

EVALUATION OF ARTHROSCOPIC ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION USING QUADRUPLE HAMSTRING TENDON GRAFT

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ABSTRACT

BACKGROUND

The anterior cruciate ligament (ACL) tear is the most common ligamentous injury to the knee joint. To reconstruct the tear in ACL the grafts and the fixation techniques used to vary with different surgeons. The commonest ones used are Quadruple Hamstring Tendon Graft (QHTG) and Bone Patellar Bone Tendon Graft (BPBT).

The autografts using quadruple hamstring tendon is preferred by many surgeons. The functional outcome of the Quadruple Hamstring Tendon Graft is evaluated using Knee Injury and Osteoarthritis Outcome Score (KOOS Scoring system) etc. The anterior cruciate ligament repaired and reconstructed arthroscopically using the QHTG are included in this study. This study aims at the results and outcome of anterior cruciate ligament reconstruction (ACLR) using KOOS scoring system. The instrument used for the measurement should be standardized, sensitive to clinical change, concise and convenient for both the patients and the clinicians for evaluations. To enable data collection from patients speaking different languages and living in different cultures, questionnaires should undergo linguistic and cross-cultural translation processes and psychometric properties should be assessed in clinical studies.

METHODS

Study Design- Prospective observational study.

Study Population- Patients with ACL injury with or without meniscal injury, attending Amala Institute of Medical Sciences and underwent arthroscopic ACLR, from January 2017-October 2017 were included in this study. The functional outcome of their knee surgeries was evaluated by following them up both pre-operatively and for 12 months post-operatively, till October 2018.

Sample Size- A total number of 51 patients with ACL injury with or without meniscal injury who underwent ACLR.

RESULTS

No patients were lost during follow up. The data suggests good functional outcome according to the KOOS Scoring. At the end of one year, they showed significant improvement with the KOOS score, thus enabling them to return to near normal function.

CONCLUSIONS

It was found that arthroscopic ACLR using QHTG enabled the patients to achieve excellent knee function and stability. The complications in this procedure were minimal.

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BACKGROUND

In this fast world movement from one place to another is a must. Knee joint has many ligaments of which anterior cruciate ligament occupy pivotal position.

The knee joint is stabilised by ACL along with other ligaments. Injury to anterior cruciate ligament alters the life style and limits the activity and movement.

Anterior cruciate ligament is injured following road traffic accident (RTA), fall from height, sports and dance

where the ligaments are subjected to severe stress. The commonest injury in the knee joint is anterior cruciate ligament tear.^{1,2} When such injuries occur in young individuals, they are forced to change their career. It becomes a great loss to them as well as to the society.

Along with other ligaments the ACL also acts as an important stabiliser against anterior translation of tibia over the femur.³ It counters the rotational movement and valgus stress. When the ACL is torn the knee becomes unstable leading to recurrent injuries such as articular damage and meniscus injuries.^{4,5} The aim of ACL reconstruction is to regain the stability of the knee so as to return to their routine normal activities such as sports and dance. Thus, the onset of osteoarthritis and subsequent recurrent injuries such as articular cartilage and meniscal damage are prevented.^{6,7} However one cannot prevent the late onset osteoarthritis after ACL repair. Arthroscopically assisted ACL repair is the accepted procedure for repair of injured ACL over the last decade.^{8,9}

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There are a lot of documents and literature available explaining ACL reconstruction and its outcome, but the data regarding the comparison between hamstring tendon graft and patellar tendon graft is minimal, thus making it difficult to choose the appropriate graft by the surgeon and the patient.¹⁰

Even though bone-patellar tendon grafts are available, Semitendinosus and Gracilis hamstring tendon grafts are widely used and many surgeons prefer the Semitendinosus and Gracilis tendon graft. The operating surgeon must select the appropriate graft for each patient.¹¹ The experience of the surgeon the choice of the graft, the positioning of the graft, method and choice of fixation and the postoperative rehabilitation are all important for the outcome of ACL reconstruction.¹² Among the ACLR autografts, the literature is variable regarding the preferred graft choice for a given patient as excellent functional outcomes have been reported after both BPTB autograft and hamstring graft.¹³

