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Original Research Article

Thigh Girth: A Predictor of Outcome in Arthroscopic Anterior Cruciate Ligament Reconstruction – A Retrospective Study

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ABSTRACT

Background: The Objective of this study was to evaluate the effect of thigh circumference on rehabilitation after arthroscopic anterior cruciate ligament reconstruction. This study was conducted in a tertiary care institute with high volume of such patients and limited resources.

The choice of graft to be used in anterior cruciate ligament (ACL) reconstruction continues to be debated. The graft options for ACL reconstruction are autograft. At this time there is no synthetic graft that is acceptable. Autograft choices include patellar tendon, hamstring tendons, Achilles tendon and tibialis anterior/posterior. However, in our study we used bone patellar bone grafts and hamstring tendon grafts.

Choosing a graft includes taking into account many variables. The anatomy of the native ligament that is being replaced, the biomechanics, biology, initial fixation strength, morbidity of harvest, ease of harvest, and return to play time all must be considered.

Method: Patients with ACL-deficient knees who were symptomatic and wanted to maintain an active lifestyle or continue sporting activities were included. Our study included sixty patients out of which we used bone - patellar tendon - bone autograft in thirty patients and thirty patients were reconstructed using hamstring tendon autografts. These patients were followed at regular intervals of 10 days starting from day 15 to day 90. The mean age of patients reviewed was 31.96 years (range, 18–40 years). Out of total sixty patients there were 51 men and 9 women (ratio: 5.66:1)

Results: We reviewed sixty knees at two weeks, six weeks and eight weeks out of which thirty-nine patients achieved 120-degree flexion in prone position and full extension at the end of four weeks. Most common complication observed in our study was anterior knee pain followed by divergence of femoral screw.

Conclusion: This is a review of a summary of data of effect of thigh girth measured clinically on post-operative rehabilitation, despite the choice of donor tendon and mode of injury, in terms of full extension and prone flexion. This study concludes that patient's thigh girth and postoperative rehabilitation period are directly proportional to each other.

Keywords: Anterior Cruciate Ligament; Arthroscopy; Magnetic Resonance Imaging; Rehabilitation; Tendon Autograft; Thigh Girth Measurement.

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INTRODUCTION

The anterior cruciate ligament (ACL) is the main stabilizer of the knee for athletic pivotal activities. It serves as an important structure for biomechanical function of the knee joint. Any injury to ACL predisposes to abnormal kinematics and leads to degenerative changes in knee joint. As results of ACL reconstruction were not satisfactory so procedure was considered inappropriate and unnecessary, previously. Earlier patients treated non-surgically did well than those treated surgically. Surgery lead to numerous complications and was unable to restore normal function of the ligament. ACL reconstruction has been attempted using silver wire[1] fascia lata[2] and iliotibial band.[3] In 1939, Campbell[4] demonstrated reconstruction using the medial portion of the patellar tendon. In 1954, the development of a successful arthroscope brought new possibilities to the field of knee surgery.[5] Arthroscopically assisted ACL reconstruction has the advantage of being minimally invasive. Grafts can be accurately placed and there is less disturbance of normal tissue.[6] Subsequent recovery and rehabilitation is thus quicker.

Several types of replacement material are available: bone-patellar tendon-bone graft, quadrupled hamstrings, allografts, and synthetic materials. The patella tendon autograft has proved to be a reliable substitute for the native ligament and has yielded good long-term results. We report our experience of 60 cases of arthroscopically assisted ACL reconstruction using bone-patellar tendon-bone and hamstring autografts and correlation between thigh girth measurements and post-operative rehabilitation.

MATERIALS AND METHODS

All cases were operated between Jan 2015 to Sept 2016 at a tertiary care centre. Patients with ACL deficient knees who were symptomatic and wanted to maintain an active lifestyle or sports activities were recruited to the study. Patients were excluded if there were associated fractures around the knee, posterior cruciate ligament injury, or if they did not wish to maintain an active lifestyle. The study was approved by the ethics committee of our institute, and informed consent was obtained from all patients.

ACL reconstruction using the bone-patellar tendon-bone graft or hamstring grafts was performed in 60 patients. All 60 patients were followed up regularly and no lost to follow-up. The mean age of the 60 patients was 26.8 years (range, 21–39 years), 35 (44.9%) were aged 26 to 30 years. There were 51 males and 9 females (ratio, 5.66:1). Injuries to the right side (n=31, 51.66%) outnumbered those to the left (n=29, 48.34%) [ratio, 1.07:1]. Injury caused by sport activities accounted for 16.67% (n=10) of the patients, whereas motor vehicle accident accounted for 53.33 (n= 32) and injuries due to fall down and due to fall of heavy weight accounted for 26.67 % (n=16) and 3.33% (n=2), respectively. Clinical examination was the mainstay for the preoperative diagnosis; however injury was confirmed by Magnetic Resonance Imaging (MRI). Radiographs were obtained in 2 planes in the standing position. Acute ACL injuries were treated conservatively for at least 2 to 3 weeks prior to surgery. Surgery was performed after acute inflammation had resolved. Full range of motion and absence of extension lag was ensured in all patients by intense preoperative physiotherapy. All patients were operated on under spinal or combined spinal-epidural anesthesia. Peri-operative prophylactic antibiotic cover was given with third generation cephalosporin parenterally.

