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Analysis of functional outcome of anterior cruciate ligament reconstruction using quadruple hamstring graft

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ABSTRACT

Background: Anterior cruciate ligament reconstruction is the most commonly reconstructed ligaments of the knee. This study attempts to analyse the functional outcome of ACL reconstruction and the parameters utilized commonly to assess the outcomes.
Methods: This is an analysis of 25 patients who underwent ACL reconstruction, who were operated by a single surgeon, and were studied for a period of one year .Analysis was made using standard scoring systems like Lysholm and IKDC score by an independent observer over a period of one year.
Results: The injury was commonly noted in the male gender although the sidedness of the injury did not seem to influence the outcome. The larger percentage of cases was operated less than 6 months from the date of injury. The mean graft diameter was 7.9 mm, with a positive correlation to the thickness of the thigh. The preoperative mean Lysholm score of 58.76 improved to 91.16 after surgery. The mean preoperative IKDC score improved from 29.26 to 58.70. One patient had infection and two had stiffness and reduced range of motion. The timing of surgery and rehabilitation influence the outcome largely.
Conclusions: Anterior cruciate ligament reconstruction surgery with quadrupled hamstring grafts provides a good outcome to ACL injuries when the surgery is timed well, with sufficient graft thickness and good rehabilitation.

Keywords: IKDC score, Transtibial technique, Quadruple hamstrings

INTRODUCTION

The anterior cruciate injury has been extensively studied all over the world. The instability associated is a very disabling problem specially if the individual is athletic and has high demand knee.[1] Many authors have described various procedures and techniques with autografts like quadriceps, tendon, hamstrings, patellar tendon etc. and allografts of achilles tendon, tibialis anterior and hamstrings.[1] Bone patellar bone tendon graft had problems regarding extensor loss, patellar fracture, loss of motion etc.[2] which led to the evolution of the hamstring graft using semitendinosus and gracilis tendons. Various implants have been described to hold the graft in the femoral and tibial tunnels, like suspensory devices, posts, screws, and suture buttons. We have used endobutton on the femoral side and bio-absorbable screw in the tibial tunnel.[3]

Though the surgery has become popular over the last two decades, there is yet consensus needed on the timing of surgery, the type of implant, the predictors of outcome such as the age, associated injuries, Although the patient age, Height, weight and gender are associated with the graft thickness, it difficult to predict the diameter of a quadruple tendon.[4] This study uses the Lyshohlm scoring and IKDC system of scoring to evaluate the results and outcome of the series of cases.

METHODS

A series of 25 cases of ACL injuries which were operated by anterior cruciate ligament reconstruction using quadrupled semitendinosus and gracilis grafts at our institute during March 2015 to March 2016. All the cases were operated on by the same surgeon in our institute and followed up for a period of one year. They were evaluated by a single interviewer to assess the outcome of the surgeries. The study was undertaken after obtaining the institute's ethical committee approval. The cases were selected based on the following inclusion and exclusion criteria.

Inclusion criteria were patients of age group between 18to 45 years with isolated anterior cruciate injury or other associated ligament injuries.

Exclusion criteria were patients below 18 years, patients above 45 years, Patients with injuries to either of the tibial condyles or the tibial eminence, patients with tri compartmental arthritis, cases requiring bilateral reconstruction, revision of ACL surgeries**,** patients who had surgery to the knee previously.

All patients were chosen for ACL reconstruction after careful clinical evaluation of the instability in the knee and correlating the MRI findings. All acute injuries of the ACL were braced and rehabilitated for at least a month. Rehabilitation included bracing, protected weight bearing, and quadriceps strengthening exercises. NSAID were used in cases of inflammation and pain as and when required. Patients were explained the nature of injury and prognosis. Patients who had partial injuries and patients who had a low demand knee and were desk workers, were given a trial of conservative management of 3 months before advising surgery. Functional recovery was assessed by lysholm scoring and IKDC scoring pre operatively. Surgical management was advised after the patient continued to have poor scores and had positive anterior drawer, Lachman's and pivot shift tests.