Following are the Advantages of Arthroscopically Assisted ACL Repair-

- No capsular incision.
- Trauma to the fat pad is reduced.
- Articular cartilage desiccation is prevented.
- Optimal and better visualisation of the femoral attachment.
- Post-operative patella-femoral pain is reduced when compared to open reconstruction.¹⁴

It has Long learning curve and is technically demanding.¹⁵

Bone-patellar-bone tendon graft was accepted as Gold standard procedure with high success rate.^{16,17} But the donor site morbidities such as pain and extensor mechanism malfunction and poor cosmeses made the surgeons to shift to hamstring tendon graft. Hamstring tendon graft gained popularity because of the less morbidity at the donor site and better extensor mechanism. Rehabilitation of knee after ACL reconstruction has made a lot of improvement in the recent days and it is considered to be one of the important factors for the good results. The rehabilitation protocols are aggressive with special emphasis upon muscle strengthening and on improving joint motion.

Aims and Objectives

To assess the functional outcome of the knee which is reconstructed by using quadruple hamstring tendon graft with the application of KOOS Score.

METHODS

The KOOS Score has five sub scales. The patients are assessed pre-operatively and are followed up at regular intervals post-operatively with a questionnaire. In this study patient participation is given more importance. The answers are collected, and the given points are calculated.

To study the arthroscopically reconstructed ACL by using QHTG and analyse it by using five subscales. They are:

Pain

frequency of pain, while twisting or pivoting, when bending, straightening, walking on flat surface, going up and down the stairs, while in bed at night, sitting or lying, standing upright.

Symptoms

Swelling in the knee, clicking noise, knee catch, straighten the knee fully, bend the knee fully.

Stiffness

Severity on walking, in sitting, on lying down.

ADL

Descending stairs, ascending stairs, arising from sitting, standing, bending to floor, walking on flat surface, getting in and out of car, going shopping, pulling on socks, rising from bed, taking out socks, lying in bed, getting up from bed, sitting, getting up from toilet, moving heavy boxes, light domestic work.

Sports/Rec-squatting, running, jumping, twisting, kneeling.

QOL- frequency of knee problem, life style modification to avoid knee damage, lack of confidence in knee function, difficulty in adapting knee movements.

Each subscale has got questions for which scores are given. The scores are tabulated from which the functional outcome of the knee prior to and after ACLR is calculated.

Study Design

Prospective observational study.

Study Setting

Amala Institute of Medical Sciences, Trissur, Kerala.

Study Duration

From January 2017 to October 2018.

Study Sample

51 patients who had ACL Injury and who Underwent ACLR were followed up for a period of 12 months post-operatively.

Inclusion Criteria

- (a) ACL injury with or without meniscal injury.
- (b) All adults of age 18 to 55 years.

Exclusion Criteria

- (a) Patients with revision ACLR
- (b) Prior knee surgery.
- (c) Age less than 18 and more than 55 Years.

ACL Reconstruction

For a dynamic and healthy individual with an ACL tear, who prefers to be active, the treatment of choice is endoscopic ACL reconstruction.

Technique

Patient is placed in supine position under spinal anaesthesia. The affected lower limb is cleaned and draped. After cleaning and draping, the side post is applied to the operating table. The knee is allowed to hang freely in 90 degrees flexion. The ACL injury is confirmed by doing a Lachman test under anaesthesia, anterior drawer test and pivot shift test.

The portals used are anterolateral and anteromedial.

Portals

Anterolateral Portal

A 11 blade is used to create this at a 45-degree angle into the joint lateral to the patellar tendon and inferior to the inferior pole of the patella.

Anteromedial Port

Made under direct visualisation and the arthroscope, with the help of a spinal needle in the direction of the anatomical foot print of the ACL. Medial portal is located just superior to the medial meniscus and must be able to provide Access to the ACL footprint.

Perform a Diagnostic Arthroscopy

Visualize the supra-patellar pouch, Patello-femoral joint, medial gutter, medial compartment, intercondylar notch (to probe ACL and PCL), lateral compartment and lateral gutter. A Quadrupled hamstring graft (semitendinosis and gracilis) taken from the ipsilateral side was used to reconstruct the torn ACL with the help of a loop fixation device. Meniscal balancing is done if required.

