

Does Preoperative Rehabilitation give Better Short Term Results in Anterior Cruciate Ligament Reconstruction?

D.V.S. Reddy, S.U. Kamath, R. Annappa, S.L. Krishnamurthy, K. Kamath & S. Mallya

Abstract

Introduction: To compare the results of preoperative rehabilitation group and standard rehabilitation protocols in anterior cruciate ligament reconstruction in a day care unit.

Materials and Methods: 41 patients with anterior cruciate ligament tear were randomly assigned to either standard or preoperative rehabilitation group. Follow up done after 3, 6, 12 and 24 weeks after reconstruction. Outcome measures included, Lysholm score, IKDC scale and range of motion. Data analysed with SPSS software version 13.1. A probability level of $p < 0.05$ was considered significant.

Keywords: Anterior cruciate ligament tear; Arthroscopic reconstruction; Preoperative rehabilitation.

Authors' Addresses: Kasturba Medical College, Mangalore, Manipal Academy of Higher Education, Manipal, Karnataka, India.

Corresponding Author: S U Kamath, Department of Orthopaedics Kasturba Medical College, Mangalore, Manipal Academy of Higher Education, Manipal, Karnataka, India.

Email: surendra.kamath@manipal.edu

Results: Out of 41 patients, 21 patients were under standard and 20 were under preoperative group. There was significant difference in range of motion at 3 and 6 weeks in preoperative rehabilitation group compared to standard group but no difference at 3 and 6 months.

Conclusion: Rehabilitation before surgery is advocated to improve the early functional outcomes at 3 and 6 weeks.

Introduction

Anterior cruciate ligament (ACL) is injured commonly in athletes involved in pivoting sports [1]. Arthroscopic ACL reconstruction is the standard treatment of care offered in these patients as a day care and restores knee anatomy and stability. The timing of surgery after injury and preoperative knee function is often evaluated for optimal postoperative results. Postoperative rehabilitation under guidance of an orthopaedic surgeon and trained physiotherapist is key to return to sports. There have been great advances in recent years in postoperative rehabilitation after ACL reconstruction [2]. Aggressive rehabilitation has been employed these days to improve the functional outcome with stress being laid on, not only on post-operative rehabilitation but also on an aggressive preoperative rehabilitation which has been well documented in the various studies and research articles. Preoperatively an exercise program is done to prepare the patient under reconstruction surgery for improved outcomes. [3]

Preoperative quadriceps strength correlates with postoperative functional outcomes in ACL reconstruction. Preoperative exercise program results in improved quadriceps strength and better single leg hop distance compared to patients who did not do any exercises preoperatively [4,5]

The aim of this study was to compare the results with or without preoperative rehabilitation followed by standard rehabilitation protocols in ACL reconstruction.

Material and Methods

The present prospective randomised study was conducted at our institution, from June 2014 to June 2017. Ethical clearance was obtained before the start of the study. A total of 41 patients were included in this study. Patients between 18 to 50 years of age who presented with clinical evidence of ACL deficiency and underwent reconstruction were included in the study. All patients were examined in outpatient department. A thorough history was taken and knee

examined clinically and documented. Associated injuries of meniscus & collateral ligaments were looked for and documented. X-ray of affected knees was taken to rule out any fractures. MRI was done to confirm the diagnosis. Patients who were randomly assigned into standard rehabilitation program were named Group S and those in preoperative group were named Group P. For Group S patients exercises were started only after the surgical procedure. Group P patients were taught exercises which they had to do at home for 3 weeks and later immediately after surgery. Surgical treatment was arthroscopic ACL reconstruction with quadrupled hamstring graft fixed with endobutton on femoral side and interference screw in the tibial tunnel. On the first post-operative day, exercises were started as per rehabilitation protocol. We emphasized the need about rehabilitation and need for regular follow-up at the time of inclusion into study. Given below are the two types of rehabilitation protocols that have been adopted (Table 1).

Assessment of functional outcome was done at 3 weeks, 6 weeks, 3 months, 6 months. Evaluation is based upon Lysholm scale and International Knee Documentation Committee (IKDC) subjective knee form [7]. Initial subjective scoring is done using Lysholm scoring system. It is a subjective scoring based on questionnaire containing- support (5 points), limping (5 points), restraining (20 points), instability (25 points), pain (25 points), climbing stairs (10 points), squatting (5 points), swelling (10 points). It is calculated as a score of 100 based upon the patient answers.

