e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(3); 595-599

Original Research Article

ACL Reconstruction with Quadrupled Hamstring Tendon Graft- A Prospective Outcome Study

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Received: 25-12-2023 / Revised: 23-01-2024 / Accepted: 26-02-2024
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Conflict of interest: Nil

Abstract:

Introduction: Anterior Cruciate Ligament (ACL) injury is one of the common sports injuries encountered. It is a very important ligament in knee which contributes to the stability of the knee joint. Reconstructing ACL is essential to prevent early onset osteoarthritis of the knee joint as well as to have better functional outcome. There are numerous autograft options like bone-patellar tendon-bone graft, Hamstring graft and peroneus longus graft with their own merits and demerits. The present study is intended to study the functional outcome following ACL reconstruction with quadrupled hamstring graft**.**

Methods and Materials: Patients with ACL injury and those who have met inclusion and exclusion criteria are included in the study. After thorough pre-op evaluation, the patients are treated with reconstruction of ACL with quadrupled hamstring graft. They are assessed pre-operatively and post-operatively up to 9 months by doing Lachman test, Anterior Drawer test, Pivot shift test and few functional scores like Lysholm knee score and IKDC subjective knee evaluation score. Thus, the functional outcome of knee is assessed**.**

Results: Among the 32 patients, who are included in the study, 28 are males. Right limbs are more commonly involved. In this study, RTA is the most common mechanism of injury. About 10 cases are also associated with meniscal injuries. The average IKDC score among the isolated ACL injury cases is 88.6 and in those associated with meniscal injuries is 86.3. About 75.4% of patients showed better outcome in the study.

Conclusion: Anatomical reconstruction of ACL is key for better functional outcomes in knees with ACL injury. Better functional outcome is seen in isolated ACL injuries compared to ACL injuries with meniscal involvement. ACL reconstruction with quadrupled hamstring graft is one of the reliable methods which provides better results. It is not associated with much donor site morbidity.

Introduction

Anterior Cruciate Ligament (ACL) injury is one of the common injuries around knee joint. The incidence of ACL injuries accounts for about 30-78 per 1,00,000 person-years [1]. ACL injuries constitute about 64% of all the athletic knee injuries [2].

Biomechanically, ACL is the most important ligamentous stabilizer of the knee joint. It prevents the anterior translation of femur on tibia and it also acts as a restraint to valgus and varus forces across the knee joint [2]. Instability following ACL injury is one of the major limiting factors especially in high demand patients [8]. This reflects the importance of ACL reconstruction for the patients to return back to professional/ recreational sports activities. There are various techniques of ACL reconstruction. Bone-patellar tendon- bone graft is one method of ACL reconstruction. It has complications like patellar fracture, weakness of extensor apparatus etc. [10].

There are different options for ACL reconstruction like autografts and allografts. Among the autografts, Quadrupled Hamstring graft is one of the most commonly used graft materials. The study helps to evaluate the functional outcome following ACL reconstruction with quadrupled hamstring graft.

Aim:

To study the functional outcome following ACL reconstruction with quadrupled Hamstring graft.

Materials and methods:

Study population: 32 patients of ACL injury attending tertiary care hospital.

Study duration: 1 year.

Study design: Prospective study.

Inclusion criteria:

1. Patients with radiological evidence of complete ACL tear
2. Patients with normal contralateral knee
3. Patients with normal knee prior to injury
4. Patients with meniscal injury which may or may not require intervention
5. After the acute period of injury
6. Normal knee ROM with no extensor lag

Exclusion criteria:

1. Patients with avulsion fractures of tibial spine
2. Bilateral ACL injuries
3. MCL and LCL injuries requiring surgical management
4. Pre-existing knee pathology

Pre-op evaluation: The cases which presented with knee injury to Emergency department and Orthopaedic OPD are examined as per the ATLS protocol. Local examination of knee is carried out. Lachman test, anterior drawer test and Pivot shift test along with other tests like varus and valgus stress test, Mc Murray's test are also done. Extensor lag is excluded before including the cases into study.

Routine skiagram of both knees in standing position in antero-posterior view and lateral view of the affected knee were taken. MRI of the knee was done to confirm the clinical diagnosis. Diagnostic arthroscopic examination of the knees was used as last resort for patients with negative or equivocal clinical and radiological findings but consistent symptoms suggesting anterior cruciate ligament deficiency.

After appropriate ethics committee approval and consent from the patient, they are included in the study.

Operative procedure:

After routine blood investigations and thorough pre-operative check-up, patients are posted for surgery. Under aseptic conditions and under tourniquet control, Antero Medial(AM) and Anterolateral (AL) portals are made. Diagnostic arthroscopy is done and findings are noted. Meniscal injuries are identified and addressed. Semitendinosus and Gracillis (STG) graft is harvested and prepared. It is quadrupled and sized.