RESULTS

Data Collection Method

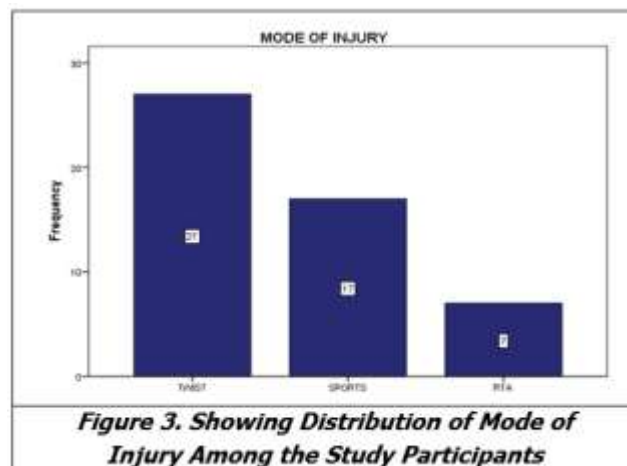
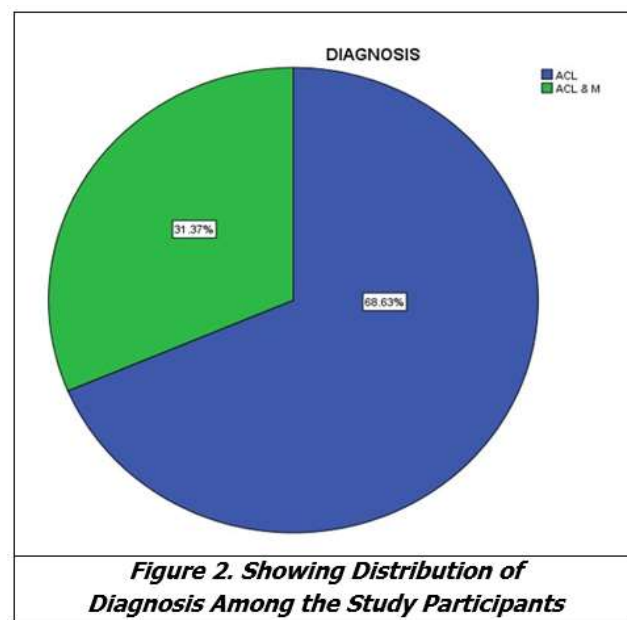
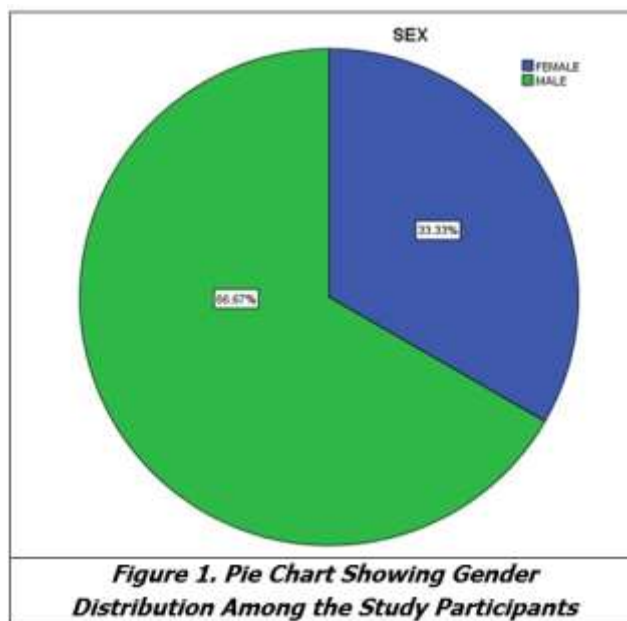
Patients who were diagnosed with ACL injury with or without meniscal injury and who underwent arthroscopic ACL reconstruction in Amala institute of medical sciences, were evaluated using the KOOS score pre-operatively and post-operatively at 10th day post-op, 1.5 months, 3 months, 6 months, 9 months and 12 months respectively. Thereby data was collected.

Statistical Analysis

Data was entered in MS Excel and using SPSS version 20. Continuous variables was represented using mean and standard deviation, whereas categorical variables were represented using frequencies and percentages.

