EVALUATION AND RESULTS OF ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION USING QUADRUPLE HAMSTRING AUTOGRAFT USING IKDC/LYSHOLM SCORE

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Abstract:

Objective-

To evaluate the functional outcome of arthroscopic single bundle anterior cruciate ligament reconstruction using quadrupled hamstring tendon (Gracilis and semitendinosus) autograft in individuals with ACL injuries.

Methods:

There were 20 patients included in our study of which 17 patients (85%) were male and 3 (15%) were female. 11 patients (60%) had right side injury while 9 (45%) had injury to the left knee. Most of the patients (35%) were in the age group of 20 to 25 years followed by 30% in the age group of 30 to 35 years.The patients were followed up for an average duration of 17.6 months with minimum follow up of 7 months and maximum follow up of 27 months.Patients were followed at 6 weeks, 6 months and 1 year and functional outcomes assessed. The International Knee Documentation 2000 score**(IKDC)** and Lysholm and Gillquist Knee Scoring Scale were used for evaluation of patients.

Results

The mean pre-op IKDC subjective score was 50.86 while the mean post op score was 87.66. There was improvement in post op IKDC score when compared with pre op score ($p<0.05$).One patient had superficial infection settled with intravenous antibiotics. One patient developed deep infection with gaping of the wound. The patient underwent debridement and closure with

intravenous antibiotics.One patient developed fixed flexion deformity of 10 degrees with range of movements ranging from 10 to 90 degrees.

Conclusion

9 patients (45%) had excellent functional outcome while 8 patients
(40%) had good outcome. The remaining 3 patients (15%) had a fair
outcome according to Lysholm knee score. 10 patients(50%) returned to complete active daily activities by 7 weeks postop, 7 (35%)returned to activities 10 weeks postop while 3(15%) returned to routine activities by 11 weeks.

Introduction:

The knee joint is one of the most commonly injured joint in our body and the most commonly injured ligament in knee is the anterior cruciate ligament. Due to the ever-increasing Road traffic accidents and increased participation in sporting activities, there is an increase in incidence of ligament injuries of the knee. The ACL along with PCL,MCL,LCL, capsule is the primary stabiliser of knee and prevents anterior translation, and restricts valgus and rotational stress to a certain degree. When an ACL injury occurs, the symptoms of knee instability, pain and a decrease in joint function occur. Although conservative treatment with intensive physiotherapy, bracing and lifestyle modification can be tried in some patients with less anticipated knee function, in symptomatic young active individuals, ACL reconstruction is necessary. Also ACL injuries are mostly associated with injury of the meniscus which need to be addressed, else the person can develop early onset of osteoarthritis of the knee[1].

The articular cartilage of the knee joint may be injured in acute ACL tears, whose incidence range from 16 – 46%, and in chronic tears, the incidence increases further[2] .

To prevent the deterioration of the existing lesions and to prevent occurrence of new lesions, a stable knee is necessary. Arthroscopic reconstruction of the injured ACL has become the gold standard. Open reconstruction of ACL which was done earlier is not practised nowadays due to the complications associated such as increased post op pain, stiffness and a lengthy rehabilitation phase.

The “ideal graft” for ACL reconstruction is still a topic of debate. Hamstring graft is one of the widely used graft for acl reconstruction.To evaluate the clinical and functional outcome of arthroscopic single bundle anterior cruciate ligament reconstruction using quadrupled hamstring tendon (Gracilis and semitendinosus) autograft in individuals with ACL injuries.

Materials and Methods:

This a retrospective study for patient managed with arthroscopic acl recontruction at our hospital from June 2018 to December 2019.There were 20 patients included in our study of which 17 patients (85%) were male and 3 (15%) were female. The patients were followed up for an average duration of 18 months with minimum follow up of 8 months and maximum follow up of 28 months.

