Functional Outcome of Arthroscopic Single Bundle Anterior Cruciate Ligament Reconstruction (ACLR) using Hamstring Auto Graft.

Muhammad Sufyan[1], Noman Khan[2], Syed Kamran Ali Shah[3], Muhammad Kazim Rahim Najjad[4], Muhammad Asif Peracha[5], Twahir Kalekhan Dina[6]

[1,4,5]Consultant Orthopedic surgeon
Department of Orthopedics Liaquat National Hospita Karachi
[2]Registrar Orthopedics
Department of Orthopedics Liaquat National Hospital Karachi
[3]Senior Registrar, Dept. of Orthopedics, Faisal Hospital, Fazaia Ruth Pfau Medical College, Karachi
[6]Resident Orthopedics
Department of Orthopedics Liaquat National Hospital Karachi

Authorship and contribution Declaration:
Each author of this article fulfilled ALL 4 Criteria of Authorship:

1. Conception and design or acquisition of data, or analysis & interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.
4. All authors agree to be responsible for all aspects of their research work.

Corresponding author:
Syed Kamran Ali Shah
E-mail: drkami1405@gmail.com

ABSTRACT

Objective: To determine the functional outcome of arthroscopic single-bundle Anterior Cruciate Ligament Reconstruction (ACLR) using Hamstring auto graft in patients with isolated complete Anterior Cruciate Ligament (ACL) rupture.

Methods: This descriptive study was conducted in Department of Orthopedics Liaquat National Hospital Karachi from 20th March 2016 to 20th March 2021.All adults patients with isolated ACL tear fulfilling the inclusion criteria were treated arthroscopically with single bundle ACLR using Hamstring auto graft. Functional outcome at two years were assessed with International Knee Documentation Committee (IKDC) scoring system and compared with pre operative value. *P* value was calculated with Chi-square test and paired Sample-t test. *P* value <0.05 was considered significant.

Results: We performed 136 single bundle arthroscopic ACLR using Hamstring auto graft. The mean age of our patients were 33.28±10.22 years. Male patients were 128(94.11%) and female patients were 8(5.88%). Right sided ACLR was performed in 88(64.70%) patients and left sided in 48(35.29%) patients. The mean pre-operative IKDC score was 43.45 ±10.68 and improved to 89.87±13.40 at two years follow up.(p<0.05).

Conclusion: Excellent functional outcome was achieved with arthroscopic single bundle Hamstring ACLR in majority of our patients. We recommend Single bundle arthroscopic Hamstring ACLR as technique of first choice for patients with isolated ACL rupture.

Keywords: Anterior Cruciate Ligament, Arthroscopy, Auto Graft, Hamstring, IKDC.

This article may be cited as:	Sufyan M, Khan N, Shah SKA, Najjad MKR, Peracha MA, Dina TK. Functional Outcome of Arthroscopic Single Bundle Anterior Cruciate Ligament Reconstruction (ACLR) using Hamstring Auto Graft. J Pak Orthop Assoc 2022;34(2): 47-51

INTRODUCTION

Partial or complete tear of anterior cruciate ligament(ACL) of the knee has a relatively higher prevalence in younger people and athletes.[1,2] ACL reconstruction surgery is the gold standard and can be performed with open or arthroscopic techniques.[3,4] The repair of torn ACL once popular in the past is not practiced now a days due to higher failure rates.[5] The extra articular ACLR introduced by MacIntosh was replaced by Erikson who popularized the intra articular ACLR.[6,7] Various tendon auto grafts have been used for ACLR but hamstring auto graft is more frequently being used than patellar bone-tendon-bone graft.[8,9] Single bundle Hamstring auto graft placed at the anatomical position through the trans-portal technique keeping the femoral tunnel independent of the tibial tunnel ensures smooth passage of the graft and consumes less operative time and less rupture rates have been reported than double bundle auto grafts.[10-13]

The objective of our study was to determine the functional outcome of arthroscopic single-bundle

ACLR using Hamstring auto graft in patients with complete ACL rupture

METHODS

We conducted this descriptive study in Department of Orthopedics Liaquat National Hospital Karachi from 20th March 2016 to 20th March 2021. All adult patients with unilateral isolated ACL ruptures were included in this study. Patients with meniscal injury, multifilament injury, revision surgery, advanced osteoarthritis of ipsilateral knee, deformities of ipsilateral lower limb and fractures of the proximal tibia or femur were excluded. The study was approved by the Ethical Committee of our hospital. Informed consent was obtained from all participants. Complete history was taken and physical examination was performed in all patients. ACL rupture was confirmed on MRI knee. The pre operative functional status was assessed with International Knee Documentation Committee (IKDC) Score.[14] The IKDC score ranges from 0 to 100.The 0 score indicates higher symptoms and lowest functional status while100 score indicates no symptoms and highest functional status.