Repeated measures ANOVA was used to find the association between KOOS score at various time points.

Bar charts, Pie diagrams and line diagrams were used to represent the result. P value<0.05 was considered as significant.



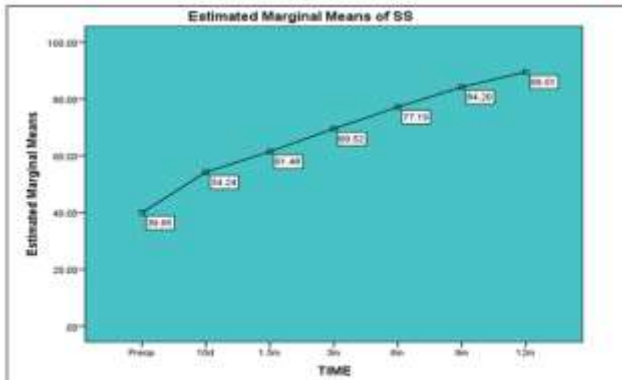


Figure 4. Graph Shows Estimated Marginal Means of (SS) Symptoms, Stiffness

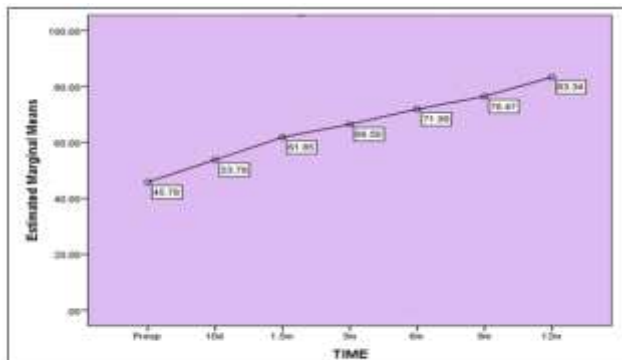


Figure 5. Graph Showing Estimated Marginal Means of ADL

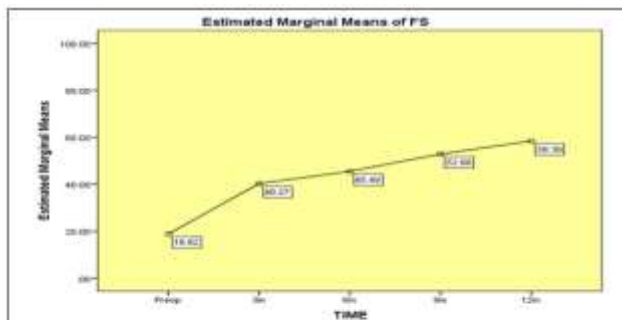


Figure 6. Graph Showing Estimated Marginal Means of (FS) Function, Sports Andrta

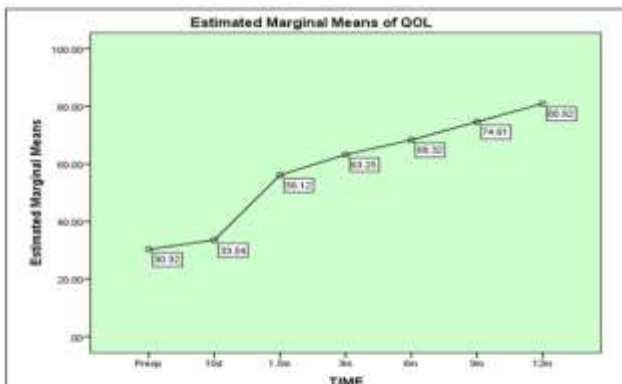


Figure 7. Graph Showing Estimated Marginal Means of (QOL) Quality of Life

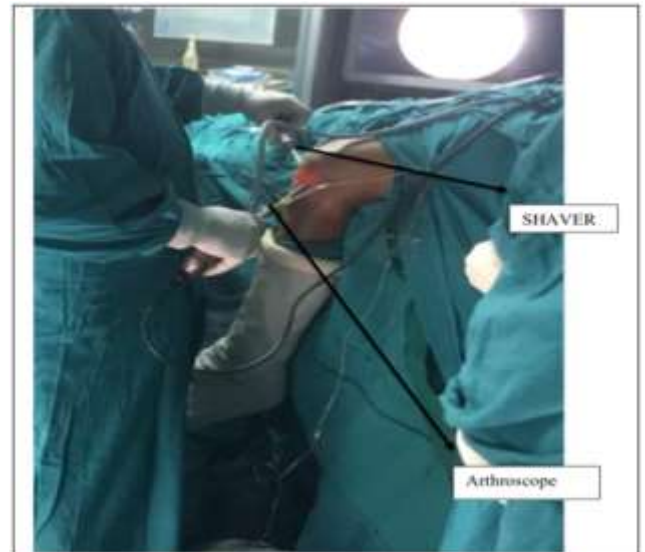


Figure 8. Showing Position of Knee During Surgery

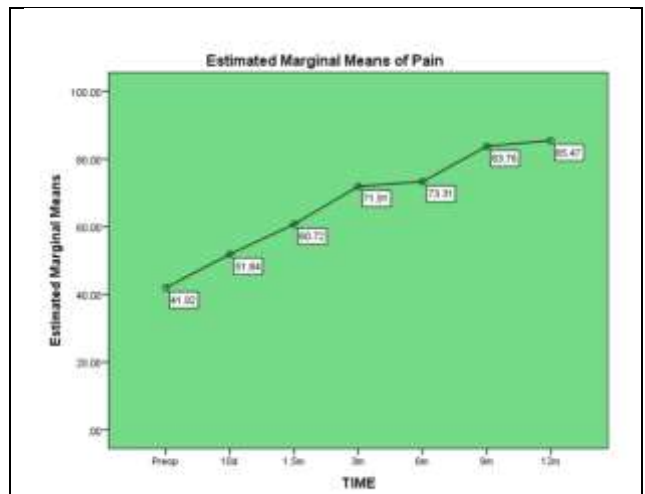


Figure 9

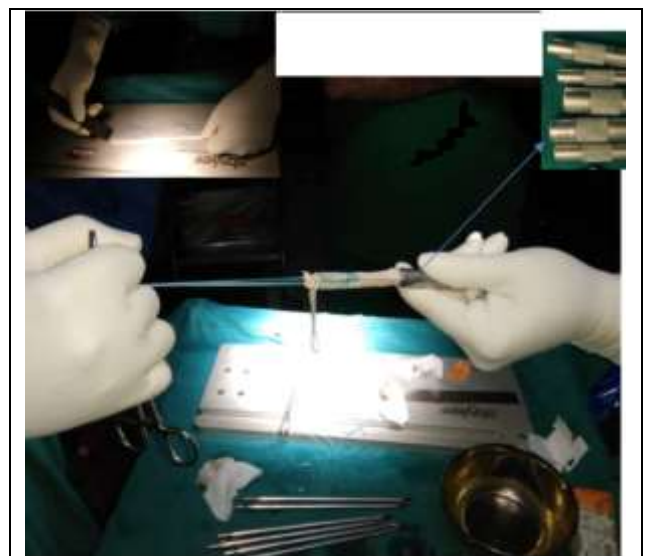


Figure 10. Preparation and Sizing of the Graft

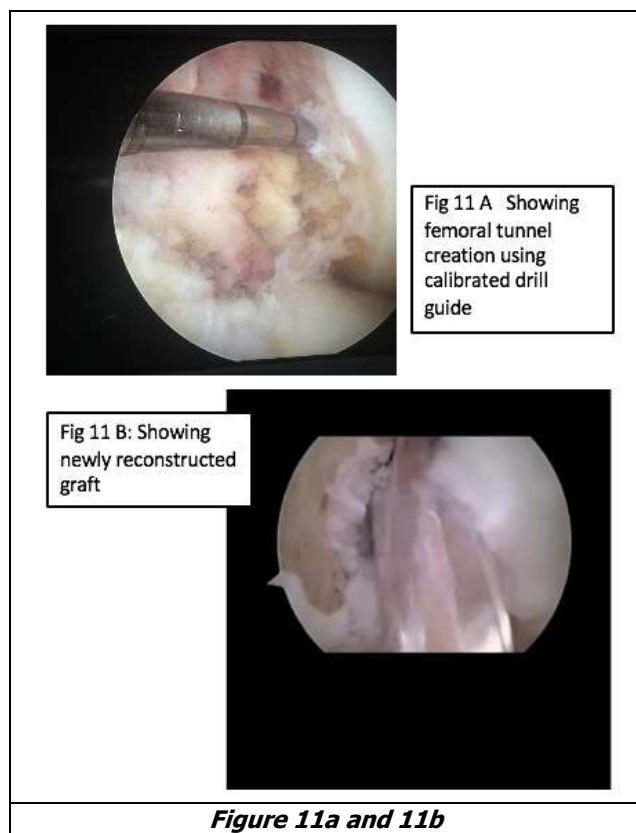


Figure 11a and 11b

DISCUSSION

The anterior cruciate ligament (ACL) occupies a pivotal position in the knee as it stabilizes the knee along with other ligaments. ACL injury and meniscal injury associated with ACL tears lead to an increased occurrence of premature osteoarthritis of knee. As a result, ACL reconstruction gained importance over the past few years and there were tremendous developments in the techniques and implants used for the fixation of the graft. Among ACLR with autografts, the preferred choice of the graft is variable. According to the literature available both BPBT and QHTG have excellent functional outcomes with low recurrence rates.¹⁸