All young and middle age patients presenting with unilateral knee complaints and history of trauma to the knee in the orthopaedic emergency and outpatient departments at our hospital and were evaluated by thorough general and local examination of the knee. In a relaxed patient and in supine position, the uninjured knee was examined first to establish ligament excursions after which the affected knee was examined. Specific tests were performed for diagnosing anterior cruciate ligament deficiency like Lachman test,Anterior drawer test Pivot shift test. Injuries to the associated structures were assessed by performing the following clinical tests. Valgus/ varus stress test (for collateral ligaments) , McMurray's test/ Apley grinding test (for menisci) like Posterior drawer test (for posterior cruciate ligament) .
Routine radiographs of both knees in standing position in anteroposterior view and lateral view of the affected knee were taken. MRI of the knee was done in all clinically suspected ACL torn cases for confirmation.

Inclusion criteria:

o Clinical /MRI evidence of symptomatic individuals with anterior cruciate ligament insufficiency
o Patients between age 20 to 40 (skeletally matured patients)
o Associated with medial or lateral meniscus tear
o No history of previous surgery in the knee
o A normal contralateral knee

Exclusion criteria:

o Asymptomatic individuals
o Patients with systemic diseases compromising their pre-anaesthetic fitness
o Associated MCL, LCL,PCL,injuries
o Patient with osteoarthritic knee
o Patients with associated fracture of tibial plateau
o Patients with local skin infections

Pre-operative work up:

Patients with ACL tear proven clinically and radiologically are admitted at our institute. Routine required medical investigations were ordered and anaesthetic assessment for regional and general anesthesia was done. Patient was taken for surgery once anesthesia clearance was obtained.

Pre-operative Rehabilitation:

1. Pre-operative strength and range of movement of knee joint were measured and documented
2. Static and dynamic quadriceps exercise were taught to patients while awaiting surgery
3. All patients were enlightened on post – operative rehabilitation

Consent:
All patient in this study were explained about the injury, diagnosis, various management options, complication of non - operative treatment and operative management, per-operative and post-operative complications, donor site morbidity, injury to surrounding structures, infection, compartment syndrome, anaesthesia risks, post - operative knee
pain, restriction of range of motion. Consent for surgery was obtained for all the patients who were included in this study. All consent was obtained prior to surgery. Patients
and their attenders were well explained about the advantages and disadvantages of procedure. Risk benefit ratio was explained.

Examination under anaesthesia and patient positioning:
All the patients in our study were operated under spinal anaesthesia in supine position. The following tests were done under anaesthesia – anterior drawer test, posterior drawer test, Lachman test and pivot shift test. A pneumatic tourniquet is applied which is positioned in the upper thigh after soft padding. The limb is scrubbed from the ankle upto the tourniquet. The patient is positioned supine and the knee joint is placed slightly away from the distal breakpoint of the standard operating table. In all the cases, prophylactic antibiotic usually 1 g ceftriaxone is given pre operatively before inflation of the tourniquet.

Surgical technique:
After diagnostic arthroscopy, hamstring graft was harvested in all patients.The technique of single bundle ACL reconstruction was done with one tibial tunnel and one femoral tunnel with their centres corresponding to the centre of the native ACL tibial and femoral attachment sites respectively. The femoral tunnel was made using the anteromedial portal thereby creating an anatomic femoral tunnel position. The quadrupled graft was fixed at the tibial side using bioscrew / titanium interference screw and at the femoral side using endobutton.

Graft preparation, passage and fixation: After the graft had been prepared, based on the length, the graft is quadrupled, the loop part of the quadrupled graft is attached to the endobutton with loop (the length of the loop in the endobutton depends on the graft length and the length of the unreamed femoral tunnel). The Ethibond suture already present within the joint is pulled out through tibial tunnel. Then the passing sutures for the ACL graft are passed through the suture loop and are taken out of the lateral thigh. With the help of these sutures, the graft is pulled via the tibial tunnel into the joint and then into the femoral tunnel. Once the estimated length of the graft is within the the tunnel, the endobutton is flipped.

Post-operative management:

Immobilisation in knee brace and limb elevation was done in the immediate post op period. Intravenous antibiotics were given postoperatively for 3 days. Wound was inspected on 2nd , 7thpost-operative day. The sutures were removed on 12th post-operative day. Rehabilitation was started on post operative day one with standard protocols.

