Outcome Assessment after Anterior Cruciate Ligament Reconstruction among Non-athletes

Kaushalendra Singh[1], Vineet Singh[2]

ABSTRACT

Introduction: About more than 1 lakh ACL Reconstruction are performed every year in United States and number of surgical procedures from an open procedure to a minimal invasive arthroscopic operation continues increasing globally. Therefore objective of present study was to evaluate outcomes after anterior cruciate ligament reconstruction and structured rehabilitation by using IKDC, KOOS and TAL score.

Material and methods: Present study was conducted in Sir Gangaram Hospital New Delhi which included 20 patients who were treated surgically (Arthroscopic Anterior Cruciate Ligament reconstruction using hamstring graft and structural rehabilitation**).** Structural rehabilitation was followed for 6 month. All cases were followed at 2 weeks, 6 weeks, 10 weeks, 16 weeks and at 6 months. The outcome was assessed by using IKDC score, KOOS score and Tegner activity level scale.

Results: IKDC is statistically highly significant at 2 weeks, 6 weeks, 10 weeks, 16 weeks and 6 months follow up (p< 0.001). KOOS is statistically highly significant at 2 weeks, 6 weeks, 10 weeks, 16 weeks and 6 months follow up (p< 0.001). TAL is statistically highly significant at 10 weeks, 16 weeks and 6 months follow up (p< 0.001).

Conclusion: There is need of various studies which should use patient-reported outcomes that reflect patients' most important concerns and further prospective longitudinal research is required in this area.

Keywords: IDKC, KOOS, TAL Score, ACL Reconstruction.

INTRODUCTION

Rupture of the Anterior cruciate Ligament (ACL) of knee is characterized by joint instability producing decrease activity, unsatisfactory knee function in short term[1-2] and associated with osteoarthritis of knee[3] in long term. Injuries of ACL thought to occur as frequently as in 1 in 3000 peoples.[4] About more than 1 lac ACL Reconstruction performed every year in United States, and number of procedures continues increasing. There are many factors to be considered when deciding whether an ACL rupture should be treated surgical or conservatively. Among these factors are the degree of instability, the presence of meniscal lesions, the patient's level of athletic activity and the patient's age. A widely advocated treatment strategy is to recommend early reconstruction in the highly active patients and to start with a non-surgical treatment for the less active patients.[5]

Due to non-availability of specific guidelines for ACL rupture management it is difficult to decide between surgical or conservative treatment approaches for patient's benefit. Surgical treatment is the most frequently reported treatment

of Anterior Cruciate Ligament injury and the preferred treatment by most orthopaedic surgeons. Arthroscopically assisted reconstruction of the Anterior Cruciate Ligament has been the method of choice since the 1990s, and the bone-patellar tendon-bone (BTB) autograft was initially the preferred graft for primary reconstruction of the Anterior Cruciate Ligament. In recent years, however, a growing use of quadruple hamstring autografts has been reported. Non-surgical treatment following Anterior Cruciate Ligament injury is less frequently reported especially in recent years. Reconstructive surgery may improve short-term knee function for those suffering from severe instability in activity and/or repeated give way episodes. The truths of treatment and outcome after Anterior Cruciate Ligament injury are few, while the consequences are likely to be severe, both in the short and long term. The overall quality of publications assessing treatment and outcome after Anterior Cruciate Ligament injury is poor and few strong conclusions can be made. Some subjects probably need to be treated surgically in order to return to pre-injury activity although the timing of return to strenuous activity could be of great importance. Improved quality of scientific publications, considerations of both short and long term consequences for the individual and a correct use of outcomes applicable to the assessment of both surgical and non-surgical treatment will enhance our understanding of the truths and consequences of anterior cruciate ligament injury.[6]

Clinical based outcome such as laxity testing does not correlate with patient-reported outcomes (PROs) such as patient satisfaction. Outcome measure should reflect perceptions of the patients. Hence outcome measures should be determined by individual needs, priorities and preferences of patients. PRO measures are both site-specific (Cincinnati Knee Ligament Rating Scale and the Lysholm Knee Scoring Scale) and disease/condition specific PRO measures. Two commonly used site-specific PRO instruments for the knee are the International Knee Documentation Committee