In our study, we evaluate the functional outcome of patients who underwent arthroscopic ACL reconstruction with quadruple hamstring tendon graft (QHTG), where the tendons of Semitendinosus and Gracilis were used (STG). 51 patients (n=51) were included in the study and they were assessed pre-operatively and postoperatively over a period of 12 months using the Knee injury and osteoarthritis score (KOOS).¹⁹

In this study the KOOS scoring system is used as it is widely used in clinical studies, research papers and even insurance policies now. It does not require any special permission and it is user friendly and takes only ten minutes to document. KOOS is used to assess short term and long-term consequences and so it can be used to assess the functional outcome on a week to week basis. Hence the KOOS scoring system is used to follow up in treatment with physical therapy, medical treatment and surgery.

The patients were in the age group of 18-55 years among which majority of them were between 21-40 years

(n=22).

The incidence of ACL injury was more in males (n=34), which is 66.7% and that of females (n=17) is 33.3%.

The right knee (n=29) was more frequently involved than the left knee. Patients were followed up under 5 subscales of KOOS namely, symptoms and stiffness, Pain, function of daily living, function of sports/recreation and quality of life, individually at regular intervals at the 10th post-operative day, 1.5 months, 3 months, 6 months, 9 months, 12 months.

According to the KOOS 2012, if at least 50% of the subscale items were answered, a mean score can be calculated. If more than 50% of subscales are omitted, the response is considered invalid and no calculations are made for that particular subscale.

