

ORIGINAL RESEARCH

**A STUDY ON ANTERIOR CIRCULATE LIGAMENT
RECONSTRUCTION USING BONE GRAFT WITH MINI
ARTHOTOMY TECHNIQUE**

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ABSTRACT

Background: Lacerations of anterior cruciate ligament (ACL) ligament in the knee is the supreme cause of ineptitude in sports like athletics, football, volleyball, rugby etc. owing to various multidirectional strain full movements. Bulk of patients electing for surgery to revamp and easy return back to their routine. Despite of their complications like graft rupture, residual laxity, and donor-site morbidity, conventional methods of ACL reconstruction is the gold standard procedure. There is therefore a requirement for further research into newer, innovative surgical techniques which can decrease complication rates. The goals of the ACL reconstruction are to restore stability to the knee; easy return back to regular activities and to delay the onset of osteoarthritis with associated recurrent injuries to the articular cartilage and loss of meniscal functions. This study is to compare the results of ACL Reconstruction using Bone-Patellar-Bone by means of Miniarthrotomy technique.

Materials and Methods: This study was conducted in Narayana Medical College/Hospital, at from May 2020 to May 2022. During this period 60 cases of adult patients with ACL deficiency were selected according to the inclusion criteria. Prospective Study of ACL Reconstruction using Bone-Patellar-Bone grafts by Miniarthrotomy technique in terms of Post-operative knee stability, Subjective Knee functions, Patient satisfaction, Graft site morbidity, Range of motion. In this study, an effort was made to weigh the advantages over arthroscopic approach.

Results: A total of 60 patients were seen and treated. In the present study mean age group was 28.2 ± 4.5 years. 50.11% of patients were with ACL tear alone, about 65.01% of the study subjects were undertook ACL reconstruction along with part

meniscectomy. At the time of 1.5 year follow up, 93.33% had lack of flexion of less than 5 degrees. The anterior drawer's test during follow up at 1.5 year 98.33% showed 0-2 mm after 1.4 year follow up. The IKDC score at 1.5 year follow up showed predominantly 98.33% patients were fell grade B followed by 5.01% and 1.66% of cases were under grade A and grade C respectively. Lachman's test at the end of 1.5 years follow up 96.66% subjects showed 0-2 mm displacement and 3.33% showed 3-5mm displacement. At 1.5 year follow up, none of the patients had shown any pathological findings. About 93.33% had shown 90% of functional hop test results and 51.66% of the subjects were with 77 – 90 indicates significant statistical difference between pre and post-operative Lysholm scores. Follow up arthroscopy showed a stable ligament at 1.5 year follow up. While follow up X-ray showed mild arthrosis and few complications like infection, calcification of ligament and arthrofibrosis were observed in one patient.

Conclusion: This study is of clinical relevance as it shows alleviation of pain after surgical treatment of the torn ACL which has been described as the stabiliser of the knee and guardian of the Meniscus. This technique allows achieving good self-reported assessments and clinical ligament evaluation up to 1.5 years. Advantages of this technique include safe clinical practice, enables patients to return to preinjury activities including high-risk sports, unlimited bone-to-bone healing, cost effectiveness, avoidance of disadvantages associated with hardware, and ease for revision surgery.

Keywords: ACL, arthrofibrosis, IKDC score, Lachman's test, meniscectomy.

