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Assessment of functional outcome of arthroscopic assisted anterior cruciate ligament reconstruction using quadrupled hamstring auto-graft: Case series

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Abstract

Background: We assessed the functional outcome of the patient following ACL reconstruction using quadrupled hamstring autograft.

Methods: In this case series of 21 patients who had ACL insufficiency underwent arthroscopic assisted ACL reconstruction using quadrupled hamstring autograft from November 2019 to March 2021. The functional outcome of patients was assessed with Lyscholtz Knee Scoring System and IKDC score.

Results: The injury was predominant in males. A larger percentage of cases was operated less than 6 months from the date of injury. The mean graft diameter was 7.90 mm, with a positive correlation to the function of the knee. The preoperative mean Lysholtz score of 59.19 improved to 94.95 after surgery. The mean preoperative IKDC score improved from 46.81 to 81.95. Excellent outcome was seen in a majority of patients. Two patients had an infection and one patient had reduced range of motion. The timing of surgery and rehabilitation influence the outcome largely

Conclusion: ACL reconstruction surgery with quadrupled hamstring graft provides an excellent outcome in ACL injuries when the surgery is timed well, with sufficient graft thickness and good rehabilitation.

Keywords: Anterior cruciate ligament, ACL tear, ACL reconstruction, hamstring graft, quadrupled hamstring, rehabilitation protocol for ACL reconstruction

Introduction

The knee joint is highly common in one of most injured joints in sports, and its prevalence is rising as the world becomes more urbanized. Knee ligaments are frequently injured in sports, particularly ones that involve contact, such as American football. Skiing, ice hockey, gymnastics, and other sports can all cause knee ligaments to rupture due to abrupt stress. Knee ligament ruptures are prevalent in road traffic incidents, particularly those involving motorbikes.

Ligament disruption can even occur devoid of a fall or direct impact when the ligaments are subjected to sudden, severe stress or strain, such as when a runner plants a foot to decelerate or change direction. According to the degree of injury, ACL is torn. Knee instability, discomfort, and a loss in joint function are all symptoms of an ACL injury. ACL tear is one of the most common knee injuries^[1]. Acute ACL tear, which prevalence range from sixteen to forty six percentage, and in chronic tears, the incidence increases further^[2].

As evidence mounted that primary repair of midsubstance ACL tears routinely failed, interest turned to reconstructing the ligament. The grafts commonly used in anterior-cruciate-ligament-reconstruction are bone-patellar tendon-bone graft, peroneus longus graft and hamstring graft. Among the above-mentioned, hamstring graft has the advantage of advancing soft tissue graft fixation technique and reporting knee pain in bone-patellar tendon-bone graft.

Materials and Methods

This study was approved by the institutional Ethical Committee of our from BLDE deemed to be university, Vijayapura. And confined to the principles of the Declaration. Informed consent was obtained from each participant. The material for the present study was obtained from the patients admitted in BLDEA S' Shri B.M. Patil Medical college hospital and research Center,

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Department of Orthopedics with diagnosis of ACL tear, confirmed by history, clinical examination, and MRI from November 2019 to March 2021. 21 patients were selected with inclusion criteria are (i) age between 18 to 45, (ii) Clinical /MRI evidence of symptomatic individuals with ACL tear, (iii) ACL tear associated with medial or lateral meniscus tears not amenable for repair. Patients with exclusion criteria

were excluded, those are (i) Associated with multi ligamentous injury, (ii) Patients with associated fracture of tibial plateau, (iii) Tibial Avulsion, (iv) Patient with osteoarthritic knee, (v) Revision surgeries, (vi) Associated sepsis or local skin infection, (vii) Patients with systemic diseases which compromising their pre-anesthetic fitness.



Fig 1: Non visualization of ACL as primary sign of ACL tear in MRI.

Preoperative Procedure: After receiving signed and informed risk consent about the nature and complications of the surgery, the patients were scheduled for surgery. All patients were started on antibiotics prophylactically. A third-generation Cephalosporin was administered via IV route prior to induction of anesthesia, and continued at 12 hourly intervals for 3-5 days, and switched over to oral form till the 12th day post-operatively, i.e., until suture removal.