If a particular subscale is not considered valid, then the results from other subscale can be reported at that time point. Hence in our study the KOOS Sports/Rec subscale was omitted till the review at 3rd month after surgery, as it is not recommended for the patients to do this earlier. However, the other subscales were calculated at that point of time as per the KOOS recommendation.

A Likert scale is used, and all items have five possible answer options scored from 0 (no problem) – 4 (extreme problem). Each of the five scores is calculated as the sum of items included and it is transformed to a 0-100 scale. Zero represent extreme knee problems and 100 represents no knee problems, as is common in Orthopedic assessment scale and generic measures.

The scores were calculated using KOOS manual score calculation formula.

Thus, scores between 0-100, represent percentage of total possible score achieved. An aggregate total score is not calculated as it is regarded desirable to analyze and interpret the 5 subscales separately.

This study profiles the early recovery of patients following primary ACLR using the KOOS demonstrating continued recovery of functions throughout the full 12 months with no evidence of a plateau effect.

This is similar to the study by Hill, G.N and Oleary, S.T (2012),²⁰ wherein the ACLR done in 165 patients were evaluated by KOOS score at 3, 6 and 12 months post-operatively. It was found to have a significant improvement in all mean KOOS domains, following 12 months of ACLR (P<0.001) and between each recording point (P<0.003) shows no plateau effect.