Evaluation:

All patients were subjected to post operative anteroposterior and lateral radiographs to determine the tunnel placement and position of endobutton and interference screw. Patients were followed at 6 weeks, 6 months and 1 year and functional outcomes assessed.

The International Knee Documentation 2000 score(IKDC)and Lysholm and Gillquist Knee Scoring Scale were used for evaluation of patients. The individual parameters were allotted specific scores depending on the patient's functional ability. The maximum possible knee score was 100. Based on the outcome scores they were divided into Excellent, Good, Fair and Poor.

Results

Twenty cases of arthroscopic ACL reconstruction were regularly followed for an average period of 18 months at our institute.Most of the patients (35%) were in the age group of 20 to 25 years followed by 30% in the age group of 30 to 35 years.

Of the 20 patients included in our study, 17 (85%) were Male patients and 3 (15%) were female. The most common mode of injury in our study was Road Traffic Accidents (60%) followed by sports (20%). The other modes of injury in our study were self fall and kick by bull.

Injury Surgery Interval:

Table I : Duration between injury and surgery

Duration	Patients	Percentage
Upto 3 months	6	30
4 -6 months	8	40
7-9 months	1	5
10-12 months	2	10

In our study, most of the patients (40%) presented 4 to 6 months after injury

Symptom at presentation:

Table II : Symptom at presentation

Symptoms at presentation	Number of patient	percentage
Knee pain	8	40
Instability	6	30
locking	3	15
Knee pain and instability	3	15
	20	100

The most common symptom at presentation was knee pain (40%) followed by instability (30%). Both knee pain and instability were present in 15% of patients.

Associated Meniscal injuries:

Table III : Associated Meniscal injuries

S.no	Associated Injuries	No of patients	Percentage
1	Isolated ACL tear	5	25
2	Medial Menisci tear	11	55
3	Lateral Menisci tear	1	5
4	Medial and Lateral Menisci Tear	3	15

In our study, there was associated meniscal injury in 75 % of patients. The most commonly injured was medial meniscus (55%) followed by injury to both medial and lateral menisci (15%). Isolated ACL tear was present in 5 patients (25%).
9 patients (45%) had excellent functional outcome while 8 patients (40%) had good outcome. The remaining 3 patients (15%) had a fair outcome according to Lysholm knee score.

IKDC Subjective score:

Table IV : IKDC subjective score

	Preop mean	Postop mean	P value
IKDC SUBJECTIVE SCORE	50.86(10.45)	87.66(6.98)	0.00001

The mean pre-op IKDC subjective score was 50.86 while the mean post op score was 87.66. There was significant improvement in post op IKDC score when compared with pre op score ($p<0.05$).

Complications:

1. One patient in our study had superficial infection at the donor site which settled with intravenous antibiotics.
2. One patient developed deep infection of the donor site with gaping of the wound. The patient underwent wound debridement and secondary closure and was given intravenous antibiotics. The wound healed well and sutures were removed after 10 days.
3. One patient developed fixed flexion deformity of 10 degrees with range of movements ranging from 10 to 90 degrees. The patient had poor compliance to the rehabilitation protocol.

Discussion:

Due to the increased occurrence of Road Traffic Accidents and increased number of persons participating in sports activities, the number of ACL reconstructions being done has been increased.

The choice of graft is a topic of great debate in recent years. The various options include bone patellar tendon bone graft, hamstring autograft, quadriceps tendon, various synthetic grafts and allograft.

Among these, the most commonly used are the Bone patellar tendon bone graft and hamstring graft. The advantages of Bone patellar tendon bone graft include high ultimate tensile load (approximately 2300 N) and a rigid fixation due to its bony ends.

But the hamstring graft has been increasingly used in recent. The advantages of arthroscopic ACL reconstruction using hamstring graft include decreased surgical site morbidity, decreased occurrence of patellofemoral adhesions and reduced incidence of anterior knee pain. Though the semitendinosus tendon has only 75% and gracilis 49% of the 108 strength of native ACL, the quadrupled semitendinosus or semitendinosus-gracilis have a tensile load of around 4108 N.

