Original Research Article

Functional outcome of arthroscopic reconstruction of anterior cruciate ligament injuries using quadrupled semitendinosus graft

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Abstract

Background: A wide variety of techniques and graft types are now available for the reconstruction of ACL. Arthroscopic ACL reconstruction using quadrupled semitendinosus tendon autograft with fixation in the femoral tunnel using endobutton and in the tibial tunnel with hybrid fixation using suture disc and anchored with a cancellous screw and washer is a relatively new technique. We have undertaken this study to analyse the postoperative outcome in our experience with this procedure. **Materials and Methods:** This was a prospective study of 30 consecutive patients with ACL injury who underwent Arthroscopic ACL reconstruction using quadrupled semitendinosus tendon autograft. Postoperatively, all patients were initiated on the same rehabilitation protocol. All patients were followed up for four to six months period at regular intervals using a subjective questionnaire. and hop test. **Results:** 90% of the patients had a favorable outcome. The mean limb symmetry index of hop tests were 83.503 ± 3.65 [range: 66.36 to 93.33]. **Conclusion:** We conclude that the functional outcome of arthroscopic anterior cruciate ligament reconstruction using quadrupled semitendinosus tendon autograft is excellent to good (90%). With proper patient selection and physiotherapy regimen, full occupational and recreational activities can be expected for most of the patients within four to six months of the procedure.

Key Words: Quadrupled semitendinosus graft, anterior cruciate ligament injuries.

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INTRODUCTION

Anterior Cruciate Ligament (ACL) injury is the most controversial ligamentous injury and has been studied extensively all over the world in the past 20 years. To date more than 400 different techniques have been described for Anterior Cruciate Ligament Reconstruction from open to arthroscopic technique[1].The bone- patellar tendon- bone is the most commonly used graft in ACL reconstruction. However, concerns regarding problems with the extensor mechanism of the knee, loss of motion, patellar fracture and the development of chronic anterior knee pain have promoted surgeons to seek other graft materials for use in ACL reconstruction. As such, the semitendinosus and gracilis tendon represent an alternative autograft donor material that may be used for reconstruction of the ACL without disturbance of the extensor mechanism. Arthroscopically assisted Anterior Cruciate Ligament reconstruction has the advantage of being minimally invasive, accurate graft placement, less disturbance of normal tissue resulting in quicker recovery and rehabilitation, minimal hospital stay and very less infection rate Anterior cruciate ligament (ACL) reconstruction with hamstring tendon is becoming increasingly popular in patients with symptomatic

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instability and in appropriately selected patients can yield successful and satisfactory results[2]. The cells of a quadrupled hamstring tendon graft probably survive intra articular implantation, but the cells of a bone-patellar tendon- bone graft do not. The quadrupled hamstring tendon graft is nourished by synovial fluid and doesn't depend on revascularization for viability.

MATERIALS AND METHODS

This was a prospective study of 30 consecutive patients who underwent arthroscopic ACL reconstruction using quadrupled semitendinosus tendon autograft during the study period of two years in GSL Medical College and Hospital, Rajamahendravaram.

Inclusion Criteria: All skeletally mature patients with ACL tear confirmed by Lachman test with or without concomitant meniscal injury that required repair were included in the study, provided that they were permitted to undergo rehabilitation after ACL reconstruction involving full weight - bearing gait and unrestricted non weight bearing range of motion.

Exclusion Criteria

1. Patients with ACL avulsion injury.
2. Anterior cruciate ligament tear with Concomitant posterior cruciate ligament, collateral ligament injuries requiring surgery or posterolateral corner injury.
3. Anterior cruciate ligament tear associated with the bony injury around the knee.
4. Patients undergoing revision ACL reconstruction.
5. Concurrent musculoskeletal condition, eg, back, hip, or ankle injury on either extremity.