INTRODUCTION

Primary anterior rotatory stabilizer of the knee joint is the anterior cruciate ligament (ACL) which originates from the medial wall of the lateral femoral condyle and inserts onto the intercondylar area of the tibia.^[1,2] Its primary function is to prevent anterior tibial translation on the femur, but it also has a role in averting internal tibial rotation and thus dropping the risk of anterior subluxation of the lateral and medial tibiofemoral components.^[3,4] Usually during a sudden twist when the tensile force of the fibers exceeds bring out partial to complete laceration of ACL. The ACL is the most commonly injured ligament in the knee, with a reported incidence as high as 3% to 15% per 1,000 populations in India and at the rate of 60 per 100,000 people per year in the United States.^[5,6,7] For the past three decades gold standard treatment option for the above is ACL reconstruction, usually with auto graft which could be auto graft, allograft, or synthetic includes patellar tendon, hamstring tendons, quadriceps tendon and others.^[8-14] The decision of selecting appropriate grafts for an individual patient depends upon operating surgeon. The mid third patella–bone tendon auto graft is most preferred for ACL reconstruction because the bone to bone attachment sites provide rapid healing and insertional strength. The initial open surgical techniques of ACL repair fell out of favor due to the limited success and unpredictability of the results and complications like degenerative arthritis,^[15,16] functional instability and a high incidence of meniscal tears,^[17] residual laxity, variable performance outcomes, rupture, and donor-site morbidity.^[18-20] It is therefore necessary to establish innovative techniques in an attempt to overcome these complications which protect the graft during the initial incorporation phase, while the patient can avail accelerated restoration of native anatomy and kinematics of the knee and habitual formal life. During the past decade arthroscopically assisted techniques

have been an accepted method of reconstructing the ACL. The advantages include elimination of capsular incisions, decrease in trauma to the fat pad, avoidance of desiccation of the articular cartilage, better visualization of the femoral attachment, and a lower incidence of post-operative patellofemoral pain than with open reconstruction.^[21]

MATERIALS & METHODS

Study was conducted during the span of 3 years from May 2019 to May 2022. 60 Subjects attending to Department of Orthopedics from Narayana Medical College/ Hospital meeting inclusion and exclusion criteria with ACL deficiency were selected after taking informed, bilingual written consent.

Inclusion criteria: Subjects were included after clinical diagnosis made by positive Lachman, Pivot shift test and anterior drawer test with confirmed ACL tear willing to surgery.

Exclusion criteria: Subjects were excluded presenting contralateral ACL deficiency, bilateral ACL reconstruction, revision ACL surgery, previous knee operation, concomitant extra-articular reconstruction and concomitant medical illness or geographic constraint that precluded follow up evaluations.

Operating procedure: A longitudinal skin incision of about 10 cm made in the patellar tendon midline region. The superficial fillet was mirrored and the medial and lateral ends of the tendon demarcated. The central third of the tendon, about 9 mm in width, was abolished with bone plugs at both ends. A miniarthrotomy was then executed and the underlying fat and synovium being incised in sagittal direction and the intercondylar area unveiled. Later notchplasty was conducted so that the osseochondral junction at the posterior inlet of the femoral notch could be felt by the finger. A drill guide was used for a precise placement of the femoral and tibial drill holes, since one of the most important parts of the operation was to ensure the accurate anatomical location of the drill holes. The patellar tendon graft was tailored (with the bone plugs at its both ends) into drilled holes and fixed with interference screws, the screws inserted between the plug and bony tunnel. The femoral site was fixed first and before screwing the tibial site the isometric position of the graft was tested by flexing and extending the knee. Finally, the patellar tendon defect was closed with stitches.

RESULTS

Table 1: Age and gender wise distribution of subjects

Age group	Male	Female	Total
< 20 years	5 (8.33%)	3 (5.1)	8 (13.33)
21 – 30 years	17 (28.33%)	9 (15.12)	20 (33.33)
31 – 40 years	9 (15.12%)	6 (10.16%)	16 (26.66%)
> 40 years	6 (10.11%)	5 (8.33%)	16 (26.66%)
Total	37 (61.66%)	23 (38.33%)	60 (100%)
Mean ± SD	32.10 ± 6.36	23.31 ± 5.6	28.2 ± 4.5
t value	1.873		
p value	0.001, S		

In the present study mean age group was 28.2 ± 4.5 years. The mean age was 32.10 ± 6.36 and 23.31 ± 5.6 years in male and females respectively. About 17 (28.33%) of the males and 9 (15.12) of the females belonged to 21 – 30-year age group shown significant correlation between age and gender distribution of incidence with p value of 0.001. [Table 1]

Table 2: Duration since injury in the study group

Duration since injury	Frequency	Percent
< 3 months	36	60.01%
3 – 6 months	15	25.21%
6 months – 1 year	9	15.1%
Total	60	100.0%

Majority of the subjects were reported to hospital with duration of injury was less than 3 months is 60.0%, 25.24% of the patients had injury 3 – 6 months back and 15% belonged to 6 months – 1 year. [Table 2]

