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Anterior Cruciate Ligament Reconstruction Using Four Strand Semitendinosus Autograft with Hybrid Fixation.

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Abstract:
A wide variety of techniques and graft types are now available for the reconstruction of ACL. The development of new surgical techniques and recent advances in instrumentation has enabled surgeons to achieve better results. However, varying opinion exist among experts with regard to the ideal technique and graft type to be used. 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.
Methods:-
This was a prospective study of 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 six months period at regular intervals using IKDC, Lysholm Gillquist Score(LGS) scoring systems and a subjective questionnaire. Functional assessment with hop test was done.
Results:- *90% of the patients had a favorable outcome as per three scoring systems. The Lysholm score improved from a mean pre-op value of 52.7 (range 22-81) to mean value of 89.7 (range 62-100) at the final follow-up at a minimum of 2 years. The single leg hop measurements improved from a mean pre-op value of 52.37% to mean value of 88.4% at the final follow-up. 93.3% of the patients had either grade 0 or grade 1 Lachman grading at the final follow-up.*
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.*

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I. Introduction

Anterior Cruciate Ligament (ACL) injury is the most controversial ligamentous injury and has been studied extensively all over the world in the past 20yrs. The Anterior Cruciate Ligament is the weaker of the two cruciate ligaments and therefore may be it torn easier than the Posterior Cruciate Ligament.Anterior knee instability associated with rupture of the ACL is a disabling clinical problem. The ACL has a poor capacity for intrinsic repair. Thus patients who have knee symptoms related to ACL deficiency, may consider ligament reconstruction as a means of stabilizing the tibio-femoral joint and restoring high level function of the knee joint. Numerous authors have described successful reconstruction of the ACL with use of a donor autograft (patellar tendon, hamstring tendon or quadriceps tendon) and allograft (Achilles, patellar tendon, hamstring tendon or tibialis anterior) tendons. Anterior Cruciate Ligament Reconstruction has been attempted using Silver wire[2], Fascia lata[3], and Iliotibial band[4]. To date more than 400 different techniques have been described for Anterior Cruciate Ligament Reconstruction from open to arthroscopic technique[5]. 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. In 1954, the development of successful arthroscope brought new possibilities to the field of knee surgery[6].

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[7]. Anterior cruciate ligament (ACL) reconstruction with Hamstring tendon is becoming increasingly popular in patients with symptomatic instability and in appropriately selected patients can yield successful and satisfactory results[8]. There are a wide variety of fixation devices for the quadrupled hamstring tendon graft; however only a few provide better strength and stiffness than interference screw fixation of a bone-patellar tendon- bone graft at implantation. Aggressive rehabilitation is safe with both types of autogenous graft as long as strong, stiff fixation methods are used. Biau, et al, in 2007, performed a meta analysis to provide qualitative data to ascertain whether bone-patellar tendon-bone graft or hamstring graft provided superior knee function as determined by final overall IKDC evaluation and return to pre injury level of activity. They found no difference in the final number of patients restoring to fill activity after hamstring tendon graft and bone-patellar tendon- bone graft reconstruction[9]. There is fair evidence that patients reconstructed with hamstring graft report less morbidity than those reconstructed with bone-patellar tendon- bone graft. The improvement of stability with bone-patellar tendon- bone graft compared with 4 strand hamstring graft remains of questionable importance for most patients. However, functional results between the two types of reconstruction remains unclear. The present study is designed to analyse the postoperative outcome of arthroscopic ACL reconstruction with quadrupled semitendinosus tendon autograft fixed in femoral tunnel using endobutton and in the tibial tunnel using suture disc and anchoring screw of 4.5 mm size with a washer.

II. Methodology

The study was conducted in Hospital for Bone and Joint Surgery Barzulla Srinagar, an associated hospital of Govt. Medical College Srinagar. The prospective study consists of a total of 30 cases who underwent arthroscopic ACL reconstruction between July 2017 to Nov 2019 using four strand semitendinosus autograft.

Inclusion criteria Inclusion Criteria

- Both Sexes.
- Age Group: 18 to 50 years.
- ACL tears with functional instability
- ACL rupture associated with meniscal tears and/or grade 1 collateral ligament tears.

Surgical technique

Initial arthroscopy

The patient receives intravenous antibiotics preoperatively. After induction ofanaesthesia, the patient was positioned supine and a tourniquet applied on the upper thigh of the operative leg. An examination under anaesthesia was performed. Diagnostic arthroscopy was performed through an anteromedial and anterolateral portals, and any chondral or meniscal procedures were performed at this time.

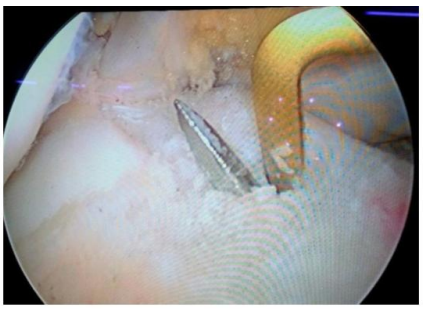
Graft harvest and preparation

Iincision was made anteromedially on the tibia starting approximately 4 cm distal to the joint line and 3 cm medial to the tibial tuberosity. Pes anserinus insertion was identified. Upper and lower borders of the Sartorius tendon were palpated, and identify the palpable gracilis and semitendinosus tendons 3 to 4cm medial to the tendinous insertion.Short incision was givin in line with the upper border of the gracilis tendon, and incision was carried just through the first layer, taking care not to injure the underlying medial collateral ligament. With the pes retracted medially, the gracilis and semitendinosus tendons were visible on the medial side. After the tendons were positively identified, the semitendinosus tendon was pulled forward with a curved clamp or a mixtar and snared with a braided suture.Then semitendinosus tendon was released from its tibial insertion. The insertion site.After carefully releasing the tendon from its insertion, a double Krackow – type whipstitch with vicryl near the insertion of the tendon was applied and release its fibrous extension to the gastrocnemius and semimembranosus muscles.All sides of the tendon were palpated to ensure there were no fibrous extensions before releasing it with an open – end tendon stripper. Then tendon preparation and pretensioning was done. The overall length of the tendon was measured.The tendon was quadrupled and whipstiching was done at ends of quadrupled tendon