Our study is to evaluate the functional outcome of arthroscopic anatomical single bundle ACL reconstruction using quadrupled hamstring autograft.D.W Lewis et al.[(3),] in their study on incidence of meniscal injuries at the time of ACL reconstruction found that 58% of patients had meniscal injuries and that medial meniscus was most commonly injured. They also concluded that meniscal repair or resection did not alter the final outcome.

In our study, there was associated meniscal injury in 75 % of patients. Five patients in our study had isolated ACL injury. Eleven patients had injury to the medial meniscus whereas one patient had injury to the lateral meniscus alone. Three patients had injury to both the medial and lateral meniscus. The most commonly injured was medial meniscus
which was in accordance with other studies.

Among the patients with meniscal injuries, three patients were treated by partial meniscectomy and in one patient meniscal repair was done. The rest of the patients were treated conservatively. The functional outcome of patients with isolated ACL injury was comparable with that of the patients with associated meniscal injuries. This is in accordance
with the study by D.W Lewis et al who stated that the presence of meniscal injury does not alter the functional outcome. The most common symptom at presentation was knee pain (40% of patients). The other presenting symptoms were instability (30%), locking
(15%) and 15% patients presented with both pain and instability.

The results of the study were compared with the studies of D Choudhary et al. 2005[(4)], Jomha et al. 1999[(5)], Riley et al. 2004[(6)], Mahir et al. 2005[(7)] and Ashok Kumar et al.2016[(8)] (see table V).

TABLE V various studies were compared with following patient variables:

Study	Graft used	No of pts	Mean age of surgery(year)	Mean follow up(months)	Gender	Average Lysholm Score
D Choudhary et al.	Ipsilateral autogenous BPTB	59	26	84	73% male	92
Jomha et al.	Ipsilateral autogenous BPTB	100	27	12	93%male	94
Railey et al.	Four stranded Hamstring graft	85	33	24	59% male	91
Mahir et al.	Four stranded Hamstring graft	62	24	18	100% male	93.5
Ashok Kumar et al.	Ipsilateral autogenous BPTB four stranded hamstring graft	34	27	14	97.1% male	90
This study	Four stranded Hamstring graft	20	29	17	85% male	91.9

Average duration of follow-up of the present study was 17 months with a minimum follow-up period 7 months and maximum follow-up period was 27 months. From the above studies, it can be seen that the functional outcome after ACL reconstruction with hamstring graft and bone patellar tendon bone graft are comparable. The mean pre-operative IKDC score in this study was 50.86 whereas the post-operative score

was 87.66. There was significant improvement in post-operative IKDC score when compared with pre operative score. The mean pre-operative IKDC score in the study by Kumar et al. was 55.63[8], Prasad et al.[9] was 42.45 and Aparajit et al[10]was 50.5 whereas the post-operative scores were 89.38, 94.33 and 86.03, respectively.

From the above data, it can be seen that the post-operative IKDC score in this study was (pre operative IKDC Score-50.86, post op IKDC score -87.66) comparable with the scores from other studies . There was no significant patellofemoral pain noticed in the patients in our study. This is similar to the study by Railey et al. who did not observe any clinically relevant patellofemoral pain in patients in whom arthroscopic ACL reconstruction using hamstring graft was done.
Agiletti et al.**(11)**in their study, found >5 mm tibial translation in 20% of knees in which the torn ACL was reconstructed with hamstring graft. In our study, anterior tibial translation was eliminated in 85% of patients who were examined at a mean of 17 months post-operatively. The remaining 15% of patients (three) had a 1positive Lachman test at the follow up examination. However the laxity did not correlate with the functional scores.

Williams et at.**(12)**in their study of 2500 cases of arthroscopic ACL reconstruction, reported an infection rate of 0.3%. In our study, one patient had a deep infection and one patient had superficial infection. The patient with deep infection was managed with wound debridement and intravenous antibiotics while the patient with superficial infection was managed with antibiotics alone.