IKDC form is one page of documentation has a qualification section, & an evaluation section. The IKDC has been shown to be reliable and valid for a number of pathologies, including ACL injury, meniscal injury, articular cartilage injury, patella-femoral pain syndrome, and knee osteoarthritis. The IKDC represents a clear and concise assessment tool for knee-related research that can be applied across pathologies and population characteristics. The documentation section is for recording patient's name, age, and record number, date of examination, date of injury, cause of injury, side involved and diagnosis. The major part of sheet consists of qualification section.

Table 1 Rehabilitation Protocol followed in both groups.

<p>Preoperative rehabilitation^{6,10}</p> <p>This includes preoperative rehabilitation and standard regimen after surgery.</p> <p>Pre-operative phase</p> <ul style="list-style-type: none"> • Quadriceps strengthening exercises • Mini Squats • Straight leg raising • Hamstring stretches • Ankle pumps • Ice application after exercises <p>Goals:</p> <ul style="list-style-type: none"> • To decrease pain, swelling and inflammation. • Restore range of motion (ROM). • Restore muscle strength. <p>Standard Rehabilitation</p> <p>Post-operative till 3 weeks:</p> <ul style="list-style-type: none"> • Knee in Motion control brace (MCB) with extension locked at 300 increased every week by 300. • Knee flexion in brace till tolerated. • Isometric quadriceps strengthening exercises • Hamstring stretches • Straight leg raising exercise • Ankle pumps • Full weight bearing as tolerated with brace locked in full extension. • Ice application after exercises. 	<p>Goals:</p> <ul style="list-style-type: none"> • To relieve pain, swelling and inflammation due to surgery. • Knee ROM 0° - 100°. • Good quadriceps contraction. <p>3 weeks to 6 weeks:</p> <ul style="list-style-type: none"> • Previous exercises plus • Weight bearing allowed as earlier • Knee in brace with full flexion and extension as tolerated. • Hamstring squats • Hamstring curls • Side to side walking. • Ice application after exercises. <p>Goals:</p> <ul style="list-style-type: none"> • Full range of flexion and extension. • Maximize muscle strength. <p>6 weeks to 3 months:</p> <ul style="list-style-type: none"> • Continue above exercises. • Brace free full weight bearing mobilization. • Knee mobilization full range • Hip abduction & adduction • Hip flexion & extension • Lateral lunges • Cycling • To walk on toes. • Stair climbing. • Backward walking.
<p>3 months to 6 months:</p> <ul style="list-style-type: none"> • Continue all exercises • Stair climbing. • Backward walking. • Running 	<p>Goals:</p> <ul style="list-style-type: none"> • Full range of movements. • Maximum muscle strength. • Return to sports. <p>6 months to 1 year:</p> <ul style="list-style-type: none"> • Continue all exercises

Each parameter is qualified as normal, near normal, abnormal, severely abnormal. The parameters are incorporated in problem areas which are 1. Range of motion, 2. Ligament examination, 3. Compartmental findings, 4. Harvest site pathology, 5. X-ray findings.

Statistical Analysis

A prior statistical power analysis was performed and sample size of 20 in each group was estimated. For comparison between groups Independent t test was used and Mann-Whitney test was used when parametric assumptions were not fulfilled. Data was analysed with SPSS software version 13.1. A probability level of $P < 0.05$ was used to show statistical significance.

Results

A total of 41 patients with ACL tear were included in the study out of which 21 (51.2%) patients were under standard group and 20 (48.8%) were under preoperative group. The mean age under standard group was 27.48 years and under preoperative group was 28.17 years. There were 38 (92.7%) males and 3 (7.3%) females. In group S among 21 patients 19 (90.5%) were males and 2 (9.5%) were female. In group P among 20 patients 19 (95%) were males and 1 (5.0%) was female. In this study majority of injuries were related to sports injuries (73.1%) and 14.6% were related to road traffic accidents. In group S 13 patients were affected on right side and 8 on left side. In group P among 20 patients 10 were right and 10 were left side. 22 (53.6%) patients had meniscal injury. Medial meniscal tear noted in 15 (36.6%) and lateral meniscus in 7 patients (17.1%).

The mean Lysholm score pre-operative in group S was 78.809 and group P was 80.412 which was not statistically significant. But the mean score was better in group P at 3 and 6 weeks as compared to group S. There was no statistical significance in Lysholm score between two groups. The difference between the scores decreased at 3 and 6 months (Table 2, Figure 1).