The average age of ACL injury in this study done by Hill, G.N. et al. was 30.4 years with a male preponderance of 74 percentage (122:43). Similarly, in our study the average age of ACL injury was also found to be 30.5 years with a male preponderance of 66.7 percentage. This was also observed in a study by Bhargav P. A. et al,²¹ where all his study subjects were younger men with an average mean age of 26.5 years.

The incidence of ACL injury in a study by Rai S.K et al²² was found to be more on the right knee (78%), which is also similar to the incidence of ACL injury in our study (56.9%). In the same study the instability of the knee was tested pre-

operatively and all the patients had a positive Lachman test, Pivot shift test and Anterior drawer test. Similarly, all these tests were found to be positive in all our patients.

In our study, only 1 patient developed a serous discharge from the tibial incision site, which appeared to be due to a foreign body reaction of the subcutaneous sutures. The culture was negative, and patient was treated by removal of the extruding suture material and oral antibiotics on op basis until the wound healed. There were no other complications in our study. We hence observed that the rate of complications in our study is far less than that of Rai S.K et al,²² in which he reported complications in 15 patients.

A study by Bhargav P. A. et al. quotes that, the most common complication as per most literature is superficial wound infection, such complications were not seen in our cases. We attribute this the state-of-the-art theatre facilities and infection control procedures in our institute.

In a study by Nag. H. L, and Gupta, H.²³ Complications of late graft loosening were reported. In our study no such complications were encountered and none of our patients required revision as a result of graft laxity.

A study by Islam M et al.²⁴ shows an accuracy of MRI in the diagnosis of ACL as 89%. In our study, the sensitivity of MRI in detecting ACL injuries were 90.2%.

A study by Stan'czak et al. states that there is comparable improvement in patients undergoing ACLR with bone tendon patellar graft and Hamstring graft, with improvement in most sub scores of the KOOS scoring system and the Kujala score, After one year follow-up no statistical significance between the 2 groups.²⁵ In our study only Hamstring tendon grafts were used and showed improvement in all the subscales of KOOS after 1 year of follow up.

CONCLUSIONS

The outcome of the patients in this study undergoing ACL reconstruction with a QHTG, was found to be good in terms of clinical stability, range of motion and general symptoms. The advantages of the semitendinosus gracilis graft were-decreased graft harvest site morbidity, less anterior knee pain post-operatively and better cosmeses. The KOOS score subscales were calculated at various time intervals by repeated ANOVA measures and p value was found to be statistically significant (<0.05) at the end of one-year follow-up.