Table 3: Diagnosis in the study group

Diagnosis	Frequency	Percent
ACL tear	30	50.11%
ACL + Anterior horn of Medial meniscus tear	19	31.66%
ACL + Lateral meniscus tear	7	11.66%
ACL + Medial meniscus tear	4	6.62%
Total	60	100%

As evident from [Table 3] dominantly 50.11% of patients were with ACL tear alone, followed by 31.66% patients had ACL along with anterior horn of Medial meniscus tear, 11.66% of the patients had ACL with tear of Lateral meniscus tear and 6.62% had ACL with medial meniscus tear.

Table 4: Procedure for repair of ACL tears in the study group

Procedure	Frequency	Percent
ACL reconstruction PTB + Part meniscectomy	39	65.01%
ACL reconstruction PTB	21	35.01%
Total	60	100%

The [Table 4] above shows that about 65.01% of the study subjects were undertook ACL reconstruction along with part meniscectomy. And rest of 35.01% underwent ACL reconstruction.

Table 5: Lack of flexion in the study group

Lack of flexion	6 months	1.5 years
< 5 deg	29 (48.33%)	56 (93.33%)
6 – 15 deg	18 (30.01%)	3 (5%)
16 – 25 deg	13 (21.66%)	1 (1.65%)
Total	60 (100%)	60 (100%)

Distribution of the study group in terms of lack of flexion shown about 48.33% of the patients had lack of flexion with less than 5 degrees at the time of 6th month follow up, 30.01% had 6 – 15 degrees of lack of flexion and 21.66% had 16 – 25 degrees. At the time of 1.5 year follow up, 93.33% had lack of flexion of less than 5 degrees, 5% had 6 – 15 degrees and only 1.65% shown 16-25 degrees of lack of flexion. [Table 5]

Table 6: Anterior drawer test in the study group

Anterior drawer test	6 months	1.5 years
0 - 2	48 (80%)	59 (98.33%)
3 – 5	12 (20%)	1 (1.66%)
Total	60 (100%)	60 (100%)

Outcome of anterior drawer's test during follow up was showed 80% had displacement of 0 – 2 mm and 20% had displacement of 3 – 5 mm. at the end of 6th month post-surgery and 98.33% shoed 0-2 mm of displacement and 1.66% had 3 – 5 mm. after 1.4 year follow up.

Table 7: IKDC subjective assessment in the study group

IKDC	6 months	1.5 years
A	5 (8.33%)	3 (5.01%)
B	51 (85.11%)	56 (98.33%)
C	4 (6.66%)	1 (1.66%)
Total	60 (100%)	60 (100%)

At 6th month post-surgery follow up, the International Knee Documentation Committee (IKDC) self- assessment grading for all the patients majorly 85.11% patients fall in to grade B followed by 8.33% of grade A and 6.66% of subjects fall in to grade C. The IKDC score at 1.5 year follow up showed predominantly 98.33% patients were fell grade B followed by 5.01% and 1.66% of cases were under grade A and grade C respectively. [Table 7]

Table 8: Lachman's test in the study group

Lachman's test	6 months	1.5 years
0 - 2	50 (83.33%)	58 (96.66%)
3 – 5	10 (16.66%)	2 (3.33%)
Total	60 (100%)	60 (100)

At the end of 6 months after surgery, 83.33% of the patients had shown 0–2 mm of displacement and 16.66% had shown 3 – 5 mm of displacement with Lachman’s test. At the end of 1.5 years 96.66% showed 0-2 mm displacement and 3.33% showed 3-5mm displacement.