Surgical Technique

A uniform surgical technique for arthroscopic ACLR was adopted for all cases. All the surgeries were performed by same team of arthroscopic surgeons under general or spinal anaesthesia and tourniquet control. Prophylactic antibiotics (Cefuroxime 1.5gms intra-venous) was administered at induction. Initial diagnostic arthroscopy was done to confirm isolated ACL rupture followed by harvesting ipsilateral Hamstring graft (Semitendinosus and Gracilis) from a separate 3cm incision at the pes-anserine with a tendon stripper. Graft was made ready with Ethibond-5 and Vicryl-1 with 20mm marking at femoral end. According to the thickness of harvested graft femoral and tibial tunnel were drilled by trans-portal approach. The harvested graft was tunneled through the tibia and fixed with Endo-button (Arthrex ACL TightRope® RT) on the femoral side. The graft was then strained and fixed with bio-absorbable interference screws (Karl Storz Mega Fix®) on the tibial side. The harvested graft was then checked with probe under arthroscopic vision for adequate tensioning. A local anaesthetic bupivacaine 2% was injected locally at the portal and harvested graft site and the knee was placed in a hinged knee brace and locked at 0 degrees. Post operatively intravenous antibiotic and analgesic were given to all the patients for 48 hours. Patients were discharged on oral antibiotic (Cefuroxime) and analgesic (Paracetamol, Diclofenac sodium) for 3 days.

Post operative follow up visits were scheduled at 2nd 4th and 6th weeks initially and then every 3rd month till 24 months. Patients were mobilized full weight bearing with a hinged knee brace (Donjay) on first post operative day and underwent standard rehabilitation protocol with 30 degrees flexion increments every week. The brace was removed at 6th week after achieving 120 degrees flexion. The patients were then advised isometric and isotonic strengthening exercises for 3 months. At final follow up visit at two years functional outcome was assessed with International Knee Documentation Committee (IKDC) Score and compared with preoperative score.

The data was analyzed with SPSS version 26**.** Frequencies and percentages were calculated for categorical variables while means and SD was calculated for quantitative variables. The pre operative IKDC score was compared with post operative IKDC and *P* value was calculated with paired Sample-t test. Data stratification was done for comparing IKDC score among different demographic variables and P value for categorical variables were calculated with Chi-square test. *P* value <0.05 was considered significant. Data was presented in table where necessary.

RESULTS

In this study 136 patients were included. The mean age of our patients were 33.28±10.22 years. Majority(94.11%,n=128) of our patients were male while female patients were only 8(5.88%). Right sided ACLR was performed in 88(64.70%) patients and left sided in 48(35.29%) patients. Majority(71.32%) of our patients were in the age range of 18 to 30 years while 39(28.67%) patients were in the age range of 31 to 45 years. The aetiology of ACL rupture was road accidents in 79(58.10%), sports injury in 43(31.62%), and fall in 14(10.31%) patients. Majority(82.31%) of patients were operated with ACLR within 6 months of rupturing their ACL,18(12.91%) patients were operated in 7 to 12 months and 6(4.42%) patients were operated more than 12 months after rupturing their ACL. The mean pre-operative IKDC score was 43.45 ±10.68 and improved to 89.87±13.40 at two years follow up.(p<0.05).Patients operated within 6 months of ACL rupture had significantly(p <0.05) better functional outcomes and IKDC scores (91.8 ± 13.4) than those operated after 12 months of injury (IKDC score 77.4±7.5) as shown in table I. Superfical

surgical site infection was documented in 4(2.94%) patients, saphenous nerve injury in 3(2.20%), arthrofibrosis in 3(2.20%) and Patello femoral syndrome was in 1(0.73%) patient.

Table I: Comparison of pre operative and post operative IKDC score in relation to demographic variables.