A preoperative assessment was made of all patients to ascertain surgical fitness. Lysholm scores and IKDC scores were noted. X-rays of both knees were taken in AP and the lateral views. MRI was done in ACL protocol to look for the level of injury and other associated injuries.

Surgical technique:

All the surgeries were done by a single surgeon with the same team under spinal or combined spinal and epidural anaesthesia. The patient was made supine with the operating limb held dangling. The other limb was held away from the operating area by a leg rest. Tourniquet was used in all cases. We do not use a pump for arthroscopy. A clinical examination was done under anaesthesia and the instability was ascertained before incision.

We use a portal slightly medial to the standard anterolateral portal to assist in better viewing of the femoral foot print. Although the portal often is close to the patellar tendon we did not find any issues with knee extension. A diagnostic arthroscopy was performed and the injuries were ascertained. A 2 cm incision was made midway between the tibial tuberosity and the postero-medial border of the tibia. The pes anserinus was exposed. The sartorial facia was opened to reveal the gracilis and the semitendinosus tendons. The tendons were carefully harvested using a tendon stripper after freeing them from their vincular attachments. The tendons were longitudinally placed one over the other after removing the muscle tissue and whip stitched together. They were quadrupled over an endobutton of appropriate size and sutured together as a single unit, and then tensioned. All the cases were operated on by the trans-tibial technique. The ACL JIG was fixed to 55 degrees in all cases and the tibial entry point using a guide pin was made intra-articularly at a point just lateral to the valley of medial spine anterior to the posterior border of the anterior horn of the lateral meniscus. The entry was checked by extension of knee to rule out impingement. Tibial tunnel was reamed 1.5 cm medial to the tibial tuberosity by graded reaming to the appropriate size. A femoral beath pin was used to locate the femoral entry point through the tibial tunnel. We try to preserve the tibial remnant stump to retain the available proprioception. The femoral point of entry was made just anterior to the anteromedial bundle foot print, while leaving a 7mm of bone posteriorly. This usually is a point just below and posterior to the lateral condylar ridge on the medial aspect of the lateral femoral condyle. The femoral guide pin was driven out. It was reamed to an appropriate size. Extreme care is taken to ream the last 5 mm of the femoral tunnel with only the 4.5 mm reamer so that the endobutton flips and doesn't back off. The graft was passed over the eye of the femoral beath pin and the endobutton is carefully flipped. The tibial end of the graft was fixed using a bio absorbable screw of appropriate size. We place the leg in 40 degrees of flexion with a posterior drawer effect while fixing the tibial screw. We routinely make a transtibial drill hole and circumscribe the excess tibial end of graft around, and tie a knot over the tibia as a post.

The limb is placed in a functional hinged knee brace post operatively. Toe touch weight bearing was started as tolerated and changed to partial weight bearing by second day. Knee range of motion exercises were started on the second post-operative day.

Data obtained has been stored in Microsoft excel spread sheets and analysed using descriptive statistics with assistance of SPSS 17 version software.

RESULTS

25 patients underwent ACL reconstruction by trans-tibial technique using quadruple hamstring graft. The mean age

of the patients involved was 26.9 years, with a male preponderance. The average height was 169.32 cm and an average body mass index of 24.375. 60% had a left sided injury, with most injuries happening in road traffic accidents (64%).

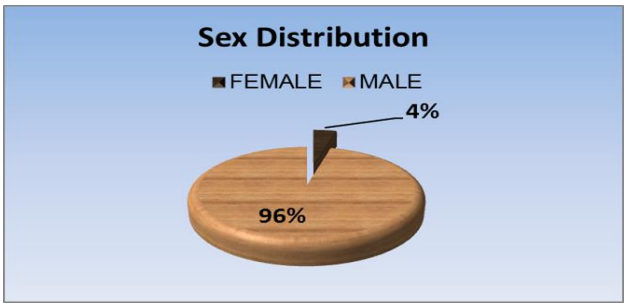

Figure 1: Sex distribution.