Surgical technique Diagnostic arthroscopy is performed through an anteromedial and anterolateral portals, and any chondral or meniscal procedures are performed at this time. A minimal soft tissue notchplasty is performed for visualization purposes only. The semitendinosus tendon is harvested and a running, interlocking No. 2-0 nonabsorbable Krackow-type whipstitch in each end of the loop so that the graft can be passed as a single quadruple graft. Anatomical femoral and tibial tunnels are drilled using jigs. Pre tensioned graft with endobutton and its threads are passed and fixed to femur by togging of the endobutton. The tibial side of the graft is fixed with a hybrid type of fixation. Suture disc is held over the tibial tunnel by passing the ethibond threads through the suture disc and tightening the knots around the disc. Further the fixation is strengthened by anchoring screw of 4.5 mm size with a washer and the ethibond threads are tied around the screw below the washer.

Postoperative Management

On the operative day, after patient recovers from anaesthesia, patient is taught to do foot and ankle pump movements. The next day patient was taught static quadriceps exercises. On the 2nd post operative day, active knee bending with gradual increase of 10-20 degrees of flexion/ day was started. On the 3rd post operative day, assisted SLRT, abduction and adduction exercises of thigh and hamstring strengthening exercises were started. By the end of 1st weak, patient will be able to walk full weight bearing with long knee brace. Sutures are removed on the 10th post operative day and patient is discharged with the advice to continue exercises as per the protocol given to them in the form of a booklet. Patients were advised to wear long knee brace for 2 months to protect the knees from getting injured. Patients were followed up every month for the first 6 months and the progresses are assessed. Patients are subject to single hop test at 4th, 5th and 6th month of post operative period and at the end of 6th month, the patients are subjected to the subjective questionnaire. Single Hop test -The subjects performed one practice trial for each limb, followed by measured and recorded trials. The subjects were instructed to begin with the nonoperative limb. Subjects started each test with the lead toe behind a clearly marked starting line. No restrictions were placed on arm movement during testing, and no instructions were provided regarding where to look. Subjects were encouraged to wear the foot wear they would normally wear during their rehabilitation sessions. For the hop test to be deemed successful, the landing must have been maintained for 2 sec. An unsuccessful hop was classified by any of the following: touching down of the contralateral lower extremity, touching down of either upper extremity, loss of balance, or an additional hop on landing. If the hop was unsuccessful, the subject was remainded of the requirement to maintain the landing, and the hop was repeated.

RESULTS

The mean age in our study was 29 years. youngest patient was 20 years old and oldest patient was 50 years old. The maximum number of patients were in the age group of 21-25 years (36.67%) followed by the age group 26-30 years (23.33%). In our series of 30 patients, 29 patients (96.67%) were males and 1 patient (3.33%) female, (Male Predominance). It may be because of the involvement of males in outdoor activities like sports, farming and road traffic accidents. Right knee was injured in 19 patients (63%) and left knee was injured in 11 patients (37%) All patients presented with complaints of giving way of the knee. 90% of the patients were able to appreciate the clicking of knee. 60% cases were having swelling and 56.67% cases presented with complaint of pain. 46.67%

gave history of locking of knee which was correlated with associated injuries in the knee. Lachman test and Anterior drawer test was found to be 90% positive which was grade 3in 46.67%, grade 4 in 53.33% and pivot shift test in 56.67%. Medial meniscual tear is the commonest associated injury (46.67%) detected by MRI followed by lateral meniscus (20%) and grade 1 medial collateral ligament injury (10%) not requiring surgery. There was no lateral collateral ligament and PCL injury. Diagnostic arthroscopy prior to ACL reconstruction confirms medial meniscal tear in 40% cases and 26.67% lateral meniscal tear. The rest of the cases (43.33%) were isolated ACL injuries. There was no PCL injury in our study.4 patients (13.33%) had pain at the graft site at the end of 6 months infection of the site was present in 2 cases (6.67%) which delayed wound healing. There was no deep infection. Majority of the patients (76.67%) were having grade I laxity at the end of 6 months but with hard end point. 1 patient (3.33%) had FFD due to noncompliant physiotherapy. 2 patients (6.67%) complaint of click but no instability. At the regular follow up and at the end of 6 months, 66.67% patients graded their recovery as very satisfied and the remaining 33.33% were satisfied with the outcome.