[1]Consultant, Department of Orthopaedic Surgeon, Vijay Hospital, Bharatpur, Rajasthan, [2]Assistant Professor, Department of Orthopaedic, Government Medical College Banda, U.P., India

Corresponding author: Dr. Vineet Singh, Assistant Professor, Dept. of Orthopaedic, Government Medical College Banda (U.P.), India

Subjective Knee Form (IKDC) and the Knee injury and Osteoarthritis Outcome Score (KOOS). Aim of present study is to assess the outcome after anterior cruciate ligament reconstruction and structured rehabilitation. The outcomes were compared using anterior laxity of knee joint (by using Lachman's and Pivot shift test)[7-8], KOOS score[9], IKDC score[10] and Tegner activity level.[11]

MATERIAL AND METHODS

Present study was a prospective randomized controlled analysis of cases having complete Anterior Cruciate Ligament tear, conducted in department of orthopaedics at Sir Gangaram Hospital, New Delhi between February 2014 to July 2015.

Inclusion criteria were age between 18 to 35 years of age, either sex, anterior cruciate ligament tear not more than 4 weeks old to a previously uninjured knee and Tegner activity level up to 5.

Exclusion criteria were professional athletes, a collateral ligament rupture, full thickness cartilage lesion visualized and Tegner activity level 6 or more than 6. Approval from ethics committee was taken before study.

After taking informed consent, all subjects were provided a self administered patient questionnaire containing IKDC, KOOS and Tegner activity scores. Surgeon questionnaire was completed at the time of surgery and includes history of knee injury, general and knee examination (including tests for anterior laxity- Lachman test and Pivot shift test), radiological examination, surgical technique used for procedure. All patients were examined during follow up clinically (assessment of Lachman test and Pivot shift test). IKDC, KOOS, TAL scores were taken of all patients at each follow up. All relevant records were kept & results evaluated by one independent orthopaedic surgeon.[9-11]

Present study included 20 patients who were treated surgically (Arthroscopic Anterior Cruciate Ligament reconstruction using hamstring graft and structural rehabilitation).[6] Structural rehabilitation was followed for 6 month. All cases were followed at 2 weeks, 6 weeks, 10 weeks, 16 weeks and at 6 months. The outcome assessed by using:-

1. International knee documentation committee (IKDC) scores.
2. Knee injury and osteoarthritis outcome (KOOS) scores.
3. Tegner activity level scale.

STATISTICAL ANALYSIS

Statistical testing conducted with the statistical package for the social science system version SPSS 17.0.Continuous variables presented as mean SD or median if the data is unevenly distributed. Categorical variables expressed as frequencies and percentages. The comparison of normally distributed continuous variables between the groups performed using Student's t test. Nominal categorical data between the groups compared using Chi- square test. For all statistical tests a *P* value less than 0.05 taken to indicate significant difference.

Surgical technique

All patients were examined under general anaesthesia, antero-medial and antero-lateral athroscopic portals were made after which routine diagnostic arthroscopy was performed. Meniscal injury and articular cartilage lesion were evaluated and, if necessary meniscectomy and treatment of cartilage lesion were performed. Four strand, single bundle hamstring graft prepared from harvested semitendinosus and gracillis tendon (harvested from ipsilateral knee). ACL reconstruction was done using transportal technique. The tibial tunnel was made with an ACL tibial guide set at 50 degree angle, and femoral tunnel was made from antero-medial portal at 9:30 'o' clock or 2:30 'o' clock position according to the side of knee using femoral guide. After that tibial guide pin was placed in appropriate position, reaming was done to the pre-determined graft size. The femoral tunnel was made leaving a 3 mm posterior wall and reamed to appropriate size. Then the graft with endobutton was passed from tibial to femoral tunnel using suture rail-road technique. Femoral fixation was done using endobutton. Then cycling of graft was done by passive flexion and extension before final tibial fixation with BIORCI HA screw or metal screw was done. Wound closure was done in layers and aseptic sterile dressing was applied and compression bandage was given to all patients. Postoperative on table examination was done by Lachman and Pivot shift test and their grading were noted.