Tibial and femoral tunnel preparation:

The anteromedial (AM) portal was established using an 18-gauge spinal needle under direct visualization.. This portal was made to allow improved visualization of the lateral wall of the intercondylar notch and achieve correct placement of the femoral tunnel. Then bony landmarks were visualized, especially the lateral intercondylar ridge and the lateral bifurcate ridge, using the following appropriate measurements: The center of the ACL femoral attachment site is 1.7 mm deep to the bifurcate ridge, 6.1 mm posterior to the lateral intercondylar ridge and 7.3–8.5 mm superior to the inferior articular cartilage border of the lateral femoral condyle in 90 degree knee flexion.

The site was located in the AP plane by extending a line in continuation with the inner edge of the anterior horn of the lateral meniscus. This point is located about 7 mm anterior to the anterior border of the PCL. The mediolateral placement of the tunnel centre corresponded to the depression medial to the medial spine in the mediolateralcentre of the ACL stump.



Arthroscopic view showing drilling of the tibial tunnel in the center of tibial footprint.

An ACL tibial tunnel guide set at 55 degrees was placed in the center of the ACL tibial insertion site, based on anatomic landmarks and previous marking. With the tunnel centre chosen, the patient's knee was flexed to 90 degrees, and the tip of the tibial drill guide was adjusted to create the desired tunnel length. The guide wire was drilled into place and its tip visualized as it entered the joint. The knee was cycled from 0 to 120 degree approximately 25 times for preconditioning of the graft. Tibial fixation was performed in 20 degrees of knee flexion using hybrid type of fixation. Suture disc was held over the tibial tunnel by passing the ethibond threads through the suture disc and tightening the knots around the disc. Further the fixation was strengthened by anchoring screw of 4.5 mm size with a washer and the ethibond threads are tied around the screw below the washer. The screw was then tightened and the excess thread was cut.

Wound Closure

Thorough lavage of the joint was done to clear off the debris. Graft harvest site was sutured in layers with no 2-0 vicryl. Skin sutured with ethilon / skin staples. ompression bandage dressing was done and long knee extension brace was applied.

III. Discussion

Anterior cruciate ligament (ACL) ruptures left untreated lead to subsequent knee disability, which can be severe with potentially devastating long term consequences. With improving results and increasingly reliable outcomes, patient and physician expectations have evolved to include the goal of return to activities and sports at normal or near normal levels. 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, however remote. 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. Lysholm score in the present series improved from a mean pre-op value of 52.7 to mean value of 89.7 at the final follow-up.In S Plaweski et al[10] 2009 series with a mean follow-up time of 51 months the Lysholm score improved from a mean pre-op value of 72.1 (range 50-86) to mean value of 94.1 (range 71-99) at the final follow-up In Eriksson et al[11] series 2001 with a median follow-up time of 31 months the Lysholm score improved from a mean pre-op value of 71 (range 29-90) to mean value of 86 (range 45-100) at the final follow-up. Sports trauma accounted for majority of the cases in most of the series reported in the literature. In the present series sports related activities was the commonest mode of injury comprising 46.7% of the patients. Road traffic accidents accounted for 23.3% of the patients. Meniscal injuries associated with ACL tears were found in 14 (46.67%) out of 30 cases in the present series. H Arsi et al[12] 2006 reported a series of 39 patients out of which 12 (30.7%) had meniscal tears. The time since injury in their study was 16 months. Ejerhed L et al[13] 2003 reported a series of 34 patients , 24 (70.6%) of which had meniscal injuries. Range of motion was compared with the contralateral knee. At the final follow-up all patients

hadnormal range of motion . In S Plaweski et al series of 105 patients 4 patients had 5 degrees of extension deficit. 7 patients had a mean flexion deficit of 7 degrees. In Ejerhed L et al 2003 series loss of extension of 5 degrees or more compared to the healthy contralateral side was registered in 9 of 34 patients and flexion deficit of 5 degrees was found in 24 of 34 patients. Complications included superficial wound infection which developed in two (6.67%) out of 30 patients at the tibial fixation site. Both the cases were managed with antiseptic dressings and oral antibiotics for 1 week. 12 (40%) patients complained of numbness over the anterior aspect of leg. In a study by Spicer et al areas of sensory change over the front of the knee were identifiable in 50% of the patients and of these 86% demonstrated sensory changes in the distribution of the infra genicular branch of the saphenous nerve.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 three scoring systems. Statistically the hop test was more of a trend with regards to IKDC and LGS, whereas it was significant with SQ.

IV. 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 withquadrupled semitendinosus tendon autograft is excellent to good (90%) with mild laxity at the end of 6 months

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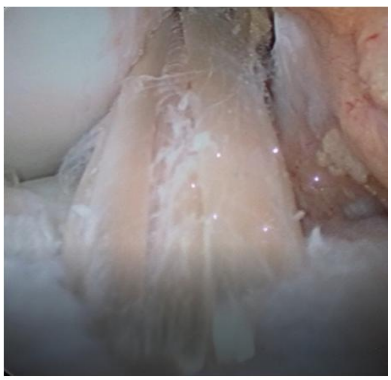
FIGURES

Semitendinosus tendon retrieval



Anteromedial portal view of the graft

Post operative radiograph

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