REFERENCES

- [1] Miyasaka KC, Daniel DM, Stone ML. The incidence of knee ligament injuries in the general population. *Am J Knee Surg* 1991;4:3-8.
- [2] Noyes FR, Bassett RW, Grood ES, et al. Arthroscopy in acute traumatic hemarthrosis of the knee. Incidence of cruciate tears and other injuries. *J Bone Joint Surg Am* 1980;62(5):687-695.
- [3] Levy IM, Torzilli PA, Warren RF. The effect of medial meniscectomy on anterior - posterior motion of the knee. *J Bone Joint Surg Am* 1982;64(6):883-888.
- [4] Jomha NM, Pinczewski LA, Clingeleffer A, et al. Arthroscopic reconstruction of the anterior cruciate ligament with patellar-tendon auto-graft and interference screw fixation. The results at seven years. *J Bone Joint Surg Br* 1999;81(5):775-779.
- [5] Barrack RL, Bruckner JD, Kneisl J, et al. The outcome of the non-operatively treated complete tears of the anterior cruciate ligament in active young adults. *Clin Orthop Related Res* 1990;259:192-199.
- [6] Jorgensen U, Sonne-Holm S, Lauridsen F, et al. Long-term follow-up of meniscectomy in athletes. A prospective longitudinal study. *J Bone Joint Surg Br* 1987;69(1):80-83.
- [7] Rangger C, Klestil T, Gloetzer W, et al. Osteoarthritis after arthroscopic partial meniscectomy. *Am J Sports Med* 1995;23(2):240-244.
- [8] Arciero RA, Scoville CR, Snyder RJ, et al. Single versus two-incision arthroscopic anterior cruciate ligament reconstruction. *Arthroscopy* 1996;12(4):462-469.
- [9] Buss DD, Warren RF, Wickiewicz TL, et al. Arthroscopically assisted reconstruction of the anterior cruciate ligament with use of autogenous patellar ligament grafts. Results after twenty-four to forty-two months. *J Bone Joint Surg Am* 1993;75(9):1346-1355.
- [10] Sajovic M, Vengust V, Komadina R, et al. A prospective, randomized comparison of semitendinosus and gracilis tendon versus patellar tendon autografts for anterior cruciate ligament reconstruction: five-year follow-up. *Am J Sports Med* 2006;34(12):1933-1940.
- [11] Feller JA, Webster KE. A randomized comparison of patellar tendon and hamstring tendon anterior cruciate ligament reconstruction. *Am J Sports Med* 2003;31(4):564-573.
- [12] Pinczewski LA, Lyman J, Salmon LJ, et al. A 10-year comparison of anterior cruciate ligament reconstructions with hamstring tendon and patellar tendon auto-graft: a controlled, prospective trial. *Am J Sports Med* 2007;35(4):564-574.
- [13] Gabler CM, Jacobs CA, Howard JS, et al. Comparison of graft failure rate between auto-grafts placed via an anatomic anterior cruciate ligament reconstruction technique: a systematic review, meta-analysis, and meta-regression. *Am J Sports Med* 2016;44(4):1069-1079.
- [14] Fu FH, Schulte KR. Anterior cruciate ligament surgery 1996. State of the art? *Clin Orthop Related Res* 1996;(325):19-24.
- [15] Meade T, Dickson T. Technical pitfalls of a single incision arthroscopically assisted ACL reconstruction. *Am J Arthroscopy* 1992;2(2):15-19.
- [16] Pinczewski LA, Deehan DJ, Salmon LJ, et al. A five-year comparison of patellar tendon versus four-strand hamstring tendon auto-graft for arthroscopic reconstruction of the anterior cruciate ligament. *Am J Sports Med* 2002;30(4):523-536.
- [17] Marder RA, Raskind JR, Carroll M. Prospective evaluation of arthroscopically assisted anterior cruciate ligament reconstruction. Patellar tendon versus

- semitendinosus and gracilis tendons. *Am J Sports Med* 1991;19(5):478-484.
- [18] Gabler CM, Jacobs CA, Howard JS, et al. Comparison of graft failure rate between auto-grafts placed via an anatomic anterior cruciate ligament reconstruction technique: a systematic review, meta-analysis, and meta-regression. *Am J Sports Med* 2016;44(4):1069-1079.
- [19] Roos EM, Roos HP, Lohmander LS, et al. Knee injury and osteoarthritis outcome score (KOOS)-development of a self-administered outcome measure. *J Orthop Sports Phys Ther* 1998;28(2):88-96.
- [20] Hill GN, O'Leary ST. Anterior cruciate ligament reconstruction: the short-term recovery using the knee injury and osteoarthritis outcome score (KOOS). *Knee Surg Sports Traumatol Arthrosc* 2013;21(8):1889-1894.
- [21] Bhargav AP, Chandra NK, Murari SPK. Evaluation of arthroscopic anterior cruciate ligament reconstruction with quadrupled hamstrings tendon graft. *Asian J Pharm Clin Res* 2106;9(3):295-299.
- [22] Rai SK, Varma R, Wani SS. Study of outcome of 300 cases of arthroscopic anterior cruciate ligament reconstruction with quadrupled hamstrings tendon graft using anterior cruciate ligament tightrope for femoral fixation. *J Musculoskelet Surg Res* 2018;2(1):26-30.
- [23] Nag HL, Gupta H. Seating of TightRope RT button under direct arthroscopic visualization in anterior cruciate ligament reconstruction to prevent potential complications. *Arthrosc Tech* 2012;1(1):e83-e85.
- [24] Islam M, Ailani R, Bhattacharyya TD, et al. Correlation between MRI findings and arthroscopic findings in internal degeneration of knee. *IOSR Journal of Dental and Medical Sciences (IOSR- JDMS)* 2017;16(4):22-25.
- [25] Stanc'zak K, Zielińska M, Synder M, et al. Comparison of hamstring and patellar tendon graft in anterior cruciate ligament reconstruction: a prospective randomized study. *J Int Med Res* 2018;46(2):785-791.