Post-operative management and rehabilitation protocol:

After surgery patients were shifted to recovery room and long knee brace was applied. Intravenous antibiotics were given for one post operative day. Patient discharged on next day of surgery. Rehabilitation protocol started from post-operative day one.

RESULTS

There were 20 patients in with average age of 27.35 years (SD ± 5.518) with 85% males and 15% females. In 55% patients, left knee involved while in 45% cases, right knee involved. (Table 1)

The mean preoperative IKDC was 34.605 (SD ± 1.9784). The mean IKDC at 2 weeks, 6 weeks, 10 weeks, 16 weeks and 6 months was 38.475 (SD±2.2278), 51.390 (SD ±1.8954), 58.475 ((SD ± 1.4563), 66.175 (SD±1.4596) and 79.020 (SD ±1.3073) respectively. IKDC is statistically highly significant at 2 weeks, 6 weeks, 10 weeks, 16 weeks and 6 months follow up (p< 0.001). (Table 2)
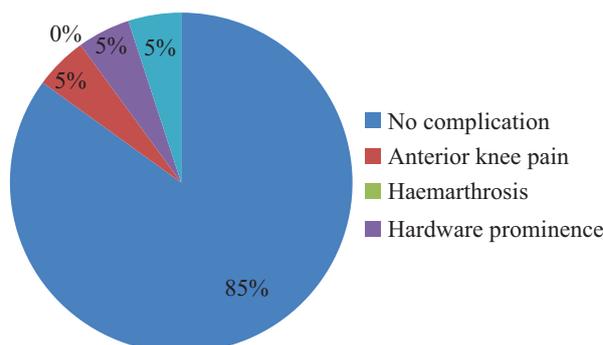

Figure-1: Complications

The mean preoperative KOOS was 38.585 (SD ± 1.6567). The mean KOOS at 2 weeks, 6 weeks, 10 weeks, 16 weeks and 6 months was 44.235 (SD ±1.5799), 56.540 (SD ±2.3082), 63.130 (SD ± 3.1495), 69.815 (SD ±2.6751) and 83.220 (SD ±2.2652) respectively. KOOS is statistically highly significant at 2 weeks, 6 weeks, 10 weeks, 16 weeks and 6 months follow up (p< 0.001). (Table 2)

The mean preoperative TAL was 1.05 (SD ± 0.605). The mean TAL at 2 weeks, 6 weeks, 10 weeks, 16 weeks and 6 months was 1.25 (SD±0.639), 1.40 (SD ±0.598), 1.95 ((SD ± 0.510), 3.65(SD±0.489) and 4.60 (SD ±0.503) respectively. TAL is statistically highly significant at 10 weeks, 16 weeks and 6 months follow up (p< 0.001). (Table 2)

Figure 1 shows that in 17 cases (85%), there was no complication followed by 1 case each (5%) showing anterior knee pain, hardware prominence and superficial infection.

DISCUSSION

Treatment of ACL rupture depends upon various factors like degree of instability, the presence of meniscal lesions, patient's level of athletic activity, willingness to commit to a six-month rehabilitation program and the patient's age. An ACL reconstruction neither diminishes secondary knee osteoarthritis chances nor restores normal knee kinematics. But it reduces giving way complaints and these complaints are still the most important indication for this operation.[12]

IKDC score: Several methods of scoring the IKDC Subjective Knee Evaluation Form were investigated. The IKDC Subjective Knee Evaluation Form is scored by summing the scores for the individual items and then transforming the score to a scale that ranges from 0 to 100. The steps to score the IKDC Subjective Knee Evaluation Form are as follows:

1. Assign a score to the individual's response for each item, such that lowest score represents the lowest level of function or highest level of symptoms.
2. Calculate the raw score by summing the responses to all items with the exception of the response to item 10 "Function Prior to Your Knee Injury"
3. Transform the raw score to a 0 to 100 scale as follows:

$$\text{IKDC score} = \frac{\text{Row score} - \text{Lowest possible score } \times 100}{\text{Range of score}}$$

The transformed score is interpreted as a measure of function such that higher scores represent higher levels of function and lower levels of symptoms. A score of 100 is interpreted to mean no limitation with activities of daily living or sports activities and the absence of symptoms. The IKDC Subjective Knee Score can still be calculated if there are missing data, as long as there are responses to at least 90% of the items (i.e. responses have been provided for at least 16 items). To calculate the raw IKDC score when there are missing data, substitute the average score of the items that have been answered for the missing item score(s). Once the raw IKDC score has been calculated, it is transformed to the IKDC Subjective Knee Score as described above.

