

FUNCTIONAL OUTCOME OF ARTHROSCOPIC ASSISTED ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

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ABSTRACT

Objective: To assess the mid-term functional outcome of arthroscopic assisted anterior cruciate ligament (ACL) reconstruction using bone-patellar tendon-bone (BPTB) graft based upon subjective scores.

Study Design: Cross sectional study.

Place and Duration of study: Department of Orthopaedics and Spine, Doctors Hospital & Medical Centre, Lahore, Pakistan from Jan to Dec 2016.

Patients and Methods: After fulfilling the inclusion criteria 52 patients who underwent arthroscopic assisted ACL reconstruction were enrolled into the study. Patients were subjectively evaluated with Lysholm knee scoring scale and Tegner activity scale. Preoperative scores were obtained and compared with those obtained 6 months after surgery and were analyzed using wilcoxon signed-rank test on IBM SPSS statistics version 20.

Results: Mean difference between preoperative and 6 months postoperative Lysholm scores was 30.04 ± 13.42 ($p < 0.001$) and mean difference in Tegner activity scale was 2.88 ± 1.11 ($p < 0.001$). Excellent scores were obtained in 40 (77%) patients, good in 1 (2%), fair in 7 (13%) and poor in 4 (8%) of patients. Postoperative complications included anterior knee pain in 3 (5.76%), superficial surgical site infection in 1 (1.9%), deep surgical site infection in 1 (1.9%) and joint stiffness in 1 (1.9%) patient.

Conclusion: Arthroscopic assisted ACL reconstruction using BPTB autograft showed an excellent functional outcome explained in terms of subjective evaluation as depicted by Lysholm knee scoring scale and Tegner activity scale.

Keywords: Arthroscopy, Anterior cruciate ligament, Reconstruction.

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INTRODUCTION

Anterior cruciate ligament (ACL) is the most commonly injured ligament in the knee¹, and hence, ACL reconstruction is one of the commonly performed procedures in orthopedic surgery^{2,3}. Complete tear of the ACL does not heal spontaneously; however, people with sedentary lifestyle do not usually require surgical reconstruction of the ligament⁴. Nonoperative treatment is poorly tolerated by active adults and adolescents⁵ and hence, requires operative management. Aim of ACL reconstruction is to restore structural integrity and joint stability¹. The ideal choice of graft for ACL reconstruction remains controversial as numerous options are available⁶ including bone-patellar tendon-bone (BPTB) autograft, quadriceps tendon,

semitendinosus and gracilis autograft⁷. BPTB has however, shown better objective stability in the long term⁸. Surgical approaches vary, and decision of specific approach, whether open (arthrotomy) or arthroscopic assisted, resides with surgeon's preference and level of skills. Furthermore, arthroscopic approaches also differ on basis of femoral tunnel placement which constitutes either transtibial technique which we use, or alternatively, the newly popularized anteromedial anatomic tunnel placement technique. Since its introduction by Dandy in 1980⁹, arthroscopic assisted ACL reconstruction has gained popularity owing to its promising results in terms of less postoperative pain, reduced morbidity and better rehabilitation as compared to open technique¹⁰. Postoperative rehabilitation protocols favor arthroscopic surgery as quadriceps strengthening exercises after open surgery have been ineffective in

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preventing the significant muscle weakness that occurs during the early postoperative period¹¹. Cameron and colleagues also favored arthroscopic method which depicted statistically significant difference in postoperative range of motion, thigh atrophy and knee extension (Cybex II test)¹². Since arthroscopic assisted ACL reconstruction technique is not very popular in our part of the world and most studies published in our country are based on open technique¹³, we have therefore, published our results to encourage orthopedic surgeons adopt this approach. Our study reports mid-term functional outcome of arthroscopic assisted BPTB ACL reconstruction at 6 months follow-up. Objectives were to evaluate outcome based on Lysholm Knee scoring scale and Tegner activity level scale.

