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Surgical management of arthroscopic anterior cruciate ligament reconstruction using quadruple hamstring graft and assessment of its fuctional outcome

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Abstract
The knee joint is one of the most commonly injured joint in our body and the most commonly injured ligament is ACL. Due to ever increasing RTA's and increased participation in sporting activities. There is increase in incidence of ligament injuries of knee. The ACL along with other ligaments, capsule is the primary stabilizer of knee and prevent anterior translation and restricts valgus and rotational stress to certain degree.

Open reconstruction of ACL which was done earlier is not practiced now a day due to complications such as increased Post-operative pain, stiffness and lengthy rehabilitation phase. Arthroscopic reconstruction of the injured ACL has become the gold standard procedure.

The ideal graft for ACL is still a topic of debate. The most commonly used graft are bone patellar tendon bone graft and hamstring graft. The hamstring graft is increasingly used now a day for the following reasons:

- Advanced soft tissue fixation technique
- Increased incidence of anterior knee pain with bone patellar tendon bone graft

This study has been done to evaluate the functional outcome of arthroscopic single bundle anterior cruciate ligament reconstruction using quadrupled hamstring tendon (Gracilis and semitendinosus) autograft in anterior cruciate injuries.

Methods: Twenty cases of arthroscopic anterior cruciate ligament reconstruction were regularly followed for an average period of 17.6 months in mamta medical college, Khammam from august 2019 to march 2021.

Results: Among twenty patients treated with arthroscopic anterior cruciate ligament reconstruction 45% (9 patients) had excellent functional outcome while 40% (8 patients) had good functional outcome and remaining 15% (3 patients) had fair outcome according to LYSHOLM KNEE SCORE. One patient had superficial infection at the donor site which settled with intravenous antibiotics. One patient developed deep infection of the donor site with wound gaping which is managed with wound debridement and secondary closure and was given intravenous antibiotics which is healed well and the sutures removed after 10 days. One patient developed fixed flexion deformity of 10 degree with range of movements ranging from 10 to 90 degree. The patient had poor compliance to rehabilitation protocol. The mean pre-operative IKDC (international knee documentation 2000 score) score was 50.86 while the mean post-operative score was 87.66. there was significant improvement in post-operative IKDC score compared with pre-operative score with P value<0.05.

Conclusion: Arthroscopic anterior cruciate ligament reconstruction with hamstring graft is an excellent treatment option for anterior cruciate ligament deficient knees. And Hamstring graft fixation with endobutton and interference screw gives good functional outcome. Good functional results are achieved by careful preoperative planning and respecting the principles of arthroscopic anterior cruciate ligament reconstruction technique.

Keywords: anterior cruciate ligament, complete tear, arthroscopic reconstruction, quadruples hamstring graft

Introduction

Objectives

- To evaluate the functional outcome of arthroscopic single bundle anterior cruciate ligament reconstruction using quadrupled hamstring tendon (gracilis and semitendinosus) autograft in complete anterior cruciate ligament tears.

- To study the complications associated with arthroscopic anterior cruciate ligament reconstruction for complete anterior cruciate ligament tear.

Material and Methodology

This is a prospective study of functional outcome and complications following arthroscopic anterior cruciate ligament reconstruction conducted in mamta medical college and general hospital Khammam from august 2019 to march 2021.

There were twenty patients included in this study operated for arthroscopic reconstruction of anterior cruciate ligament tears with hamstring graft. 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 20 months.

All young and middle-aged patients presenting with unilateral knee complaints and history of trauma to knee in orthopaedic emergency and outpatient department in mamta medical college and general hospital Khammam were evaluated through general and local examination of unaffected knee to establish ligament excursion and after which the affected knee was examined with following specific tests for diagnosing anterior cruciate ligament deficiency

1. Lachman test
2. Anterior drawer test
3. Pivot shift test

Injuries to the associated structures were assessed by performing the following clinical tests.

- Valgus/varus stress test (for collateral ligaments)
- Mc murray's test/Apleys grinding test (for menisci)
- Posterior drawer test (for posterior cruciate ligament)

Routine radiographs of both knee in standing position in AP and LATERAL views. MRI of the knee was done in all anterior cruciate ligament torn cases for confirmation.