Limitations:

Limitations of this study are Small sample size .The results of the study were assessed using subjective scores and not based on objective assessment.Also the duration of follow-up is short.Follow up studies of longer duration are required to assess the long term outcome of this procedure

Conclusions:

In young active adults, anatomic single bundle reconstruction with quadrupled hamstring graft gives good functional results when combined with proper rehabilitation protocol.

Acknowledgement: nil

Conflicts of Interest

The authors have no conflicts relevant to this article.

References:

1. David Simon, Randy Mascarenhas, Bryan M. Saltzman, Meaghan Rollins, Bernard R. Bach Jr., and Peter MacDonald, "The Relationship between Anterior Cruciate Ligament Injury and Osteoarthritis of the Knee," Advances in Orthopedics, vol. 2015, Article ID 928301, 11 pages, 2015.

2. Brophy RH, Zeltser D, Wright RW, Flanigan D. Anterior cruciate ligament reconstruction and concomitant articular cartilage injury: incidence and treatment. Arthroscopy. 2010;26:112–120

(3). Lewis, D. W., Chan, D., Fisher, O., Lechford, R., Mintowt-Czyz, W. J., & Lewis, M. W. (2012). INCIDENCE OF MENISCAL AND CHONDRAL INJURIES AT THE TIME OF ACL RECONSTRUCTION, AND THEIR RELATIONSHIP WITH OUTCOME AT 2 YEARS. *Orthopaedic Proceedings*, 94-B(SUPP IX), 41.

(4). Chaudary, D., Monga, P., Joshi, D., Easwaran, J., Bhatia, N., Singh, A. Arthroscopic reconstruction of the anterior cruciate ligament using bone–patellar tendon–bone autograft. Experience of the first 100 cases. *J Orth Surg*. 2005;13:147–152

(5). Jomha NM, Pinczewski LA, Clingeleffer A, Otto DD. Arthroscopic reconstruction of the anterior cruciate ligament with patellar-tendon autograft and interference screw fixation The results at seven years. J Bone Joint Surg Br. 1999;81:775–9.

(6). Williams R.J., III, Hyman J., Petrigliano F., Rozental T., Wickiewicz T.L. Anterior cruciate ligament reconstruction with a four-strand hamstring tendon autograft. J Bone Joint Surg Am. 2004;86:225–232.

(7). Mahiroğullari M, Kuşkucu M, Kiral A, Pehlivan O, Akmaz I, Tirmik U. Early results of reconstruction of chronic anterior cruciate ligament ruptures using four-strand hamstring tendon autograftsActaOrthopTraumatolTurc. 2005;39:224–230.

(8). Kumar PK, Rambabu P, Srinivasarao K, et al. Functional outcome of arthroscopic reconstruction of anterior cruciate ligament tears. J. Evolution Med. Dent. Sci. 2016;5(10):427-432, DOI: 10.14260/jemds/2016/98

(9). Veeragandham P, Raghavan V, Chattopadhyay A, Banerjee U, Kothari S. Functional outcome following arthroscopic ACL reconstruction using semitendinosus graft: a prospective observational study. Int J Res Orthop 2017;3:423-30.

(10). APARAJIT, Prasad; KOICHADE, M. R.; JAIN, Nimesh. Study of Arthroscopic Reconstruction of Anterior Cruciate Ligament Injury. **International Journal of Biomedical Research**, [S.l.], v. 7, n. 6, p. 329-336, jun. 2016. ISSN 0976-9633.

(11). Aglietti P, Buzzi R, Zaccherotti G, De Biase P. Patellar tendon versus doubled semitendinosus and gracilis tendons for anterior cruciate ligament reconstruction. Am J Sports Med. 1994;22:211-8.

(12). Williams RJ 3rd, Laurencin CT, Warren RF, Speciale AC, Brause BD, O'Brien S. Septic arthritis after arthroscopic anterior cruciate ligament reconstruction. Diagnosis and management. Am J Sports Med. 1997;25:261-7.