Demographic variables	Preoperative IKDC (mean ± SD)	Postoperative IKDC (mean±SD)	*P* value
Age(years)			
18-30	41.5 ± 7.3	88.4 ± 9.5	0.67
31-45	43.3 ± 9.4	84.6 ± 11.4	0.51
Gender			
Male	40.6 ± 7.9	87.4 ± 10.5	0.93
Female	44.5 ± 8.4	84.5 ± 9.5	
Time of presentation (months)			
0-6	45.4 ± 12.3	91.8 ± 13.4	0.0002
6-12	40.7 ± 8.24	83.7 ± 10.6	
>12	36.3 ± 10.2	77.4 ± 7.5	

DISCUSSION

In this study we performed 136 single bundle arthroscopic ACLR with Hamstring auto graft and documented an improvement of IKDC from preoperative 43.45 ±10.68 to 89.87±13.40 post operative at two years follow up.(p<0.05).Single bundle anatomical ACLR has been favored by many authors as it restores the normal biomechanics of knee joint, improves function and avoids the long term degenerative changes in the knee joint. A thorough knowledge of anatomical landmarks and optimum visualization is however mandatory.[15] Chuaychoosakoon[16] is of the opinion that single bundle ACLR is associated with less postoperative pain than double bundle ACLR resulting in prompt rehabilitation and optimum patient satisfaction in cases of single bundle ACLR. Chen and colleagues[17] conducted a meta-analysis of five RCTs comprising of 144 patients treated with single bundle ACLR and 144 with double bundle ACLR. These authors noted no significant difference in the functional outcome between the two in terms of IKDC score, Lysholm score and Tegner score. No significant difference was noted for graft failure rates and osteoarthritis knee in between the two groups. These authors concluded that double bundle ACLR was not superior to single bundle ACLR. Chen and Zhu[18] treated 539 patients with single bundle Hamstring ACLR and 381 with double bundle ACLR. Although the post operative Lysholm score, Tegner score and IKDC significantly improved in both the groups at 27 months follow up, no difference in the functional outcome in between the two groups was noted. These authors concluded that both single bundle and double bundle Hamstring ACLR are equally effective for the treatment of ACLR.Brophy[19] had demonstrated that double bundle ACLR was more costly than single bundle ACLR. Sun and Zahao[20] treated 32 patients with single bundle Hamstring ACLR and at 2 years follow up noted an improvement in Lysholm score from pre operative 45 to 92 postoperatively(p<0.001).The Tegner score improved from 1 to 4(p<0.001).These authors recommended single bundle ACLR as a reliable technique for reconstruction of ACL.

In our study we had noticed that patients operated within 6 months of ACL rupture had significantly(p <0.05) better functional outcomes and IKDC scores (91.8 ± 13.4) than those operated after 12 months of injury (IKDC score 77.4±7.5),Contrary to our findings Smith and Davies[21] conducted a systematic review and meta-analysis by analyzing six papers and 370 ACLR and concluded that no difference in the functional outcome was noted in patients with early(within 3weeks of injury) ACLR and delayed ACLR(within 4 to 6 weeks of injury).

We had documented few complications in our study. Superficial surgical site infection was documented in 4(2.94%) patients, saphenous nerve injury in 3(2.20%), arthrofibrosis in 3(2.20%) and Patello femoral syndrome was in 1(0.73%) patient. Variable frequency of complications of single bundle Hamstring ACLR have been reported in the literature. Parkinson[22] analyzed the causes of failure of single bundle ACLR in 123 patients and noted that younger patients, shallow non-anatomical femoral tunnel and patients with deficient meniscus were more prone to graft failure than others.

Our study had few limitations. The design of our study was descriptive and our sample size was small. We had used only IKDC outcome criteria. Further studies are therefore recommended to address all such limitations.

CONCLUSION

Excellent functional outcome was achieved with arthroscopic single bundle Hamstring ACLR in majority of our patients. We recommend Single bundle arthroscopic Hamstring ACLR as technique of first choice for patients with isolated ACL rupture.