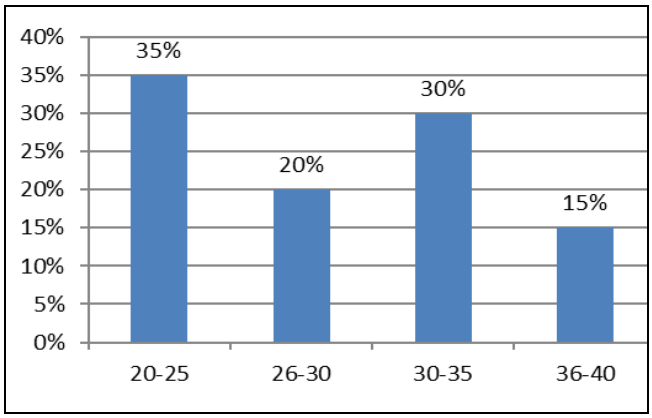
Patients with clinical and MRI evidence of symptomatic individuals with anterior cruciate ligament insufficiency, Patients associated with medial and lateral meninscal tear and grade 1 and 2 medial collateral and lateral collateral ligament injuries with no history of previous surgery in the knee and normal contralateral knee were included in our study.

Asymptomatic individuals with systemic diseases compromising their anaesthetic fitness and with associated Posterior cruciate ligament tears grade 3 medial collateral ligament and lateral collateral ligament injuries and patients with osteoarthritic knee and associated tibial plateau fracture and local skin infections were excluded in our study.

Observation and Results: Twenty cases of arthroscopic ACL reconstruction were regularly followed for an average period of 17.6 months in Mamta Medical College and General Hospital Khammam was studied from August 2019 to March 2021. Following factors were observed and tabulated as follows:

Table 1: Incidence of Acl Tears According to Age Distribution

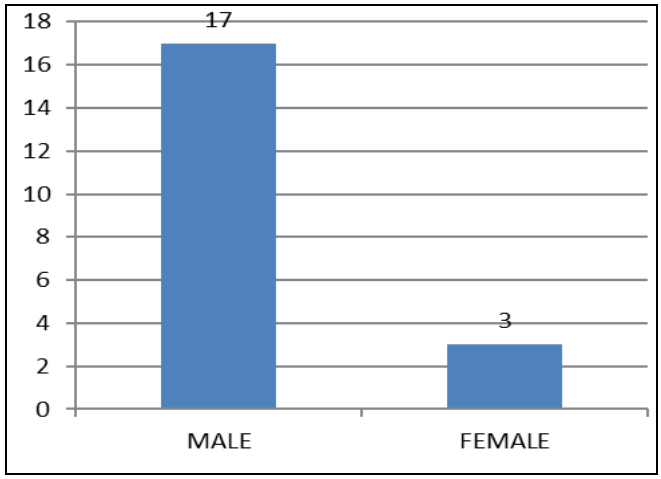
Age group(years)	No. of cases	Percentage
20-25(years)	7	35%
26-30(years)	4	20%
30-35(years)	6	30%
36-40(years)	3	15%



Graphs 1: Most Of Them Patients (35%) Were In The Age Group Of 20 To 25 Years Followed By 30% In The Age Group Of 30 To 35 Years**.**

Table 2: Incidence According To Sex

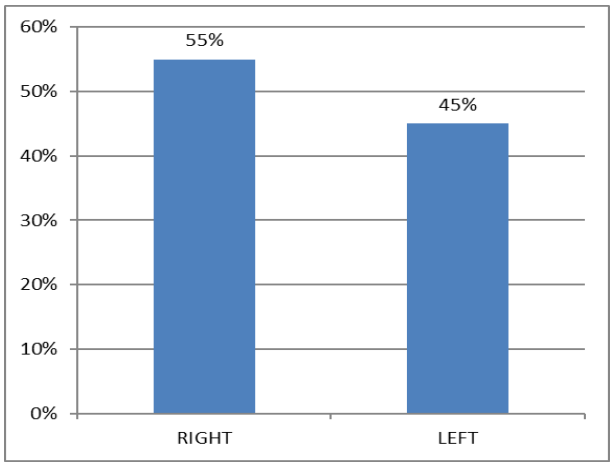
Gender	No. of cases	Percentage
Male	17	85%
Female	3	15%



Graph 2: Of The 20 Patients Included In Our Study. 17(85%) Were Male Patients And 3(15%) Were Females