Table 2 Comparison of Lysholm score between two groups.

	Group 1	Group 2	t test, p value*
PRE Operative	79.809	80.412	0.611:Not Significant
3 Weeks	82.476	86.312	0.416:Not Significant
6 Weeks	86.333	90.109	0.509:Not Significant
3 Months	92.428	93.856	0.586:Not Significant
6 Months	97.761	98.558	0.462:Not Significant

Range of Motion: Is a component of IKDC knee rating system which has both subjective and objective components. In range of motion – lack of extension and lack of flexion are estimated. Estimated as Normal, Nearly normal, Abnormal and severely abnormal depending on loss of movements. In our study before surgery in group S, 9 (42.9%) patients had ‘normal’ (IKDC Grade I) knee extension and 12 (57.1%) had ‘nearly normal’ (IKDC Grade II) whereas group P had 11 (55%) patients normal and 9 (45%) near normal knees. At 3 weeks in standard group 6(28.6%) patients had abnormal (grade III) and 15 (71.4%) were nearly normal and in preoperative group, 2 (10%) had abnormal and 18 (90%) had near normal which was statistically

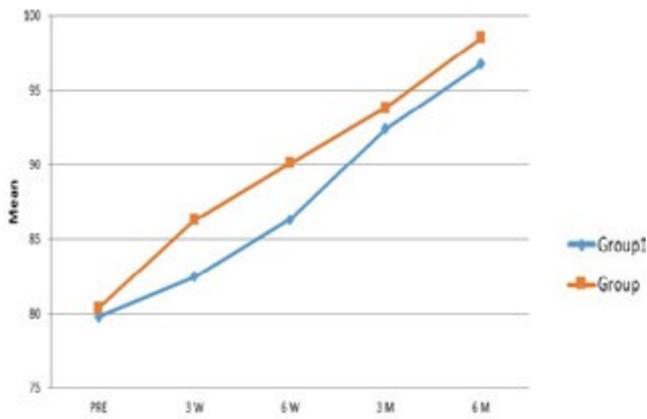


Figure 1 Lysholm scores in both groups.

significant ($p = .014$). At 6 weeks knee extension was nearly normal in 10 (47.6%) and normal in 11 (52.4%) patients in standard group whereas it is 4 (20%) and 16 (80%) in preoperative group which was statistically significant ($p = 0.037$) between two groups. At 3 months all were normal in preoperative group whereas 95.2% were normal in standard group and 4.8% had near normal. At 6 months all had normal knee extension. At start of our study 71.45% of group S and 85% of group P patients had grade II (16-250) lack of flexion. Immediate post-operative analysis showed 'severely abnormal' (Grade IV) knee in all groups of patients. At 3 weeks among standard group, 13 (61.9%) patients had grade IV (>250) whereas in preoperative group it was only 8 (40%). This improvement in preoperative group was statistically significant ($p = .0017$). At 6 weeks follow up knee flexion in preoperative group was improved to abnormal in 1 (5%), nearly normal in 11 (55.0%) and normal in 8 (40.0%). This was not statistically significant between two groups. Further analysis of the results showed relative improvement in the grade in preoperative group over the standard group at 3 months and 6 months, however this improvement was not statistically significant. By the end of 6 months all patients had normal knee flexion.

Lachman Test: There was no statistical significant difference between two groups (Table 3, Figure 2). At the end of 6 months 90.6% of patients in both group S had grade I (1-2mm) and 9.4% had group II (3-5mm) and 95% in group P had grade I and 5% had grade II.

Table 3 Lachman test comparison between two groups.

Lachman test	p value*	Significance
Preoperative	0.821	NO
3 Weeks	0.867	NO
6 Weeks	0.898	NO
3 Months	0.969	NO
6 Months	0.969	NO

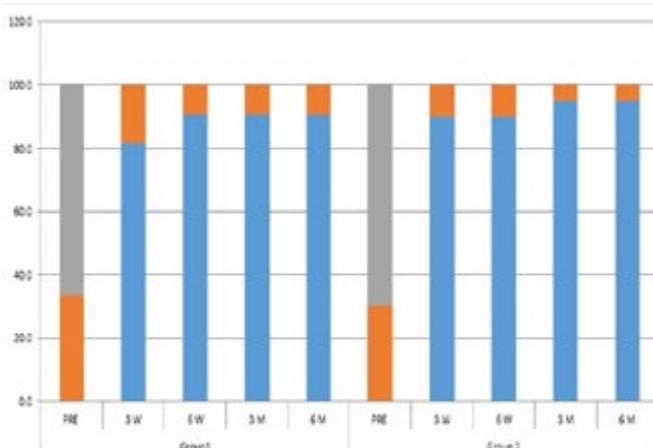


Figure 2 Lachmann test results.