Single hop test

Table 1:

Limb Symmetry Index	Minimum	Maximum	Mean
Preoperative	22.72	57.14	44.355
Postoperative	66.36	93.33	83.503

Limb symmetry index was calculated by the percentage of affected limb over the normal limb. The preoperative index ranges from 22.72 to 57.14 with a mean of 44.355. Post operatively the index improved to a mean 0f 83.503 ranging from 66.36 to 93.33. 63% of the patients were complaint with the post operative rehabilitation protocol. The percentage was higher initially but with the improvement in the daily life activities, the patients gradually decreased their physiotherapy intensity and thus the final noncompliancy was 37%.87% of the patients were able to return to their pre injury activity including farming and to competitive sports.

DISCUSSION

Anterior cruciate ligament (ACL) ruptures left untreated lead to subsequent kneeadisability, which can be severe with potentially devastating long term consequences. Although there are many potential graft choices from which to choose for ACL reconstruction, hamstring autografts have over the past decade increasingly become more popular. Several studies have shown that multiple-strand hamstring tendon ACL reconstructions have higher strength, stiffness, and cross-sectional area compared with patellar tendon grafts. Harvest of hamstring tendon autografts also yields less donor site morbidity than harvest of patellar bone- tendon- bone grafts and carries no risk of patellar fracture. Technical factors, specifically the absence of adequate fixation techniques, initially limited the use of hamstring grafts for ACL reconstruction. New techniques focus on optimizing graft strength and stiffness. Successful ACL reconstruction using hamstring autograft requires stable initial graft fixation and, ultimately, graft- to- bone healing. Hamstring reconstruction using femoral endobutton fixation has been shown to have excellent initial mechanical properties, including pullout strength. Tibial hybrid fixation with suture disc and an anchoring screw with a washer provide excellent soft tissue to bone fixation. Total number of patients in the study were limited to thirty. 29 (96.67%) were male patients and one female patient (3.33%), all aged between15 and 50 years of age. The side of injury was distributed accordingly - 63% [19 patients] to right knee while 37% [11 patients] injured their left knee. Arthroscopic ACL reconstruction was done as an in-patient procedure in all patients under spinal anaesthesia. Among the athletes, only two were into competitive sports- the others were involved in recreational sporting activity. Majority of our patients (57%) are from farming community and the rest (23%) are having sedentary lifestyle. Once the day to day activities of walking, squatting and climbing stairs returned, after following patients according to rehabilitation protocol for 6 months during immediate post operative and follow up period, it was observed that adherence to physiotherapy gradually waned in most of the patients. Vassilios S Nikolaou et al, in June 2008, after a retrospective analysis of MRI efficiency in diagnosing internal lesions of the knee, reported that the accuracy for tears to the medial, lateral meniscus, anterior and posterior cruciate ligaments and articular cartilage was 81%, 77%, 86%, 98% and 60% respectively[3]. They found that the clinical examination had significant lower reliability in the detection of these injuries and concluded that MRI is very helpful in diagnosing meniscal and cruciate ligament injuries. But in a countable percentage reports with false results and in chondral defects its importance is still vague. The arthroscopy still remains the gold standard for definitive diagnosis. In our study, clinical evaluation of the patients for instability was an essential component. Lachman test and Pivot shift test was more specific in diagnosing ACL injury which were further confirmed by arthroscopy, unlike anterior drawertest which in most of the patients was inconclusive as no correlation between preoperative and examination under anaesthesia. All patients performed the hop test in the postoperative four to six months period. The mean limb symmetry index of the single hop test was 83.503.

