligament reconstruction: A long-term prospective study. ***Am J Sports Med***. 30: 845-850.

[12] Kim, M., Lee, B., Park, J. (2011). Anatomic single bundle anterior cruciate ligament reconstruction by the two anteromedial portal method: the comparison of transportal and transtibial techniques. ***Knee Surg Relat Res***. 23 (4): 213-219.

[13] Shaikh, S., Ahmed, N., Adil, S., et al. (2020). A prospective evaluation of clinical and functional outcome of single bundle anatomic anterior cruciate ligament reconstruction with hamstrings autograft. ***J. Pak Med***

Assoc. 70 (12(B)): 2476-2480.

[14] Jüri, T., Vivianne, J., Lucy, J. (2002). Concomitant throscopic anterior cruciate ligament partial meniscectomy worsens outcome after reconstruction, ***Acta Orthop Scand***. 73 (2): 179-185.

[15] Melton, J., Murray, J., Karim A., (2011) Meniscal repair in anterior cruciate ligament reconstruction: a long-term outcome study. ***Knee Surg Sports Traumatol Arthrosc*** 19 (10): 1729-1734.

[16] Shelbourne, K., Carr, D. (2003) Meniscal repair compared with meniscectomy for bucket-handle medial meniscal tears in anterior cruciate ligament-reconstructed knees. ***Am J Sports Med***. 31 (5):718-723

[17] Wu, W., Hackett, T., Richmond, J. (2002). Effects of meniscal and articular surface status on knee stability, function, and symptoms after anterior cruciate ligament reconstruction: A long-term prospective study. ***Am J. Sports Med***. 30 (6): 845-850.

[18] Hakan, S., Yildirim, T., Gürsu, S., et al. (2015). Short-term effects of partial meniscectomy on the clinical results of anterior cruciate ligament reconstruction ***Knee Surg Sports Traumatol Arthrosc.***, 23(1), 184-187.