Conflict of Interest: None

Grants/Funding: None

REFERENCES

1. Myklebust G, Bahr R. Return to play guidelines after anterior cruciate ligament surgery. Br J Sports Med. 2005;39(3):127-131.
2. Orchard J, Seward H. Epidemiology of injuries in the Australian Football League, seasons 1997-2000. Br J Sports Med. 2002;36(1):39-44.
3. Jagtap V, Gorgile N, Shah Y, Rokade V, Bartakke G. Functional outcome of an arthroscopic anatomical single bundle anterior cruciate ligament reconstruction using semi-tendinosus graft with fixation using endo-button on femoral side and suture disc on tibial side: a prospective clinical study. Int J Res Orthop. 2017;3(6):1175-1179.
4. Frank CB, Jackson DW. The science of reconstruction of the anterior cruciate ligament. J Bone Joint Surg Am. 1997;79(10):1556-1576.
5. Groves EW. The classic Operation for repair of the crucial ligaments. Clin Orthop Relat Res. 1980 ;(147):4-6.
6. Bertoia JT, Urovitz EP, Richards RR, Gross AE. Anterior cruciate reconstruction using the MacIntosh lateral-substitution over-the-top repair. J Bone Joint Surg Am. 1985;67(8):1183-1188.
7. Eriksson E. Reconstruction of the anterior cruciate ligament. Orthop Clin North Am. 1976;7(1):167-179.
8. Lipscomb AB, Johnston RK, Snyder RB, Warburton MJ, Gilbert PP. Evaluation of hamstring strength following use of semitendinosus and gracilis tendons to reconstruct the anterior cruciate ligament. Am J Sports Med.1982;10(6):340-342.
9. Martin SD, Martin TL, Brown CH. Anterior cruciate ligament graft fixation. Orthop Clin North Am. 2002;33(4):685-696.
10. Fu FH, van Eck CF, Tashman S, Irrgang JJ, Moreland MS. Anatomic anterior cruciate ligament reconstruction: a changing paradigm. Knee Surg Sports Traumatol Arthrosc. 2015;23(3):640-648.
11. Sadoghi P, Kropfl A, Jansson V, Müller PE, Pietschmann MF, Fischmeister MF. Impact of tibial and femoral tunnel position on clinical results after anterior cruciate ligament reconstruction. Arthroscopy. 2011;27(3):355-364.
12. Xu H, Zhang C, Zhang Q, Du T, Ding M, Wang Y, *et al*. A Systematic Review of Anterior Cruciate Ligament Femoral Footprint Location Evaluated by Quadrant Method for Single-Bundle and Double-Bundle Anatomic Reconstruction. Arthroscopy. 2016 ;32(8):1724-1734.
13. An VV, Scholes C, Mhaskar VA, Hadden WJ, Parker D. Limitations in predicting outcome following primary ACL reconstruction with single-bundle hamstring autograft - A systematic review. Knee. 2017;24(2):170-178.
14. Irrgang JJ, Anderson AF, Boland AL, Harner CD, Kurosaka M, Neyret P, *et al.* Development and validation of the international knee documentation committee subjective knee form. Am J Sports Med. 2001;29(5):600-13.
15. Malempati CS, Metzler AV, Johnson DL. Single-Bundle Anatomic Anterior Cruciate Ligament Reconstruction: Surgical Technique Pearls and Pitfalls. Clin Sports Med. 2017;36(1):53-70.
16. Chuaychoosakoon C, Parinyakhup W, Wiwatboworn A, Purngpiputtrakul P, Wanasitchaiwat P, Boonriong T. Comparing post-operative pain between single bundle and double bundle anterior cruciate ligament reconstruction: a retrospective study. BMC Musculoskelet Disord. 2021 ;22(1):753. doi: 10.1186/s12891-021-04635-5.
17. Chen H, Chen B, Tie K, Fu Z, Chen L. Single-bundle versus double-bundle autologous anterior cruciate ligament reconstruction: a meta-analysis of randomized controlled trials at 5-year minimum follow-up. J Orthop Surg Res. 2018;13(1):50. doi: 10.1186/s13018-018-0753-x.
18. Chen K, Zhu W, Zheng Y, Zhang F, Ouyang K, Peng L, Liu H, Feng W, Huang Y, Zhang G, Deng Z, Lu W. A retrospective study to compare the clinical effects of individualized anatomic single- and double-bundle anterior cruciate ligament reconstruction surgery. Sci Rep. 2020 ;10(1):14712.
19. Brophy RH, Wright RW, Matava MJ. Cost analysis of converting from single-bundle to

double-bundle anterior cruciate ligament reconstruction. Am J Sports Med. 2009 ;37(4):683-687.

20. Sun L, Zhao J, Shen J, Du B, Yuan B. Anatomic single-bundle anterior cruciate ligament reconstruction in Asian population. ANZ J Surg. 2013;83(4):262-7. doi: 10.1111/j.1445-2197.2012.06317.x.
21. Smith TO, Davies L, Hing CB. Early versus delayed surgery for anterior cruciate ligament reconstruction: a systematic review and meta-analysis. Knee Surg Sports Traumatol Arthrosc. 2010 ;18(3):304-311.
22. Parkinson B, Robb C, Thomas M, Thompson P, Spalding T. Factors That Predict Failure in Anatomic Single-Bundle Anterior Cruciate Ligament Reconstruction. Am J Sports Med. 2017;45(7):1529-1536.