Surgical Procedure: All patients operated were by same surgeon and follow up of patients were done by same surgeon. We used titanium interference screw or biodegradable interference screw. After scrubbing painting and draping was done, tourniquet was used and diagnostic arthroscopy was done to confirm ACL tear with standard arthroscopic portal. Hamstring graft from same operative limb was chosen for graft selection with 5 cm incision over antero-lateral aspect of proximal tibia. Gracilis and semitendinosus were harvest one by one using tendon stripper. To achieve uniform size, the tendon ends are trimmed. To form Quadrupled tendons the graft is looped. Both ends of the tendon were suture together with ethibond 2-0 for around three to four centimeters. The graft sizer is then used to measure the quadruple graft diameter. Intraarticular preparation was done, the joint cavity was visualised after arthroscope was inserted through the antero-lateral portal. The joint is debrided with help of shaver introduced through the anteromedial portal. Ligamentum plicae, fat pads, synovium hypervascular structures and synovial reflections that obstructs the view. Femoral attachment footprint of the ACL and medial surface of the lateral femoral condyle is thorough assessed. It's vital to avoid injuring the PCL during joint debridement. Femoral and tibial tunnel was prepared. Tibial tunnel was done in same incision used for graft harvest. Quadrupled hamstring Graft was passed through tunnel with help of ethibond no. 5. And interference screw was used to fix the graft. Closure was done in layers and tourniquet was deflated.



Fig 2: Intra op picture showing Graft harvest technique. Using tendon stripper for hamstring graft

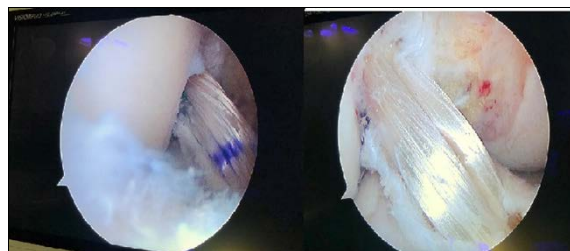


Fig 3: Intra op scope picture showing graft passed through femoral tunnel.

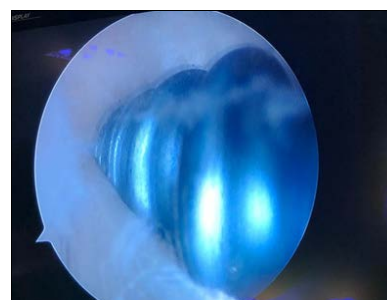


Fig 4: Intra op scope picture showing titanium interference screw is passed through femoral tunnel.

Postoperative protocol ^[3]

General guidelines

- During primary re-vascularisation and graft fixation, i.e., around 8–12 weeks, special attention given to graft protection.
- Change in the time limits for using a brace and crutches.
- Stretching/strengthening of the hamstrings were done with caution because to donor site morbidity.

Brace

- 0 to 1-week post-op brace is locked in full extension for sleep and ambulation
- 1 to 3-week post-op unlock brace up to 90 degrees
- 3 to 4 weeks post-op ambulation without brace when a patient showed reasonable quadricep control
- 3 to 8 weeks post-op brace for uneven surface ambulation

Weight bearing

- Post-op 0 to 1 week: partial weight-bearing
- Post-op 1 to 4 weeks: progress to full weight bearing with a normal gait
- 3 to 8 weeks post-op brace for uneven surface ambulation
- At around 16 weeks, the patient should be able to progress to full weight-bearing running.

Exercise

- Active assisted isometric quad exercise for 0 to 1-week post-op and delay quad strengthening for 12 weeks post-op
- 1 to 4-week post-op straight leg rise in all planes in full extension
- One-week post-op Heel side up to 90 degree
- Gentle hamstring muscle stretching
- At week 12 post-op, continue to develop hips, hamstrings, and calf muscles while gradually adding resistance to open chain hamstring workouts.
- If desired, begin swimming.
- At 6 months safe return to sports activity and work

Clinical Evaluation: At regular intervals follow up at an outpatient level at 6 weeks, 3 months, and 6 months for clinical examination and radiological evaluation was done. If possible, further follow up was done. At every visit, patient was assessed clinically regarding pain, limp, stability of knee joint, swelling.