Table 1: Side of injury.

Side of injury	No. of patients	Percentage (%)
Left	15	60
Right	10	40
Total	25	100

The commonest symptom presented was instability (88%) followed by pain (80%). In our study the period elapsed from injury to the date of surgery ranged from 3 months to 2 years with a mean of 8.5 months. 68% had no associated injuries.

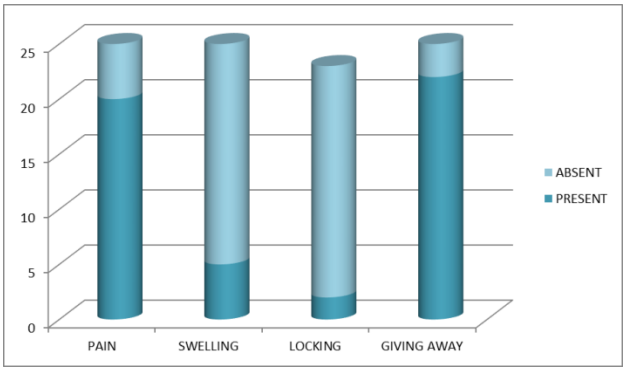

Figure 2: Presenting symptoms.

All the patients had positive anterior drawer test at grade 3. Lachman's test was positive in 96%, and pivot shift test was positive in 72%. The average graft length was 103.2 mm with an average diameter of 7.9 mm.

The preoperative Lysholm score was fair (65-83) in 56% and poor (<65) in 44%, it is improved to excellent (>90%) in 72% and 24% had a good outcome (84-90).

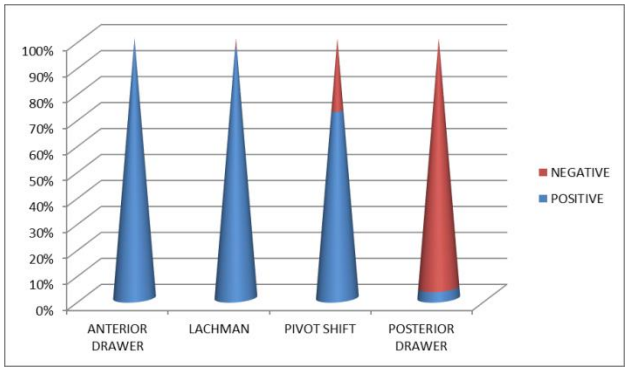

Figure 3: Clinical evaluation in outpatient.

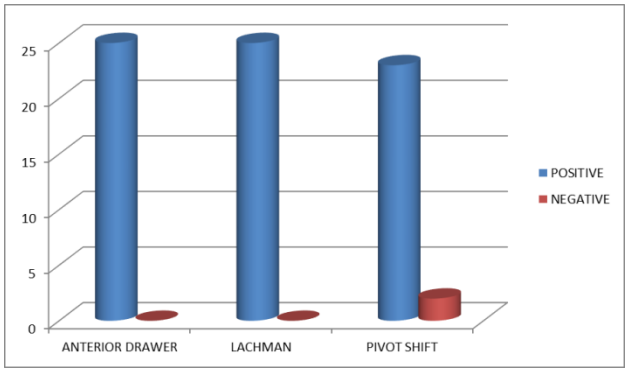

Figure 4: Clinical evaluation under anaesthesia.

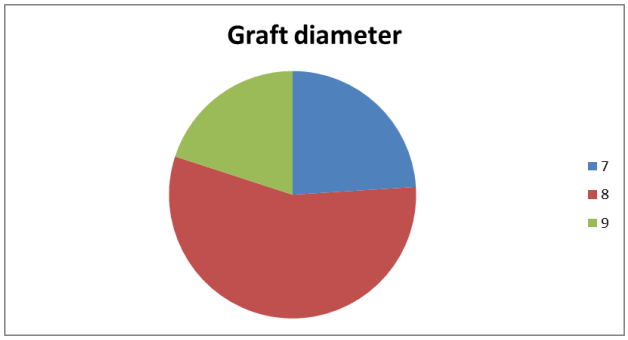

Figure 5: Graft diameter.