EUA and Documentation

The Lachman test, the pivot-shift test and the collateral ligament examination was performed under anesthesia. A pneumatic tourniquet was used, and the operated leg was draped free. In all cases, diagnostic arthroscopy was done to confirm MRI findings and meniscal tears were treated by partial meniscectomy before starting procedure for ACL reconstruction.

FOR BONE – PATELLAR TENDON - BONE (QUADRICEPS) GRAFTS

Graft Harvesting: A skin incision was made from the lower pole of the patella to 2 cm below the tibial tuberosity and extended medially. The paratenon was cut in line with the incision, and the patellar tendon isolated. With the knee flexed to 45^0, the mid-third of the patellar tendon was cut using a double-edged knife (10 mm). Plugs measuring 25 mm long were marked on the anterior surface of the tibia and patella using a No. 22 blade. An oscillating saw with No. 238 saw blade was used for bone plug harvesting. A curved osteotome was used for graft detachment.

FOR HAMSTRING GRAFTS

Graft Harvesting: Skin Incision An oblique 3-cm skin incision is made over the pes anserine, starting1cm medial to the tibial tubercle and heading posteromedial, 5cm below the joint line. Harvesting of the graft and drilling of tibial tunnel is done through this incision. Subcutaneous fat is incised and the pes anserine is stripped off with a sponge. The tendon is exposed, identified and fascia is incised. A Kocher is used to traction this flap. The most inferior tendon, Semi-T, is lifted up with the tip of the scissors or a Kocher and stripped off with tendon stripper. The total length of the tendon was usually 28 to 30cm. In case of shorter graft, gracilis tendon was harvested in the same fashion.

Graft Preparation: The edges of the graft were trimmed using a small nibbler to enable smooth passage through a No. 9 size. Two holes perpendicular to each other were drilled on the tibial plug and one on the femoral plug using a 2-mm drill bit. A No. 5 Ethibond suture (Ethicon, Johnson and Johnson, Westwood [MA], US) was threaded through each hole. The retro patellar fat was dissected off the tendinous portion using Mayo scissors. The bone-tendon junction on the femoral side of the graft was marked using a sterile marking pen. The graft was then assembled on the graft workstation. The length of the graft and plugs were measured accurately and covered with a moist sponge.

Notch Preparation: The ligamentum mucosum was excised together with all soft tissue on the lateral wall of the intercondylar notch. Most of the remaining ACL tissue was removed except for the tibial stump, because it was believed to enable proprioceptive function.

Notch Plasty: Notch plasty was performed only in cases of stenotic notches of less than 20 mm or when 'over-the-top' position was not visible. An arthroscopic burr or curette was used.

Tibial Tunnel Placement: An ACL tibial jig's hook was positioned via the anteromedial portal just anterior to the PCL and in the middle of the intercondylar notch in the coronal plane. The cannulated guide was then pressed against the tibial cortex 1.5 cm medial to the tubercle and 1 cm proximal to the pes anserinus tendons. A pin was drilled and observed arthroscopically as it entered the nominated site on the intercondylar region. A 9-mm cannulated reamer was used to prepare the tunnel over the guide pin.

Femoral Tunnel Placement: A femoral offset guide was used to position the guide pin 7 mm anterior to the 'over-the-top' position. A 9-mm reamer was used to create a footprint prior to the final reaming. This footprint was confirmed to be 2.5 mm anterior to the 'over-the-top' position, to prevent posterior blow-out. The final reaming was continued to a depth of 5 mm to 7 mm greater than the bone-plug length. The mouth of the tunnel was cleared of all soft tissue.

Graft Placement and Fixation: A 'beath' pin was drilled across both the tibial and femoral tunnels to exit through the anterolateral aspect of the thigh. The graft was threaded through this 'beath' pin with the femoral plug up. The 'beath' pin was withdrawn from the femoral side by gentle hammering, and the plug seated in the femoral tunnel. A 2-mm Kirschner's wire was placed into the femoral tunnel alongside the graft at 110^0 knee flexion. An interference screw was threaded over it arthroscopically to fix the graft. The knee was cycled 5 to 10 times while applying tension over the holding sutures. Tibial fixation was performed at 20^0 flexion using a 9-mm interference screw.