Tibial tunnel: After visualizing the stump at the tibial ACL footprint, with the knee flexed at 90 degrees, an external tibial tunnel drill guide/zig was placed at an angle of 50 degrees in the sagittal plane and 20 degrees in the frontal plane to allow the guide pin to enter intraarticularly in the centre of the tibial ACL stump. The tibial tunnel was drilled over the guidewire with appropriate size reamer as per the graft size.

Femoral tunnel: The medial side of the lateral femoral condyle was also cleared and the posteromedial edge was identified. The femoral footprint was identified and midpoint of the footprint was marked and the guide wire was passed with the knee in maximum flexion through the AMP portal.

The graft was transfixed to femoral tunnel using an endo button. The graft is fixed to the tibia with a titanium interference screw with the knee at 30 degrees flexion.

Compression dressing was done after the surgery**.**

Appropriate post-operative ACL rehabilitation protocol was followed which included isometric quadriceps exercises and assisted knee flexion exercises in 1st post-op week, sitting knee flexion exercises up to 80 degrees in the second post-op week, full weight bearing, stationary cycling, back walking by one-month post-operative period. Patients were followed up till 9 months and were allowed for sport activities.

During the follow-up, the outcomes are assessed using clinical tests like Lachman, anterior drawer tests and knee scores like Lysholm knee score and IKDC subjective knee evaluation score

Results

Among the 32 patients who are included in the study, there are 28 males and 4 females. Right limbs (57%) are more commonly involved than the left. RTA (34.4%), Fall (34.4%) and Sports injuries (31.2%) are the different modes of injuries in decreasing order of frequency. About 10 ACL injuries are associated with meniscal tears, medial meniscus (6), lateral meniscus (2) and both menisci (2). Functional assessment using Lachman test, anterior drawer test, pivot shift test done at the end of 9 months follow-up is tabulated below

Table 1: Anterior Drawer test, Lachman test and Pivot shift test at the end of 9 months

Grade	Anterior Drawer test	Lachman test	Pivot shift test
Grade-0	21 (65.6%)	18(56.2%)	29 (90.6%)
Grade-1	10 (31.2%)	12 (37.5%)	3 (9.4%)
Grade-2	1 (3.1%)	2 (6.2%)	0(0)
Grade-3	0 (0%)	0 (0)	0(0)
P-value	0.77	0.59	0.04

It is also observed that the average IKDC scores in patients with isolated ACL injury (88.6) was better than those associated with meniscal injuries (86.3). Lysholm's scores showed better outcome with 75.3% patients with excellent scores and 21.8% patients with good results.

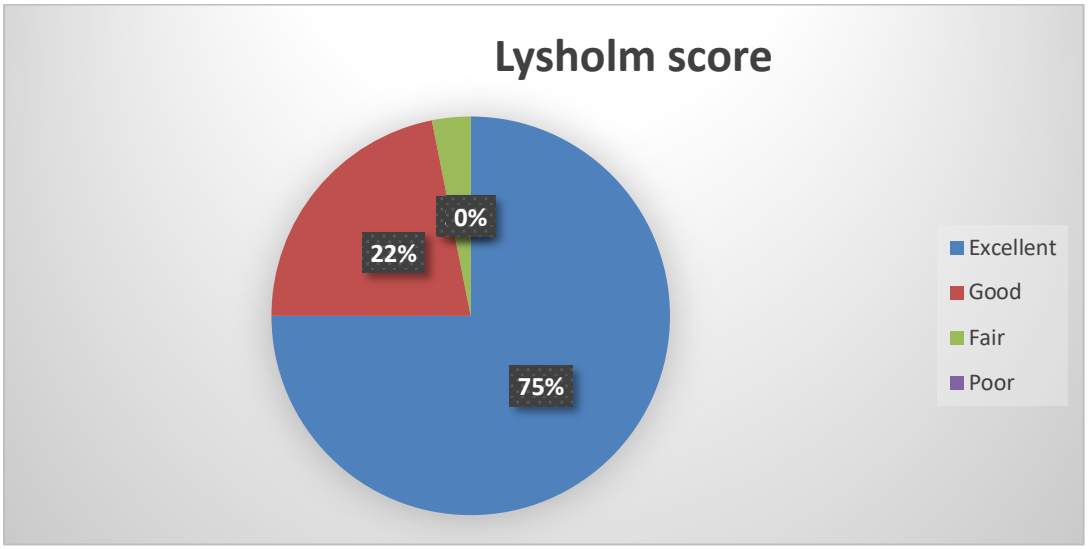

Figure 1: Lysholm scores at the end of 9 months:

Other than 3 cases that had post-operative stiffness of knee, there are no complications in the study. With physiotherapy, the Range of motion of the knee has improved in all of them.