PATIENTS AND METHODS

This prospective cross sectional study was conducted at Doctors Hospital & Medical Centre, Lahore between Jan and Dec 2016. After ethical approval from the institutional review board, sample size of 52 patients was calculated with 95% confidence interval and 10% margin of error, assuming 84% of patients will have excellent outcome. Patients were selected through non-probability/consecutive sampling technique. Those with previous surgery of the affected knee, multiligament injury of the affected knee, re-injury to the operated knee, and those who had false positive MRI as confirmed on diagnostic arthroscopy, were excluded. Written informed consent was obtained from all patients. Subjective evaluation with Lysholm Knee scoring scale and Tegner activity level scale was done. Performa were filled in by patients under supervision of researcher. All patients were evaluated at the time of admission and again at 6 months follow-up. IBM SPSS statistics version 20 was used for statistical data analysis. Mean and standard deviation were documented. Preoperative and postoperative scores for both Lysholm and Tegner scales were documented and difference between preoperative and 6 months post-operative scores was evaluated using Wilcoxon signed rank test. A *p*-value less

than 0.05 was considered as a significant value. Categorical variables were presented by frequency and percentage.

Surgical Technique

We generally begin the procedure with thorough diagnostic arthroscopy under tourniquet control to confirm the injuries present. If meniscal tear is seen, partial meniscectomy or repair is done. ACL footprint is then shaved with a power shaver, notchplasty is done and position of the femoral tunnel is marked with a cannulated drill. This is known as transtibial technique of femoral tunnel placement, as opposed to the newly popularized anteromedial tunnel placement technique. BPTB graft is then harvested through midline longitudinal incision. Middle thirds of the patellar tendon is harvested along with bone plug at either ends taken with a power saw. Required length is then measured and bone plugs are trimmed to desired length and diameter. Nibbled bone pieces are saved to be inserted into the harvest site at completion of the procedure. Meanwhile, the midline incision is temporarily sutured to maintain intra-articular pressure. Insertion sites at the tibia and femur are marked with the help of a specialized jig and are reamed. The graft is then held in slings of suture material and passed through the tibia into the femur over beath needle. Both ends are fixed with bioabsorbable screws. Suture slings and temporary sutures are then removed. Anterior drawer test is performed to confirm stability and appropriate tension on the graft. Residual bone is impacted both into the proximal and distal ends of the graft harvest site. Tourniquet is deflated and hemostasis is secured. Incision is sutured in layers with absorbable sutures for deeper soft tissues and non-absorbable subcuticular suture for skin. Portals are infiltrated with bupivacaine and left open for drainage. Aseptic dressing and Robert Jones bandage are applied. Isometric quadriceps strengthening exercise and partial weight bearing with the help of walker are started on 1st postoperative day under supervision of a physical therapist. Knee is supported in extension with a knee immobilizer for 2 weeks

after which passive range of motion at the knee is begun. Sutures are removed 14 days after the surgery and rehabilitation started under the supervision of physical therapist.

RESULTS

Fifty two patients met our inclusion criteria and were enrolled into the study. Average age of patients was 27.79 ± 7.60 years. Forty nine (94.2%)

difference between preoperative and post-operative Lysholm score was 30.04 ± 13.42 (*p*<0.001) and mean difference between pre-operative and postoperative Tegner activity scale was 2.88 ± 1.11 (*p*<0.001). Postoperative complications included anterior knee pain in 3 (5.76%), superficial surgical site infection in 1 (1.9%), deep surgical site infection requiring arthroscopic lavage in 1 (1.9%) and joint stiffness requiring

Table: Modes of injury (n=52).

Mode of Injury	No. of Cases	Percentage (%)
Roadside accident	28	53.8
Sport injury	20	38.4
Fall	4	7.6