KOOS manual scoring

Scores are assigned as 0 for no problem, 1 for mild problem, 2 for moderate, 3 for severe and 4 for extreme problems. If a mark is placed outside a box, the closest box is chosen. If two boxes are marked, that which indicated the more severe problems is chosen. Missing data are treated as such; one or two missing values are substituted with the average value for that subscale. If more than two items are omitted, the response is considered invalid and no subscale score is calculated and summed up the total score of each subscale and divided by the possible maximum score for the scale.

Variables	Patients; N=20	
Age Range (Years)	Mean± SD	Min – Max
	27.35 ± 5.518	19-35
Sex	No. of cases	% of cases
Male	17	85%
Female	3	15%
Side distribution	No. of cases	% of cases
Left	11	55%
Right	9	45%
Table-1: General Patient Characteristics		

IKDC	Patients; N=20		
	Mean± SD	Mean Difference from Baseline ± SD	p value from Baseline
Pre op	34.605 ± 1.9784		
2 wks	38.475 ± 2.2278	(-)3.87 ± 1.64	<0.001
6 wks	51.390 ± 1.8954	(-)16.78 ± 1.74	<0.001
10 wks	58.475 ± 1.4563	(-)23.87 ± 1.75	<0.001
16 wks	66.175 ± 1.4596	(-)31.57 ± 1.80	<0.001
6 months	79.020 ± 1.3073	(-)44.42 ± 1.93	<0.001
Table-2: Showing changes in IKDC Score			

KOOS	Patients; N=20		
	Mean± SD	Mean Difference from Baseline ± SD	p value from Baseline
Pre op	38.585 ± 1.6567		
2 wks	44.235 ± 1.5799	(-)5.65 ± 0.61	<0.001
6 wks	56.540 ± 2.3082	(-)17.95 ± 1.98	<0.001
10 wks	63.130 ± 3.1495	(-)24.54 ± 3.40	<0.001
16 wks	69.815 ± 2.6751	(-)31.23 ± 2.71	<0.001
6 months	83.220 ±2.2652	(-)44.64 ± 2.18	<0.001
Table-3: Showing changes in KOOS Score			

TAL	Patients; N=20		
	Mean± SD	Mean Difference from Baseline ± SD	p value from Baseline
Pre op	1.05 ± 0.605		
2 wks	1.25 ± 0.639	(-)0.2 ± 0.41	0.042
6 wks	1.40 ± 0.598	(-)0.35 ± 0.49	0.005
10 wks	1.95 ±0.510	(-)0.90 ± 0.72	<0.001
16 wks	3.65 ±0.489	(-)2.6 ± 0.68	<0.001
6 months	4.60 ±0.503	(-)3.5 ± 0.76	<0.001
Table-4: Showing changes in TAL Score			

Traditionally in orthopaedics, 100 indicate no problems and 0 indicates extreme problems. The normalized score is transformed to meet this standard. Following are the formula used for each subscale.

S. No.	Subscale	Formula
1	Pain	100- Total score P1-P9 x 100/36
2	Symptoms	100- Total score S1-S7 x 100/28
3	ADL	100- Total score A1-A17 x 100/68
4	Sport & REC	100- Total score SP1-SP5 x 100/20
5	QOL	100- Total score Q1-Q4 x 100/16

TAL score

Score is given between level 10 and level 0. Level 10 is indicated by activities showing for various Competitive sports like soccer, football, rugby etc. and level 0 is marked by Sick leave or disability pension because of knee problems in TAL score.