Table 9: Graft site pathology in the study group

Graft site pathology	6 months	1.5 years
None	52 (86.66%)	60 (100%)
Mild	8 (13.33%)	0 (0%)
Total	60 (100%)	60 (100%)

Graft site pathology assessment in present study showed that mostly 86.66% of patients were without any pathological signs and about 13.33% of subjects showed mild graft site pathology at the end of 6th month follow up and at 1.5 year follow up, none of the patients had shown any pathological findings. [Table 9]

Table 10: Functional hop test in the study group

Functional hop test	6 months	1.5 years
> 90%	49 (81.66%)	56 (93.33%)
76 – 89%	11 (18.33%)	4 (6.66%)
Total	60 (100%)	60 (100%)

About 81.66% of the patients had shown hop test of more than 90% at the end of 6th month and 18.33% had 76 – 89%. At 1.5 years follow up, 93.33% had shown 90% of functional hop test results and only 6.66% had 76 – 89% of activity. [Table 10]

Table 11: Lysholm scores in the study group

Lysholm score	Pre-operative n (%)	Post-operative n (%)
< 60	47 (78.33%)	0 (0%)
60 – 76	12 (20%)	6 (10.10%)
77 – 90	1 (1.66%)	31(51.66%)
> 91	0 (0%)	23 (38.33%)
Mean ± SD	36.14 ± 12.26	86.99 ± 19.42
t value p value	- 6.251 0.001 S	

The mean Lysholm score during pre-operative period was 36.14 ± 12.26 during pre-operative stage and 86.99 ± 19.42 during post-operative period. About 78.33% of the patients had Lysholm score of less than 60 and 20% of the patients had Lysholm score of 61 – 76 and 1.66% of the subjects showed >91 of Lysholm score during pre-operative period. The Lysholm score during post-operative period none of the patients showed < 60, 51.66% of the subjects were with 77 – 90 Lysholm score followed by 38.33% of the patients had a score of

> 90 and 10.10% had 60-76 Lysholm score indicates significant statistical difference between pre and post- operative Lysholm scores. [Table 11]

DISCUSSION

Earlier studies reported that the mini arthroscopy technique was easier than arthroscopic method and doesn't involved any sophisticated instrumentation. Even the technique could be used by a surgeon in his initial stages of learning. They encountered no complications in the procedure. They also recommended as a good option for surgeons who are not well versed with arthroscopic ACL reconstruction or have limited facilities. The comparison between present work and earlier works conformed that there were no differences in proprioception, clinical results and stability between the arthroscopic and the mini arthroscopy technique. [Table 12]

Table 12: Comparison of study results with previous work

Author	Year	Sample no	Conclusions
Daniel M. Benson et al, ^[22]	2021	20	ACL reconstruction with suture tape augmentation using a reduced-size bonepatellar tendonebone autograft. This is a simple and reproducible technique with reduced surgical morbidity and the advantage of a stabilizer to protect the graft while it is incorporating during initial accelerated rehabilitation. Clinical studies are necessary to determine the overall outcomes of this procedure, and we look forward to presenting these as we follow up our patients prospectively over the next 2 years.
L.N. Gakuu et al, ^[23]	2007	25	This study is of clinical relevance as it shows alleviation of pain after surgical treatment of the torn ACL which has been described as the stabiliser of the knee and guardian of the Meniscus.
Wojciech Widuchowski et al, ^[24]	2012	52	ACL reconstruction with patellar tendon autograft fixed to femur with press-fit technique allows achieving good self-reported assessments and clinical ligament evaluation up to 15 years. Advantages of the bone patellar- tendon- bone (BPTB) press-fit fixation include unlimited bone-to-bone healing, cost effectiveness, avoidance of disadvantages

			associated with hardware, and ease for revision surgery. BPTB femoral press-fit fixation technique can be safely applied in clinical practice and enables patients to return to preinjury activities including high-risk sports.
Present study	2022	60	ACL reconstruction with patellar tendon autograft with Mini arthroscopy procedure has many advantages including eliminating the need of displacement of the patella and minimizing the biomechanical disturbance to the patella-femoral joint after operation.

CONCLUSION

ACL reconstruction with patellar tendon autograft with Mini arthroscopy which allows achieving good self-reported assessments and clinical ligament evaluation up to many years and the procedure can be done where arthroscopically assisted ACL reconstruction is not available. The procedure has many advantages including eliminating the need of displacement of the patella and minimizing the biomechanical disturbance to the patella-femoral joint after operation. The avoidance of patellar displacement during operation in combination with good rehabilitation program reduces morbidity, retains full movement, decreases patella femoral pain and prevents muscle wasting. Successful ACL reconstruction performed before significant joint deterioration has occurred can preserve joint function while allowing a resumption of high-level sporting activity.

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