Table 3: Incidence According To Side

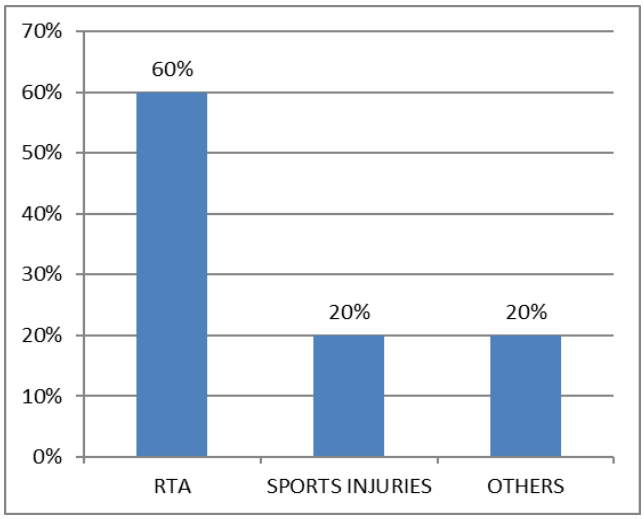
SIDE	No. of cases	Percentage
Right	11	55%
left	9	45%
Total	20	100%



Graphs 3: In The Present Study Right Side Was Commonly Injured In 55% Of Cases Than Left Side (45%)**.**

Table 4: Mode of Injury

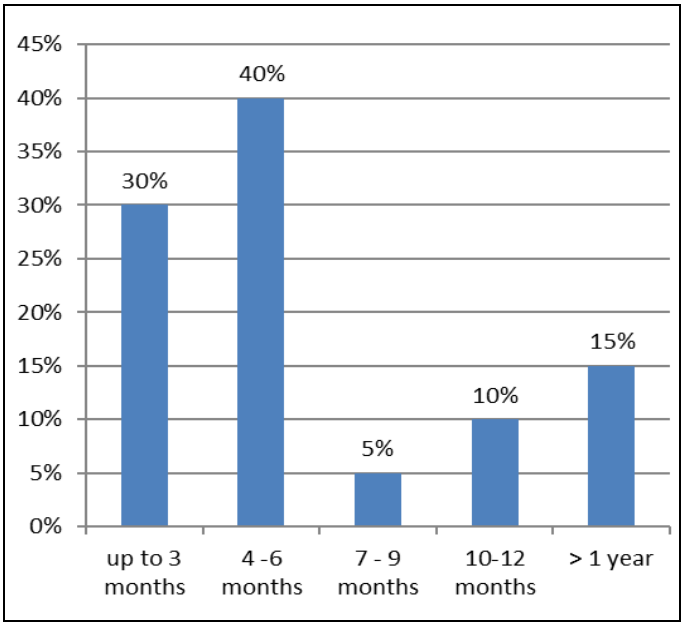
Mode of injury	No of Cases	Percentage
RTA	12	60%
Sports Injuries	4	20%
Others	4	20%
Total	20	100%



Graphs 4: RTA Is The Most Common Mode Of Injury (60%) Followed Sports Injuries (20%).

Table 5: Duration Between Injury and Surgery

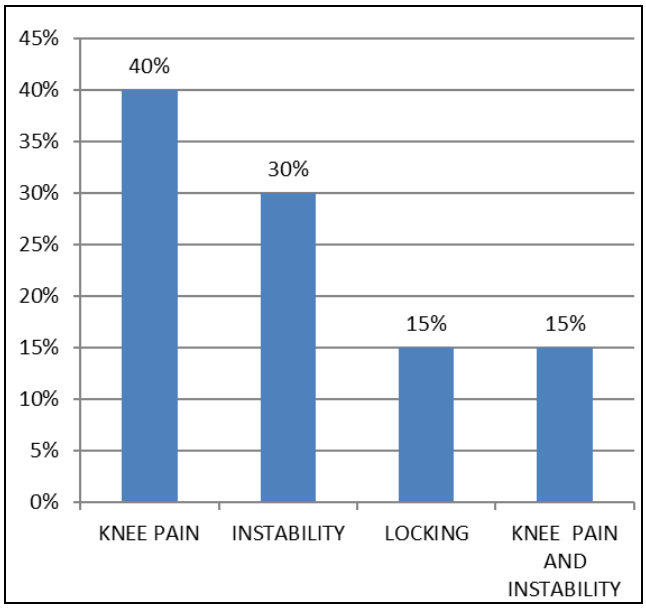
Duration	Patients	Percentage
Up to 3 months	6	30%
4 - 6 months	8	40%
7 - 9 months	1	5%
10 -12 months	2	10%
1 year above	3	15%



Graphs 5: In Our Study, Most of The Patients (40%) Presented 4 To 6 Months After Injury.