Clinical assessment: All patients were clinically assessed by using International knee documentation committee (IKDC questionnaire) and Lysholm and Gillquist knee scoring system.

Results

Total 21 cases were studied, mean age of the patient in current study was 30.38, and 19 of patients (90.5%) were male. In our study, we the most common mode of injury was due to Sports injury (57.1%), followed by RTA (42.9%) [As shown in chart 1]. In our study, an interference screw was used, out of which titanium screw was used in 16 patients (76.2%), and bio screw in 5 patients (23.8%), and 61.9% of the patients presented within 6 months after injury. The diameter of quadrupled hamstring graft used in our study was 7 mm in 5 patients (23.8%), 8 mm in 14 patients (66.7%), 9 mm in 2 patients (9.5%).

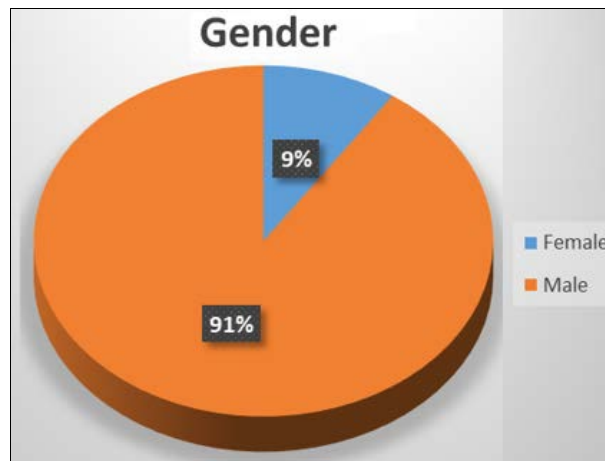


Chart 1: Showing sex distribution.

The mean pre IKDC Questionnaire subjective score was 46.81±7.139, while the mean post-op IKDC score was 81.95±3.653. There was a significant improvement in the post-op IKDC score compared with the pre-op score ($p < 0.0001$). The mean pre-op Lysholm knee scoring was 59.19±7.047, while the mean post-op Lysholm knee scoring was 94.95±4.727. There was a significant improvement in post-op Lysholm knee scoring compared with pre-op score ($p < 0.0001$) [as shown in chart 2].

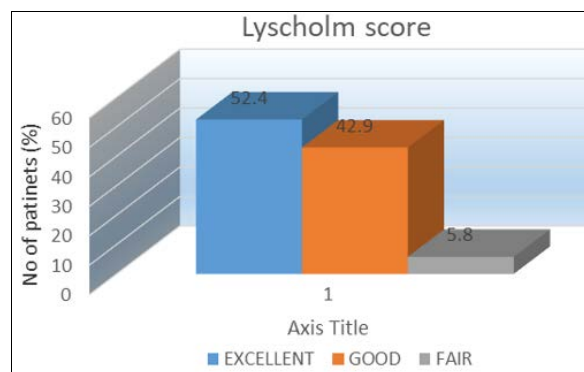


Chart 2: distribution of Post Op functional outcome of knee based on Lysholm score

Table 1: Functional outcome of study showing significant P value

Comparison between	Pre		Post		Paire t test	P value
	Mean	+SD	Mean	+SD		
IKDC score (out of 87)	46.21	7.139	81.95	3.653	16.143	0.0001*
Lysholm knee scoring score	59.19	7.047	94.95	4.727	-15.683	0.0001*

In our study, 3 patients, i.e., 14.3%, had surgical site infection. In which 2 patients out of 3 had a superficial surgical site infection at the donor site, which was managed by intravenous antibiotics. The third patient developed a deep surgical site infection over donor site with wound gaping. This patient was a known case of diabetes. The patient underwent wound debridement procedure, had diabetic control management. The infection was settled with broad-spectrum antibiotics. Sutures were removed after post-suture 12 days. One patient developed restricted ROM ranging from 5 to 50 degrees in follow up of post-op 3 months. We had lost follow up of that patient until post-op 3 months due to

COVID-19 Pandemic. After the patient was admitted and had aggressive post-op physiotherapy protocol under supervision, the functional outcome was improved. This patient had the least IKDC and Lysholm score in post-op 6 months 72 and 83 respectively.