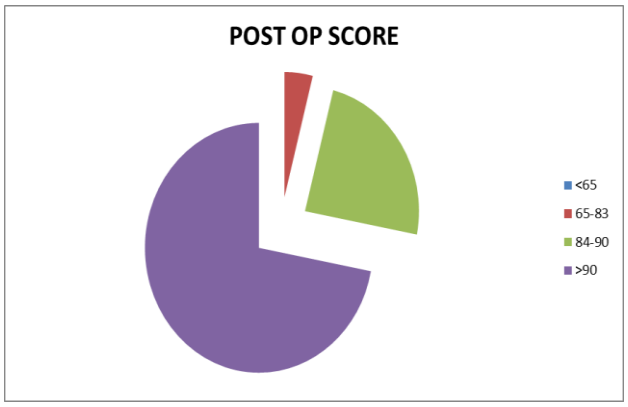

Figure 6: Postoperative Lysholm score.

The mean IKDC score was 29.26 which increased to 58.70 postoperatively, with a standard deviation of 4.45. 1 patient had infection (4%). 2 patients had postoperative stiffness. 92% had negative anterior anterior drawer test while 8% had grade 1 anterior test. 84% returned to pre injury level of activity.

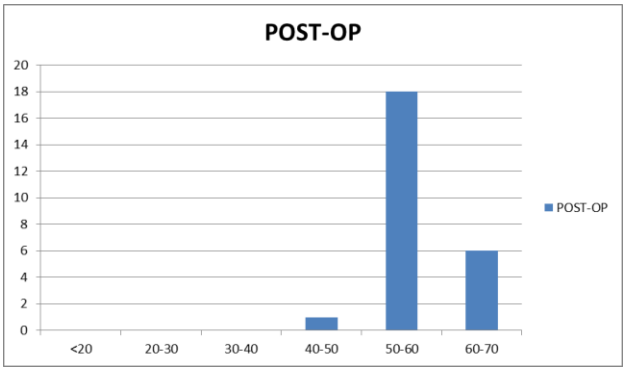

Figure 6: Postoperative IKDC score.

DISCUSSION

The study comprises 25 patients who underwent single bundle anterior cruciate ligament reconstruction using quadrupled hamstring graft in Nizam's Institute of Medical Sciences, Hyderabad for a period of one year. All patients were operated for the reconstruction using endobutton on the femoral side and interference screw on the tibial side.

96% were male and 4% were female all aged between 15 to 45 years of age. 60% were injured in the left knee and 40% were injured in the right knee. Brown et al studied the incidence of the sidedness of limb injury and sex incidence and stated that although their study pointed that females are more prone to this injury, the incidence is yet, more in males due their increased exposure to work in a strenuous environment.[5] They also hypothesed that limb sidedness have no influence in either during injury or the recovery period. Our study did not find any significance in the sidedness or the gender to the recovery during rehabilitation.

An analysis of the efficiency of MRI in diagnosing internal derangement of knee, by Nikolaou et al reported accuracy for tears of medial, lateral meniscus, anterior and posterior cruciate ligaments and articular cartilage was 81,77,86,98 and 60 percentages respectively.[6] They also stated a lower reliability for accuracy in clinical examination, and avoids the surgical risks of a diagnostic arthroscopy. Our study had MRI accuracy of more than 90%. MRI is preferable to arthroscopic diagnosis before surgery.

There is no clear consensus on the timing of surgery, although much has been studied so far in the literature. Most authors have opined on waiting for at least 3 weeks before ACL reconstruction from the time of injury.[7-9] In our study we treated acute injuries with bracing and rehabilitation and restricted activity until swelling reduced and the patient regained functional range of motion in the knee. Perioperative edema, hyperaemia and ROM appear to influence the outcome of ACL surgery.