Table 6: Symptoms At Presentation

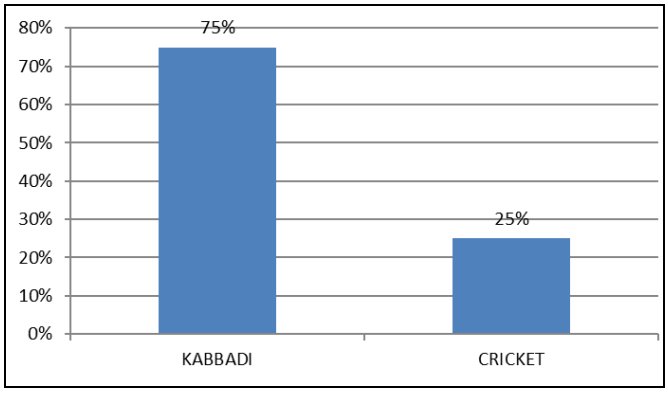
Symptoms At Presentation	No. Of Patients	Percentage
Knee Pain	8	40%
Instability	6	30%
Locking	3	15%
Knee Pain And Instability	3	15%



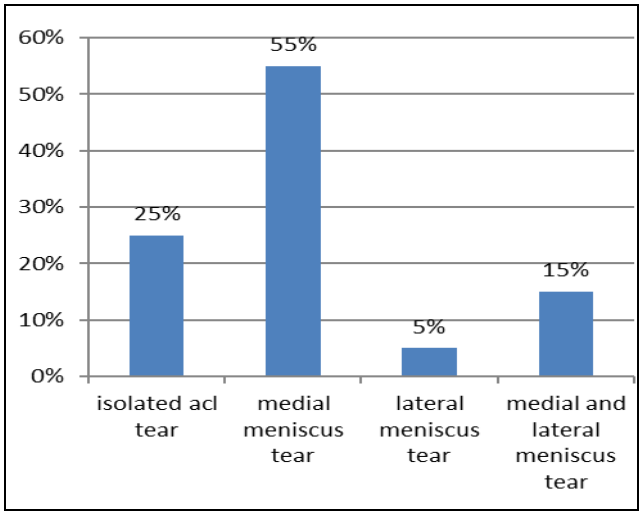
Graphs 6: The Most Common Symptom At Presentation Was Knee Pain (40%) Followed By Instability (30%). Both Knee Pain And Instability Were Present In 15% Of Patients.

Table 7: Sports Causing Acl Injury

Duration	Patients	Percentage
Kabbadi	15	75%
Cricket	5	25%



Graphs 7: In This Study, Kabaddi Was The Most Common Sport Causing Injury To The Anterior Cruciate Ligament.



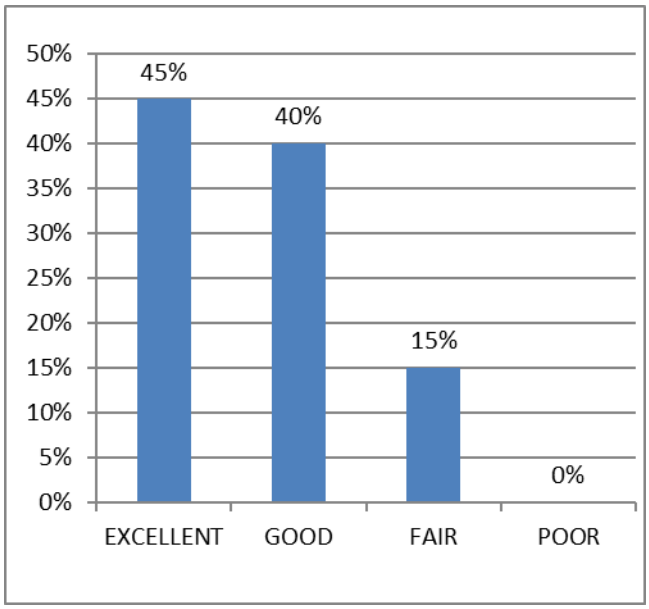
Graphs 8: In Our Study, There Was Associated Meniscal Injury In 75% Of Patients. The Most Commonly Injured Was Medial Meniscus (55%) Followed By Injury To Both Medial And Lateral Menisci (15%). Isolated Acl Tear Was Present In 5 Patients (25%).