patients were males whereas three (5.7%) were females. All patients had unilateral knee involvement, out of which 29 (55.7%) had their right knee involved and 23 (44.2%) had involvement of their left knee. Isolated ACL tear was seen in 28 (53.8%) patients, whereas associated medial meniscal tear was seen in 21 (40.3%), lateral meniscal tear in 2 (3.8%) and both medial and lateral meniscal tears in 1 (1.9%) patient. Most common mode of injury was roadside accident in 28 (53.8%) patients, followed by sport-related injuries in 20 (38.4%) patients, whereas 4 (7.6%) patients had other mechanisms of injury (table). Average interval between injury and surgery was 11.3 ± 9.63 months where 11 (21.2%) patients were operated within 3 months and 10 (19.2%) were operated 1 year post injury. Such long interval may be due to the reason that thirty three of fifty two patients (63.4%) were referred from other cities after failure of conservative trial. One patient was morbidly obese with BMI 42.5, whereas rest of the patients had no comorbids. Postoperative Lysholm scores were calculated. Excellent score (>90) was obtained in 40 (77%) patients, good score (84-90) in 1 (2%), fair score (65-83) in 7 (13%) and poor score (<65) in 4 (8%) of patients (figure). Mean preoperative Lysholm score was 58.19 (± 20.0) as compared to postoperative mean of 88.23 (±12.17). Similarly, improvement in Tegner scale was depicted by preoperative mean of 2.52 (± 0.91) compared to postoperative mean of 5.40 (± 1.49). Mean

manipulation under anesthesia in 1 (1.9%) patient.

DISCUSSION

This study aimed at investigating mid-term functional outcome of arthroscopic assisted ACL reconstruction. BPTB autograft was harvested in all patients which is documented to have satisfactory results in terms of subjective

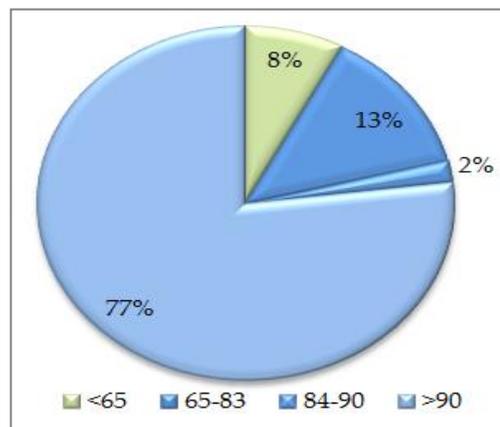


Figure: Postoperative lysholm scores.

and objective evaluation¹. We found excellent mid-term results on subjective scoring scales. Complications documented in this study were a single case of deep infection which was satisfactorily managed with arthroscopic lavage and an additional course of antibiotics; one patient with superficial surgical site infection requiring additional course of oral antibiotics, and one case of joint stiffness which occurred due to non-compliance of the patient with

rehabilitation program. Surprisingly, contrary to other studies^{1,13}, more than one-half (53.8%) of our patients reported roadside accident as the mechanism of injury, whereas sport-related injury was seen in 20 (38.4%) patients. Medial meniscus was found on arthroscopy to be most commonly affected in conjunction with ACL tear, which is similar to the results of other studies^{13,14}. Patients frequently complain of anterior knee pain after ACL reconstruction, especially with BPTB autograft, however, only 3 (5.76%) of our patients reported the symptom. Loss of extension is an important measure when patients complain of pain after surgery. Classified as minor (<3° loss of extension) and major (>3 loss of extension)¹⁵, two of our patients had major and one had minor loss of extension, out of which 2 recovered. Patients presenting within a week of the injury were investigated with MRI and were offered conservative trial which had two benefits. Firstly, patients get a chance to self-evaluate their functional status after resolution of the initial inflammatory phase and decide whether they require operative or nonoperative management. Secondly, isometric quadriceps strengthening exercises are begun as “prehabilitation”, which is rehabilitation starting preoperatively, which makes postoperative rehabilitation easier and yields superior results^{16,17}. Our study had few shortcomings; patients were evaluated by subjective means and objective measures were not employed. Moreover, we have no comparison to prove the superiority of our operative technique against the traditional open technique. Sample size in our study was restricted and further studies based upon larger cohorts are needed. Lastly, the economic burden of duplicating these results is not projected as arthroscopic surgery costs more than traditional open technique and requires a learning curve, though not very steep.