Patient is important stakeholder in modern health care setup demanding individual assessment of outcome after surgical intervention on patient-derived subjective assessment of symptoms and function. The present study has assessed outcome on basis of three PRO instruments i.e. IKDC score, KOOS score and TAL score. First study to find out the ability of

Knee-specific health quality of life instruments in ACL tear was published by Tanner et al.[13] In their results, it was observed that 72% of the items in the IKDC were endorsed by 51% of patients compared with only 45% for the KOOS. Patients who have undergone ACL reconstruction tends to experience fewer symptoms and disabilities in comparison of articular cartilage repair population.[14]

In present study, outcome after ACL surgical reconstruction were assessed for non-athletes. IKDC is statistically highly significant at 2 weeks, 6 weeks, 10 weeks, 16 weeks and 6 months follow up (p< 0.001). KOOS is statistically highly significant at 2 weeks, 6 weeks, 10 weeks, 16 weeks and 6 months follow up (p< 0.001). TAL is statistically highly significant at 10 weeks, 16 weeks and 6 months follow up (p< 0.001). These results are comparable to previous studies done by various authors for reconstructed ACL injuries.[15-20]

One patient had anterior knee pain which was relieved by physiotherapy and oral analgesics. One case was noted with superficial infection which was healed with antibiotics, one patient was reported with hardware prominence (at tibial post) which was taken out at 6 months post-op. Some other complications also reported in literature like infection, bacterial arthritis of the knee, embolus of the popliteal artery and a fatal pulmonary embolism. There can also be complaints at the harvest place of the transplant, such as a patella fracture and localized pressure pain.[21-25]

In first 5 years, 6% of the patients showed secondary ACL rupture after an ACL reconstruction surgery, sport intensity being most important predictor specifically for the first year. There is high probability of damage to knee after ACL rupture. The risk for knee osteoarthritis within 10 to 15 years after the initial trauma is tenfold.[61] No such complication was seen in our study. However our study was short term study and sample size was small so results may be differ in large sample size and long term follow up.

The aim of each individual knee instability treatment is to restore the homeostasis of this joint as much as possible. This will enable each patient to undertake the previous activities before ACL tear. At present it is still unclear which individual will benefit most with operative or conservative treatment. This study shows that an ACL reconstruction is a good operation to stabilize the knee.

This study was randomised controlled prospective study and evaluating patients were treated by a single surgeon at a single centre, means that there was consistency in surgical technique and implant use in the study. These are the strengths of present study. The limitation of our study is that our study had small sample size and short-term follow up so results may be differ in a large size sample and a long term follow-up.

CONCLUSION

The IKDC, KOOS and TAL are PRO measures that are increasingly being used for measuring outcome after ACL reconstruction surgery. The present study was designed to assess the outcome after anterior cruciate ligament reconstruction and structured rehabilitation. IKDC and KOOS was statistically highly significant at 2 weeks, 6 weeks, 10 weeks, 16 weeks and 6 months follow up (p< 0.001). TAL was statistically highly significant at 10 weeks, 16 weeks and 6 months follow up (p< 0.001).The selection of a PRO measures should be based upon study aims and target population. Further research is required to assess the effect of the postoperative process and to evaluate these findings with respect to clinical and functional outcome prediction and long-term health prognostics.

REFERENCES

1. Spindler KP, Warren TA, Callison JC Jr, Secic M, Flescish SB, Wright RW. Clinical outcome at a minimum of five years after reconstruction of the anterior cruciate ligament. J Bone Joint Surg Am. 2005; 87:1673-1679.
2. Spindler KP, Wright RW. Anterior cruciate ligament tear. N Engl J Med. 2008;359:2135-2142.
3. Lohmander LS, Englund PM, Dahl LD, Roos EM. The long –term consequence of anterior cruciate ligment and meniscus injuries: osteoarthritis. Am J Sports Med. 2007; 35:1756-1769.
4. Miyasaka KC, Daniel DM, Stone ML. The incidence of knee ligament injuries in the general population. Am J Knee Surg. 1991;4:43-48.
5. Zysk SP, Refior HJ. Operative or conservative treatment of the acutely torn anterior cruciate ligament in middle-aged patients. A follow-up study of 133 patients between the ages of 40 and 59 years. Arch Orthop Trauma Surg. 2000;120:59-64.
6. Frobell RB, Lohmander LS, Roos EM. Anterior cruciate ligament injury of the knee into a randomized clinical trial comparing surgical and non-surgical treatment. Contemp Clin Trials. 2007;28:295-302.
7. David O, Draper, Shane S. Schulthies PT. Examiner

proficiency in performing the anterior drawer and Lachman Tests. J Ortho Sports and Physical Therapy. 1995;22:263-266.