These values gradually reduced when the outcome became poorer on the scoring systems. Statistically the hoptest was significant with SQ. Andrea Reid et al, in March 2007, published their results of a series of hop tests on 42 patients, 15 - 45 years of age who had undergone ACL reconstruction[4]. The mean limb symmetry index in above study was calculated at the 22nd postoperative week against at 24th postoperative week in our study. The mean values of above study were all above 85%. In our study the mean value is around 83%. This could be due to some patients, especially the ones with a poorer outcome had much lower limb symmetry indices which was skewing the mean to the lower side. Moreover, many patients were quite apprehensive in performing the hop test, thereby increasing the disparity between the normal and the operated limb scores.

Table 2: Comparison of our results with Andrea reid et al & Gulick TD studies

	Andrea reid[4] et al. study, 2007	Gulick TD[5] Study, 2002	Present study
Number of Patients	42	57	30
Average age	26 years	27 years	29 years
Rehabilitation Protocol	4 - 6 months	4 - 6 months	4 - 6 months
Hop test- Mean Limb Symmetry	88.2 ± 9.5 (63.8 - 103.2) At 22 weeks	-	83.503 ± 3.65 (66.36-93.33) At 24 weeks
Laxity			
Up to Grade 1	72%	74.6%	76.67%
Return to priorlevel of function	-	84%	86.67%

Time period elapsed between the injury and the ACL reconstruction ranged from 1-1/2months to 2 1/2 years with a mean value of 6.6 months. The duration of surgery ranged from 95 minutes to 140 minutes with a mean of 109.5 minutes. 4 patients (13.33%) had pain at the graft donor site. One patient (3.33%) had numbness around the graft donor site which gradually resolved completely. 23 patients (76.67%) had laxity of up to grade 1. In spite of this, Lachman test was hard end and it is the reason for the success of the surgery. Two patients (6.67%) had superficial skin infection resulting in delayed wound healing and thus resulting in decreased post operative scores. Gulick TD[5] and others in 2002 studied on 57 patients and concluded that 84% of their patients returned to pre injury level of function. In our study 86.67% patients returned to their previous level of function with 63% of the patients complaint with the physiotherapy regimen. In 2003, Fareed H et al reported the results of a retrospective study on patients who underwent arthroscopic ACL reconstruction[79]. The purpose of their study was to evaluate their initial experience with this procedure. Between July 97 and march 2001, 29 patients underwent arthroscopic ACL reconstruction with 4 strand hamstring tendon graft. 25Were available for follow up. All patients underwent same rehabilitative protocol. Patients were evaluated using the IKDC ligament evaluation system. The average follow up was 25.4 months[6].

SUMMARY

This study was conducted on 30 patients suffering from ACL deficiency. More number of patients fall in the age group of 21-40 years with the peak incidence between 21-25 years. Nature of the injury in our series was road traffic accidents in 13 (44%); sports in 10 (33%) comprising 77% of the patients. Farming is the common occupation followed by sedentary and others. Giving way of the knee is the main presenting symptom (100%) in our study. Evaluation with Lachmen test under anaesthesia equates with arthroscopic evaluation (100%). Medial meniscus was the commonest associated injury (40%). All the 30 cases underwent arthroscopic ACL reconstruction with quadrupled semitendinosus tendon autograft and were given, rehabilitation protocol for a period of 6 months from post operative day 1. and the results were evaluated periodically at 16 wks, 20 wks and 24 wks. On evaluation of the patients during the follow up by SQ & single hop test, 90% of the patients had excellent to good results. 87% of the patients were able to return to preinjury level of activity..Superficial infection (2patients) was the complication encountered in our study. However, these had no contribution in the final outcome.

CONCLUSION

This study was conducted on 30 patients suffering from ACL deficiency in the age group of 20 - 40 years. All patients had instability of knee in the form of giving way evaluated by Lachman test and confirmed by arthroscopy. The functional outcome of anterior cruciate ligament reconstruction with quadrupled semitendinosus tendon autograft is excellent to good (90%) with mild laxity at the end of 6 months.

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