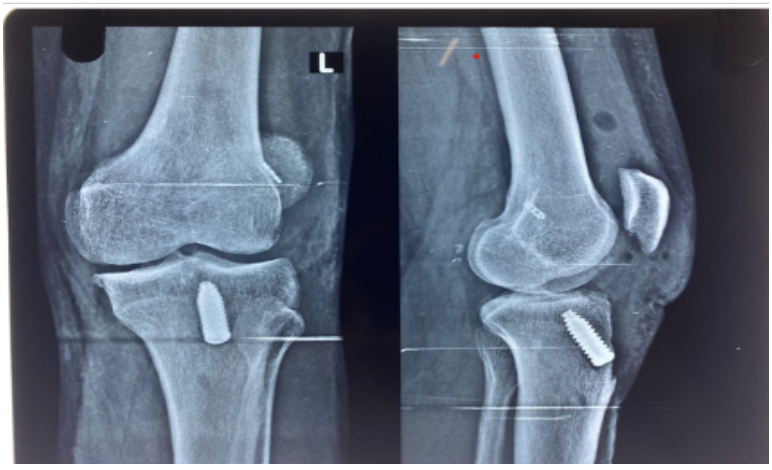

Figure 2: Post-op X-ray

Discussion

ACL is one of the most crucial ligaments of the knee joint, which prevents anterior translation of the knee and counteracts the valgus stress and rotatory forces on the knee. Following ACL tear, anatomic reconstruction of the ACL is the current trend for managing ACL injuries. There is a wide variety of graft choices like autograft, allograft and synthetic grafts. Among the autografts, bone-patellar tendon-bone graft, hamstring graft and quadriceps graft are used.

There are numerous techniques which involve endobuttons, interference screws to provide added stability to the graft. Each one has its unique merits

and demerits. The bone-patellar tendon-bone graft, though offers advantages like better osseous union and earlier healing, better functional outcome in terms of residual laxity than Hamstring graft, it is associated with complications like patellar fracture and anterior knee pain. The quadriceps graft is another option which has advantages like superior biomechanical strength and increased application in revision ACL, it also has disadvantages like anterior knee pain, patellar fracture and patellar tendon rupture [11].

Peroneus longus is also a good option as an autograft for ACL reconstruction. Studies show that there is insufficient evidence to prefer peroneus longus over other autograft options.[12]

In this study, functional outcome following reconstruction with Quadrupled hamstring graft and endobutton is studied. Hamstring tendons have the advantage of minimum donor site morbidity and preserved knee extension compared to bone-patellar tendon-bone graft [9]. About 18% of the patients had associated medial meniscus injuries and 6.3% had lateral meniscus and both menisci involved each, as compared to 53% with medial meniscus injury and 20% with lateral meniscus injuries in the study done by Sudhakar et al [4].

Postoperatively, about 93% of the patients had grade-0 pivot shift test and rest of them had grade-1 pivot shift test in the study done by Anil Kumar Mishra et al [5]. About 96% of patients had grade-0 pivot shift test in the study done by Chodavarapu LM et al [7]. The results of the above study are similar to our study where 90.6% had grade-0 pivot shift test.

Most of the studies used Lysholm score to assess the functional outcome following the surgery. Outcomes in various studies based on Lysholm score is illustrated in Table-2.

Table 2:Outcomes in various studies based on Lysholm score

Lysholm score	Khan MS et al	Sudhakar et al	Chodavarapu LM et al [7]	Anil Kumar Mishra et al	Present study (P-value- 0.56)
Excellent (>90)	30%	27%	72%	45%	75.4%
Good(84-90)	60%	53%	24%	50%	21.9%
Fair (65-83)	10%	13%	4%	5%	3.1%
Poor (<65)	0%	7%	0	0	0

As per the subjective IKDC scoring, the mean score in the present study was around 87.9. The results are similar to those of Charlton et al [6], where, the mean IKDC score was 83.

In that study, the IKDC scores were better in knees not associated with meniscal injuries akin to the present study. The mean IKDC score in study done by Chodavarapu LM et al was 58.7 [7]. There are 3 cases with post-operative knee stiffness, which improved with physiotherapy.

Conclusion:

Anatomical reconstruction of ACL is key for early rehabilitation of the patients with ACL injury. ACL reconstruction with quadrupled hamstring graft using endo button and interference screw is one of the reliable methods of treatment. Though the residual laxity is more compared to bone-patellar tendon- bone graft, the donor site morbidity is less in case of usage of Hamstring tendon quadrupled graft. Better scores are observed in isolated ACL injuries compared to those with associated meniscal injuries. Appropriate physiotherapy and rehabilitation protocols are necessary for better outcome.

Limitations of the study: Follow up period is less

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