8.   Buss DD, Min R, Skyhar M, Galinat B, Warren RF, Wickiewicz TL. Non-operative treatment of acute anterior cruciate ligament injuries in a selected group of patients. Am J Sports Med. 1995;23:160-165.

9.   Roos EM, Roos HP, Ekdahl C, Lohmander LS. Knee injury and Osteoarthritis Outcome Score (KOOS)-validation of a Swedish version. Scand J Med Sci Sports. 1998;8:439-448.

10. Irrgang JJ, Ho H, Harner CD, Fu FH. Use of the International Knee Documentation Committee guidelines to assess outcome following anterior cruciate ligament reconstruction. Knee Surg Sports Traumatol Arthrosc. 1998;6:107-114.

11. Tegner Y, Lysholm J. Rating systems in the evaluation of knee ligament injuries. Clin Orthop Relat Res. 1985;198:43-49.

12. Meuffels DE, Favejee MM, Vissers MM, Heijboer MP, Reijman M, Verhaar JA. Ten year follow-up study conservative versus operative treatment of anterior cruciate ligament ruptures. A matched – pair analysis of high level athletes. Br J Sports Med. 2009;43: 347-351.

13. Tanner SM, Dainty KN, Marx RG, Kirkley A. Knee-specific quality-oflife instruments: which ones measure symptoms and disabilities most important to patients? Am J Sports Med. 2007;35:1450-1458.

14. Hambly K, Griva K. IKDC or KOOS? Which measures symptoms and disabilities most important to postoperative articular cartilage repair patients? Am J Sports Med. 2008;36:1695-1704.

15. Clancy WG, Ray JM, Zoltan DJ. Acute tears of the anterior cruciate ligament. Surgical versus conservative treatment. J Bone Joint Surg Am. 1988;70:1483-1488.

16. Daniel DM, Stone ML, Dobson BE, Fithian DC, Rossman DJ, Kaufman KR. Fate of the ACL-injured patient. A prospective outcome study. Am J Sports Med. 1994; 22: 632-644.

17. Casteleyn PP, Handelberg F. Non-operative management of anterior cruciate ligament injuries in the general population. J Bone Joint Surg Br. 1996;78:446-451.

18. Maletius W, Messner K. Eighteen- to twenty-four-year follow-up after complete rupture of the anterior cruciate ligament. Am J Sports Med. 1999;27:711-717.

19. Nebelung W, Wuschech H. Thirty-five years of follow-up of anterior cruciate ligament-deficient knees in high-level athletes. Arthroscopy. 2005;21:696-702.

20. Ait Si Selmi T, Fithian D, Neyret P. The evolution of osteoarthritis in 103 patients with ACL reconstruction at 17 years follow-up. Knee 2006;13:353-358.

21. Van Tongel A, Stuyck J, Bellemans J, Vandenneucker H. Septic arthritis after arthroscopic anterior cruciate ligament reconstruction: a retrospective analysis of incidence, management and outcome. Am J Sports Med. 2007;35:1059-1063.

22. Allum R. Complications of arthroscopic reconstruction of the anterior cruciate ligament. J Bone Joint Surg Br. 2003;85:12-16.

23. Janssen RP, Sala HA. Embolism of the popliteal artery after anterior cruciate ligament reconstruction: a case report and literature review. Knee Surg Sports Traumatol Arthrosc.2007;15:1449-1451.

24. Janssen RP, Sala HA. Fatal pulmonary embolism after anterior cruciate ligament reconstruction. Am J Sports Med. 2007;35:1000-1002.

25. Salmon L, Russell V, Musgrove T, Pinczewski L, Refshauge K. Incidence and risk factors for graft rupture and contralateral rupture after anterior cruciate ligament reconstruction. Arthroscopy. 2005;21:948-957.