Table 8: Associated Meniscal Injuries

Associated Injuries	No. of Cases	Percentage
Isolated Acl Tear	6	30%
Medial Meniscus Tear	11	55%
Lateral Meniscus Tear	1	5%
Medial And Lateral Meniscal Tear	3	15%

Table 9: Lysholm knee score

Results	Patients	Percentage
Excellent	9	45%
Good	8	40%
Fair	3	15%
Poor	0	0%



Graphs 9: I9 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.

Table 10: IKDC Subjective Score

	Pre-Op Mean (Standard Deviation)	Post-Op Mean (Standard Deviation)	P Value
IKDC Subjective Score	50.86(10.45)	87.66(6.98)	0.00001

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. Arthroscopic reconstruction of the injured ACL has become the gold standard and is one of the most common procedures done in orthopedics and thus it has been extensively studied and outcomes of ACL reconstruction have gained considerable attention.

The choice of graft is a topic of great debate in recent years. The various options include bone patellar tendon bone graft, hamstring graft auto graft, 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 load9approximately 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 includes 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 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.

The prospective study was conducted in mamta medical college and general hospital, Khammam to clinically evaluate the clinical results of arthroscopic single bundle ACL reconstruction. This study group comprised of 21 patients with one patient lost to follow up.

In our study, the most common mode of injury was Road Traffic Accident followed by sports injuries. One of the patients had an injury due to kick by a bull. Among the sports injuries, Kabbadi was the most common cause of ACL tear. Male predominance was found in our study. 17(85%) patients were males and 3(15%) were females. Of the patients were in the age groups of 20-25 years (35%) 40% of the patients underwent ACL reconstructions 4 to 6 months after injury.

The right knee was involved in 11(55%) of patients and left knee in 9(45%) patients. There was not much difference in lateralization of injury.

In our study, there was associated meninscal injury in 75% of patients. Five patients in our study had isolated ACL injury. Eleven patients had injury to the medial meniscus where as 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.

The most common symptoms 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 Chowdhary *et al*, Jomha *et al*, Riley *et al*, Mahir *et al* and Ashok Kumar *et al*. and the Average age of patient at the time of surgery in the present study was 29 years where as that of johma *et al*, D Chowdhary *et al*, Railey *et al*, Mahir *et al* and Kumar *et al* were 26,27,33,24 and 27 years respectively.

Patient variables in various studies

Study	Graft Used	No. of patients	Mean age at surgery	Mean follow up interval (months)	Gender	Average Lysholm Score
D Chowdhary *et al*	Ipsilateral autogenous BPTB	59	26years	24	73%Male	92
Jomha *et al*	Ipsilateral autogenous BPTB	100	27years	12	93% Male	94
Railey *et al*	Four stranded Hamstring graft	85	33years	24	59% Male	91
Mahir *et al*	Four stranded hamstring graft	62	24 years	18	100%Male	93.5
Ashok Kumar *et al*	Ipsilateral autogenous BPTB four stranded hamstring graft	34 (12,22)	27 years	14	97.1% Male	90
This study	Four stranded Hamstring graft	20	29 years	17	85% Male	91.9

Average duration of follow up of the present study was 17 months with a minimum follow up period of 7 months and maximum follow up period was 27 months. The Average Lysholm score at the end of the study is 91.9.

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. There was no significant patellofemoral pain noticed in the patients in our study.

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 patient (three) had a 1+ Lachman test at the follow up examination. However the laxity did not correlate with the functional score.

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. While 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.

Conclusions

the summary of this prospective study is as follows:

- In young active adults, anatomical single bundle reconstruction with quadrupled hamstring graft gives good functional results.
- The absence of patellofemoral pain with the use of hamstring graft makes it a more desirable option for patients with patellofemoral cartilage disorders or those with chronic patellofemoral pain.
- Hamstring graft fixation with endobutton and interference screw gives good functional outcome.
- Arthroscopic anterior cruciate ligament reconstruction with hamstring graft is an excellent treatment option for anterior cruciate ligament deficient knees.

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