Harvest Site Pathology at 3 weeks 61.9% of patients in standard group 39.1% had grade II and had grade I whereas in group P, 70% had grade I and 30% had grade II. At 6 weeks 90.6% of patients in standard group had grade II and had 9.4% grade I whereas in other group, 95% had grade I and 5% had grade II. By the end of 6 months 20 patients in standard group had grade I and 1 patient grade II whereas in group P all patients had grade I.

Complications in our study were 1 (2.4%) patient standard group had infection following reconstruction for which arthroscopic lavage and parenteral antibiotic administration needed. 2 (4.8%) patients had harvest site infection which was superficial skin infection healed by 3 weeks. One (2.4%) patient had re-rupture in the same knee after 1 year of reconstruction.

Discussion

The success of reconstructing anterior cruciate ligament is not just placing graft in anatomic location but, in turn help patients succeed in activities which they demand. The goals of preoperative rehabilitation is to decrease pain, swelling, eliminate antalgic gait, restore range of motion, improve muscle strength and neuromuscular control. This helps in preparing the patient for surgery and better post-operative outcomes. [9, 10] Better IKDC and Knee injury and Osteoarthritis Outcome Score (KOOS) scores were found in preoperative rehabilitation group and higher return to sport rates 2 years after ACLR in study of international cohort with preoperative rehabilitation with neuromuscular training and without preoperative rehabilitation [11]. A 4 week rehabilitation program before surgery significantly improved knee extensor muscle strength post-operatively and improved knee function, improving single-legged hop test (SLHT) distance [5]. Age, preoperative rehabilitation, full knee extension and neuromuscular control are factors which influence postoperative recovery and return to play in athletes following ACL reconstruction. Preoperative rehabilitation improves ROM which reduces the risk of arthrofibrosis postoperatively. Aggressive preoperative rehabilitation is advised in athletes for early gain of motion and early surgery [10].

Although there is differing opinion regarding the optimal preoperative rehabilitation program and time before surgery, few studies have highlighted these aspects. Twenty volunteers who had gym and home based rehabilitation program for 6 weeks resulted in SLHT test results and Quadriceps strength with better muscle cross sectional area in MRI an self-assessment using the modified Cincinnati scores [12]. Even though there has been no conclusion on aspect of rehabilitation for consideration (progressive strengthening, neuromuscular training) patients should be given exercises more than just quiet knee ie painless knee, complete range of motion with quadriceps activation [11-15].

In a review of more than 500 studies with 8 studies meeting inclusion criteria it was found that preoperative rehabilitation was beneficial to patients undergoing ACLR with better outcomes, better knee related function and improved muscle strength [16]. A review of literature suggests patients with a 3 to 6 weeks of rehabilitation results in better quadriceps activation and functional outcomes. Although there is no optimal preoperative functional level suggested it is recommended that patients should attain limb symmetry index (LSI) of 90% and hop performance before surgery [4, 5, 13, 14, 15].

The patients will be accustomed to the exercises in preoperative group and continue after surgery and were ahead of standard group who had to start exercises after surgery. The compliance to exercises in preoperative group it was better at 3 weeks than standard group. So it is to emphasise pre-operative exercise regimen to improve the early results after surgery such that patient rehabilitation is faster and early return to sporting activities. Hence accelerated rehabilitation can be

implemented to young athletics who can return to sports early.

Limitations of our study: The sample size was small. A larger sample size and return to sports assessment would have added more details to the study. During the rehabilitation program, we had problems in calculating regarding the number of physical therapy visits and time spent at the rehabilitation facilities. This was only a short time outcome requires further follow up at 1 and 2 years to evaluate the long term functional outcomes. Further studies are required to assess the duration of rehabilitation required and precise exercises to be done before surgery.

Conclusion

By this study we can conclude that early rehabilitation before surgery is advocated to improve the early functional outcomes at 3 and 6 weeks.

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