CONCLUSION

Arthroscopic assisted ACL reconstruction using BPTB autograft has an excellent functional outcome explained in terms of

subjective evaluation as depicted by Lysholm knee scoring scale and Tegner activity scale.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

1. Ettinger M, Etter F, Calliess T, Bohnsack M, Becher C. Long term results of bone-patella-tendon-bone ACL reconstruction. *J orthop* 2017; 14(1): 91-4.
2. Surer L, Michail K, Koken M, Yapici C, Zhu J, Marshall BD, et al. The effect of anterior cruciate ligament graft rotation on knee biomechanics. *Knee Surgery, Sports Traumatology, Arthroscopy* 2017; 25(4): 1093-1100.
3. van Eck CF, Schreiber VM, Mejia HA, Samuelsson K, van Dijk CN, Karlsson J, et al. “Anatomic” anterior cruciate ligament reconstruction: a systematic review of surgical techniques and reporting of surgical data. *Arthroscopy* 2010; 26(9): S2-12.
4. Monk AP, Hopewell S, Harris K, Davies LJ, Beard D, Price A. Surgical versus conservative interventions for treating anterior cruciate ligament injuries. *Cochrane Database Syst Rev* 2016; 4: CD011166.
5. Raines BT, Naclerio E, Sherman SL. Management of Anterior Cruciate Ligament Injury?: What's In and What's Out?. *Indian J Orthop* 2017; 51(5): 563-75.
6. Niu Y, Niu C, Wang X, Liu J, Cao P, Wang F, et al. Improved ACL reconstruction outcome using double-layer BPTB allograft compared to that using four-strand hamstring tendon allograft. *Knee* 2016; 23(6): 1093-7.
7. Han HS, Seong SC, Lee S, Lee MC. Anterior cruciate ligament reconstruction. *Clin Orthop Relat Res* 2008; 466(1): 198-204.
8. Anderson AF, Snyder RB, Lipscomb AB. Anterior cruciate ligament reconstruction. *Am J Sports Med* 2001; 29(3): 272-9.
9. Dandy DJ. Arthroscopic surgery of the knee. *Br J Hosp Med* 1982; 27(4): 360-5.
10. Laffargue P, Delalande JL, Maillat M, Vanhecke C, Decoulx J. Reconstruction of the anterior cruciate ligament: arthrotomy versus arthroscopy. *Rev Chir Orthop Reparatrice Appar Mot* 1999; 85(4): 367-73.
11. Noyes FR, Mangine RE, Barber S. Early knee motion after open and arthroscopic anterior cruciate ligament reconstruction. *Am J Sports Med* 1987; 15(2): 149-60.
12. Cameron SE, Wilson W, St Pierre P. A prospective, randomized comparison of open vs arthroscopically assisted ACL reconstruction. *Orthopedics* 1995; 18(3): 249-52.
13. Ali SD, Noor S, Mangi IK, Shah SK, Sufyan M. Functional outcome of ACL reconstruction using patellar bone tendon bone graft. *Age* 2014; 30(68): 30.
14. Struwer J, Frangen TM, Ishaque B, Bliemel C, Efe T, Ruchholtz S, et al. Knee function and prevalence of osteoarthritis after isolated anterior cruciate ligament reconstruction using bone-patellar tendon-bone graft: long-term follow-up. *Int Orthop* 2012; 36(1): 171-77.
15. Marimuthu K, Joshi N, Sharma M, Sharma CS, Bhargava R, Rajawat AS, et al. Anterior cruciate ligament reconstruction using the medial third of the patellar tendon. *J Orthop Surg Res* 2011; 19(2): 221-25.
16. Failla MJ, Logerstedt DS, Grindem H, Axe MJ, Risberg MA, Engebretsen et al. Does extended preoperative rehabilitation influence outcomes 2 years after ACL reconstruction? A comparative effectiveness study between the MOON and delaware-Oslo ACL cohorts. *Am J Sports Med* 2016; 44(10): 2608-14.
17. Shaarani SR, O'Hare C, Quinn A, Moyna N, Moran R, O'Byrne JM. Effect of prehabilitation on the outcome of anterior cruciate ligament reconstruction. *Am J Sports Med* 2013; 41(9): 2117-27.