Discussion

The number of ACL-reconstructions has increased as a result of the increased occurrence of sports activity and urbanization. Arthroscopic reconstruction of an injured ACL has become the gold standard, and it is one of the most popular arthroscopic procedures. As a result, it has been thoroughly investigated, and the outcomes of ACL reconstruction have received a lot of attention. In current study, 61.9% of the patients presented within six months after injury. The Right knee has predominance with 12 (57.1%) of patients and the left knee in 9 (42.7%) patients. Brown *et al.* [4] studied the incidence of the sidedness of limb injury and sex incidence and stated that although their study pointed out that females are more prone to this injury, the incidence is yet, more in males due to increased exposure to work in a strenuous environment. They also hypothesised that limb

sidedness does not influence either during injury or the recovery period. According David Logerstedt *et al.*, [5], the incidence of meniscal injuries at the time of anterior-cruciate-ligament-reconstruction was reported to be 58 percent, with the medial meniscus being the most usually affected. They also came to the conclusion that meniscal repair or resection had no effect on the end result. The medial meniscus injury is more common than seen in the study. ACL-reconstruction with meniscus repair or meniscectomy were excluded from our study. There is no clear demonstration on the timing of surgery, although much has been studied so far in the literature. Most authors have opined on waiting for at least three weeks before anterior-cruciate-ligament-reconstruction from the time of injury [6].

D Chaudhary *et al.* 2005 [7], Mahir *et al.* 2006 [8], Jomha *et al.* 1999 [9], Ashok P Kumar *et al.* 2016 [10]. These studies were used to compare the results. Mean age of surgery, graft used, Number of patients studied, gender distribution, and mean follow up interval were studied. Our study was compared and found similarities in results. All articles had significant improvements after ACL reconstruction.

Table 2: Comparison of studies

Study	Mean age at surgery	Graft Used	Gender	No. of Patients	Mean Follow up Interval (months)
D Choudhary <i>et al.</i>	26 Years	Ipsilateral autogenous BPTB	73% Male	59	84
Mahir <i>et al.</i>	24 Years	Quadrupled hamstring graft	100% Male	62	18
Jomha <i>et al.</i>	27 Years	Ipsilateral autogenous BPTB	93% Male	100	12
Ashok Kumar <i>et al.</i>	27 years	Ipsilateral Autogenous BPTB four Stranded hamstring graft	97.1%	34	14
present study	30.38 years	Quadrupled hamstring graft	91%	21	11.10

Puneet Chamkeri *et al.* 2017 [11] found majority of patients (70.0%) were classified as 'Normal', 'Excellent' as per IKDC, LGS scoring and 23.3% of patients were classified as 'Near Normal', 'Good' as per IKDC, LGS scoring respectively. Williams *et al.*, [12] in their study of 2500 cases of arthroscopic anterior-cruciate-ligament-reconstruction, reported an infection rate of 0.3%. In our study, 2 patients had a superficial surgical site infection at the donor site, which

was managed by intravenous antibiotics. And 1 patient developed a deep infection of the donor site with gaping of the wound. Treme *et al.* [13] opined that a graft diameter of <7 mm would have a higher risk of failure. The average diameter of the graft in our study was 7.90 mm. The graft used in the current study with a diameter of 9 mm average functional outcome was maximum, i.e., 58.25. Compared to 7- and 8-mm diameter.

Clinical pictures



Fig 6: showing clinical pictures of patient with MRI showing the ACL tear and post op XRAY film with titanium interference in situ

Conclusion

In young active individual, ACL reconstruction with quadrupled hamstring autograft produces good functional results. Fixation of the hamstring graft with a titanium and biodegradable interference screw results in an excellent functional outcome. For ACL deficient knees, arthroscopic assisted ACL reconstruction with quadrupled hamstring autograft is an appropriate therapy of choice.

Limitations

- Sample size
- Small period - Longer-term follow-up studies are needed to establish the long-term outcome of this operation.

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