Treme et al proposed that graft length is related to the height and BMI of the patient, while the diameter is related to the thickness of the thigh.[10] He further opined that a graft diameter of <7 mm will have a higher risk of failure. The average length of the graft in our study was 103.2 mm while the average diameter was 7.96 mm and the average BMI was 24.375 kg/m^2

Clinical evaluation of the patients for ACL reconstruction was done using the anterior drawer, Lachman's and the pivot shift tests. Pivot shift test correlated with complete ACL injury in all the cases. The anterior drawer test though was positive in all the patients, correlated to complete ACL injury in 22 cases while the rest were partial ACL injuries.

Kocher et al evaluated the relation between an objective assessment of knee laxity and the subjective assessment of symptoms and function.[11] He opined that the pivot shift test was a better correlator of 'functional stability" than the Lachman's test or instrumented knee laxity. In our study 96% the cases had a negative pivot shift test.

21 out of 25 patients regained pre injury level activity. Preoperatively, 56% had fair while 44% have poor Lysholm scores. Postoperatively 72% had excellent scores at >90, 24% had a good score of 84-90 and 4% had a fair outcome at 65-83 with a mean score at 91.16%. IDKC scores were <40 preoperatively, which improved postoperatively, with at a score 50-60 in 72%. 24% had a score at 60-70 with a mean of 58.70 (Figure 6). Lysholm scoring in our study significantly improved from mean preoperative scoring 58.76±15.29 to a mean post-operative score of 91.16±3.87 with a p value <0.001 which is comparable to Williams et al in which the mean score improved from 55 points to 91 points post operatively at a 2 year follow up ($p<0.01$).[12]

56% of the patients were operated between 0-6 months, while 36%were operated between 6-12 months from the date of injury and 12% after one year of injury. Delay in surgery did not grossly affect the outcome, although one case was operated at 3 weeks of injury which had postoperative stiffness. IKDC scores in our study improved from a mean pre-operative score of 29.26±4.94 to a mean post-operative score of 58.70±4.45 with a p value <0.001. Our study was for a year, probably the reason for a lower IKDC score. Despite demonstrating face validity, the IKDC scoring system there is the lack of patient contribution to item selection indicating that content validity cannot necessarily be assumed.[13] Although the IKDC system is less subjective than most other scoring systems, it is possible it may give a less favourable result compared to other evaluating systems.[13]

Also, although the scores are lesser when compared our study revealed, "functionally" the subjects of the study were better off than they were before surgery. It is possible the cases we studied were lower demand knees than those compared to other studies.

Figure 7: Preoperative X-ray and MRI.

Figure 8: Postoperative X-ray.

Figure 9: Quadrupled graft.

Figure 10: Guide wire from tibial foot print to femoral foot print.

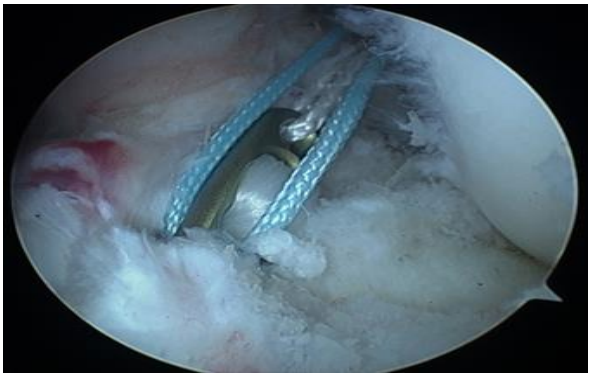

Figure 11: Passage of graft.

CONCLUSION

ACL reconstruction with quadruple hamstring graft is time tested technique. Adequate graft with appropriate thickness is a prerequisite for the success of surgery. Timing of surgery, precision in technique and adequate rehabilitation are the variables which influence strongly the outcome of surgery. Lysholm scores and IKDC scores are useful parameters to access the outcome of surgery. Subjective assessment of each individual after the reconstruction, during follow up sometimes is equally important than relying on objective scoring systems.

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Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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