Postoperative Management: A compression dressing and rigid knee brace were applied postoperatively. Partial weight bearing was encouraged and gradually increased. Full weight bearing was permitted 4 weeks postoperatively. An intensive rehabilitation programme was instituted to allow patients to resume sporting activities and to regain range of motion, muscle strength, and normal gait.

RESULTS

Evaluation was performed using number of days taken to achieve full extension, 120 prone flexion and no extensor lag on straight leg raise. At final follow up of 90 days; the entire study group had achieved full extension and 120 ^{0} flexion at knee joint in prone position.

To be more precise 32 % (n = 19) patients had achieved full extension within 24 post-operative days, 51 % (n= 31) had achieved same between 25 to 44 days. However, 15 % (n = 90) and 2% (n = 1) gained full extension between 45 to 64 days and 65 to 74 days respectively.

Patients were also followed up post operatively in terms of 120 ^{0} flexion in prone position. Results showed that 37 % (n = 23) and 45 % (n = 27) patients had achieved above range of motion in first 24 days and between 25 to 44 days respectively. Between 45 to 64 days 15 % (n= 9) patients achieved 120 ^{0} flexion in prone position and remaining 3 % (n = 2) took 65 to 74 days for the same. There were 51 males and 9 females in our study.

Most patients who underwent ACL reconstruction had associated injuries of the knee. During arthroscopic ACL reconstruction, meniscal tears were treated by partial meniscectomy. Collateral ligament tears were managed conservatively. The most common complication was anterior knee pain in six (6) patients which was subsided within 2 wks. One patient had infection and divergence of screw was another complication in one patient.

DISCUSSION

In the 1970s, ACL tear was considered the beginning of a progressive deterioration of the knee that often ended an athlete's career. Now many athletes routinely return to play as soon as three to four months after an injury and certainly by the next season as medical profession has gained considerable experience in the surgical treatment of ACL injuries.[7] The operative treatment has evolved from open procedures performed in the hospital with postoperative casting to arthroscopically performed outpatient procedures with early weight bearing and splint immobilization. The incidence of ACL injury is 1 in 3000 patients. Increase in ACL injury in recent times is due to more involvement of young adults in sports activities. ACL is an important knee stabilizing structure amongst all other stabilizing structure. Primary function of the ACL is to prevent hyperextension and its secondary function is to restrain tibial rotation and varus and valgus stress. Rupture of the ACL compromises the stability of the knee and leads to episodes of giving way, recurrent injury to the menisci, and premature degenerative changes.[8,9] Arthroscopically assisted ACL reconstruction facilitates early recovery. Arthroscopic ACL reconstruction facilitates early rehabilitation, improves patient comfort and allows an early return to pre-injury activity. Management of associated injuries can be carried out simultaneously.[10,11] Reported incidence of Meniscal injury varies considerably ranging from 16% to 82 % in acute ACL tear and up to 96% in chronic ACL tears.[12-14] Fixation of graft using interference screws provides sufficient stability to meet the demand of a vigorous postoperative protocol.[11] It remains the gold standard for ACL reconstruction.[12] This method allows intensive retraining of the knee soon after surgery.

In our study, 60 cases of ACL tear were treated arthroscopically and followed up at a regular interval as per protocol in a tertiary care hospital. Among these patients, the most common associated injury was medial meniscal tear (n=21, 35 %) which were treated by meniscectomy. Other associated injury was medial collateral ligament tear (n=2, 3.33 %). Presence of associated injury is indicative of damage occurring at the time of initial insult as well as the predisposition to secondary damage in the ACL deficient knee. Extensive bone bruises that could not be detected clinically or arthroscopically after the first injury were evident on MRI even in truly isolated ACL ruptures.[15] These associated injuries compromise the results of ACL reconstruction. Limitation of our study was inequality in the sex ratio, short follow up and small sample size. Residual anterior knee pain (n= 6, 10 %) was the most common complication among our patients. Patients were instructed to start range-of-motion exercises on suture removal and early weight bearing as soon as possible. Divergence of a femoral screw was another complication. There were no disruptions of the extensor mechanism or non-traumatic graft failure.

This study has shown that patients with optimal thigh girth and following rehabilitation protocol pre-and post-operatively had achieved good range of motion in terms of full extension and 120 ^{0} prone flexion in early post-operative period.

CONCLUSION

Among patients with ACL tear repaired arthroscopically, within middle age group, with no major associated injuries and with proper following of pre-and post-operative rehabilitation protocols, shows direct relationship between optimal thigh girth and early range of motion of knee joint than either side of optimal.

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