

## ORIGINAL ARTICLE

### A CLINICAL STUDY OF ARTHROSCOPIC MANAGEMENT OF ANTERIOR CRUCIATE LIGAMENT INJURIES OF KNEE JOINT

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**ABSTRACT: BACKGROUND:** Anterior Cruciate Ligament (ACL) tear is a common sports injury of the knee. There are a lot of controversies related to the management of this injury and more than 2000 papers have been published on the various aspects of the topic. Arthroscopic reconstruction of the ACL with autogenous graft material is widely used nowadays. The two most commonly used grafts are the central one-third of the patellar ligament (bone-tendon-bone, BTB) and the hamstring tendon (Semitendinosus-gracilis, STG) construct but the former graft leads to increased donor site morbidity & hurdles in postoperative rehab & pain. The aim of the study is to study the Arthroscopic management of anterior cruciate ligament injury of knee joint using quadrupled hamstring graft. **METHOD:** The study was carried out on 30 cases of anterior cruciate ligament injury of knee joint attending the OPD and emergency of department of Orthopaedics, Silchar Medical College & Hospital who met the inclusion criteria. An informed consent was obtained from each patient prior to participation in the study. All the patients were examined in detail and worked up to obtain pre-anaesthetic clearance. X-rays and MRI were done routinely in all the cases. Clinical and radiological parameters were recorded. Arthroscopic anterior cruciate ligament reconstruction with quadrupled hamstring graft was done in all the patients. Concomitant meniscal injuries were treated according to the merit of the injury. Patients were followed up at regular intervals and outcome variables were assessed and recorded. **RESULTS:** Results of our study clearly showed that arthroscopic ACL reconstruction using quadrupled hamstring graft is a safe, effective and reproducible procedure in restoring knee function with minimal donor site morbidity. At follow up evaluation, all patients had good outcomes in terms of clinical stability, range of motion and general symptoms. **CONCLUSION:** From the results in this study, we conclude that arthroscopic ACL reconstruction using hamstring grafts for ACL tears leads to good results in terms of clinical stability, range of motion of knee and functional outcome with negligible graft site morbidity. It is a safe, reliable and reproducible method for diagnosing as well as describing the type of ACL injury very accurately. The procedure is technically demanding and has a steep learning curve.

**KEYWORDS:** Anterior cruciate ligament; Hamstring graft; Arthroscopic Reconstruction.

**INTRODUCTION:** Anterior cruciate ligament (ACL) is frequently injured during sports participation. The annual incidence of isolated ACL injury has been reported to be 30/100000 persons and combined ACL injuries to be 98/100000 persons at physically active populations.<sup>[1,2]</sup> Associated injuries include other ligament tears, meniscal injuries, articular cartilage injuries, bone injuries and sometimes intra-articular fractures. The typical mechanism of injury is deceleration with twisting, pivoting or a change of direction on a weight bearing knee.

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There are a lot of controversies related to the management of ACL injury and more than 2000 papers have been published on the various aspects of the topic. The conservative management of ACL tears eventually leads to poor outcomes. Primary repair was tried earlier but the results were far from satisfactory. Arthroscopic reconstruction of the torn ACL is the preferred method of treatment nowadays.

The arthroscopically aided approach has the advantages of smaller skin and capsular incisions, less extensor mechanism trauma, improved viewing of the intercondylar notch for placement of the tunnel and attachment sites, reduced hospital stay, less postoperative pain, fewer adhesions, earlier motion, and easier rehabilitation. The selection of grafts depends on the surgeon's preference and the tissues available. Among the autogenous tissues currently available, the most commonly used are central one third patellar tendon, quadrupled hamstrings and less commonly quadriceps tendon grafts. Each of these grafts has been shown to have sufficient load-to-failure strength and stiffness to replace the cruciate ligament.

### **MATERIALS AND METHODS:**

**Study Design and Setting:** 32 cases of clinically or radiologically diagnosed anterior cruciate ligament injury of knee joint attending the OPD and emergency who met the inclusion criteria with effect from 01-07-2012 to 30-06-2013 were enrolled in the study. Patients were aged between 18-50 years. Patients with infective condition in and around the knee joint, tibial plateau fracture and distal tibial fractures were excluded from the study. Preoperative assessment was done using IKDC knee examination system.<sup>[3]</sup> and Tegner score.<sup>[4]</sup> Laxity was measured by clinical tests and range of motion was measured using Goniometer. For the purpose of documentation, a standard proforma was maintained.

**Surgical Technique:** Thorough diagnostic arthroscopy was first done via the standard anterolateral portal. The associated meniscal injuries were addressed accordingly. Arthroscopic partial meniscectomy or arthroscopic meniscal repair was performed in same sitting. Total meniscectomy group were excluded from the study. Anterior cruciate ligament tear was confirmed by the empty notch sign and probing. On confirming the diagnosis, hamstring graft was harvested from the ipsilateral side by standard technique. We did not do routine pre-tensioning of the graft with tensioner. The graft diameter measured and then placed in antibiotic mixed normal saline solution.

Tibial guide pin was placed at the midpoint of ACL footprint which was 6-7mm anterior to anterior margin of posterior cruciate ligament, 5 mm lateral to medial tibial spine and 3-4 mm posterior to the posterior edge of anterior horn of lateral meniscus. A tibial tunnel was made using a tibial drill guide and cannulated tibial reamers equal to the size of the graft diameter. Once the tibial tunnel was made, an accessory medial portal was made just above the meniscus. Transportal offset guide was used to mark the entry point of femoral tunnel in the medial wall of the lateral condyle of the femur. Entry point was made at 10 o'clock position for right knee and 2 o'clock position for left knee approximately. The femoral tunnel was first drilled with 4mm reamer till it pierced the femoral cortex. Femoral tunnel length was then measured. We used Merselene tape loop along with Endobutton for femoral side fixation. The loop of merselene tape was

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adjusted such that a minimum of 25 mm of graft remains inside the femoral tunnel. The tunnel is then reamed to a depth of 10 mm additional to the calculated intra-tunnel graft length and to a diameter equal to the graft diameter. The 10 mm of additional reaming is done to ensure smooth flipping of the endobutton on exiting the femoral tunnel.

The graft was then marked and passed into the tibial and femoral tunnels with help of a beath pin. The femoral end of the graft was then fixed with endobutton. Cyclical loading was also done before fixing the tibial end of the graft since pre-tensioning was not done. The tibial graft site was then fixed at 20 degree flexion of the knee joint using bioabsorbable/Titanium Interference screw. During this final screw tightening, an assistant applied posterior force on the tibia constantly. The graft was then re-examined with a probe and impingement checked. For additional anchorage on the tibial side, suture buttons were used in 4 cases and suture posts were used in 2 cases.

The joint was then thoroughly irrigated with normal saline; the incision was closed in layers. Antiseptic dressing was done; knee immobilization was done in 15 degrees flexion by compression bandage and knee brace. Early active range of motion and full weight bearing was started on second day onwards.

Average duration of surgery was around 75 minutes with range of 60 to 90 minutes.

Standard physiotherapy protocol was followed in every patient [5]. They were discharged at an average of 2.7 days with range from 2 to 4 days. Follow up were done on 2nd week and 4th week and after that every month for 6 months.

Intraoperative complications included 2 cases of inadequate graft size and one case of impingement. Gracilis graft was used to get adequate graft size and notchplasty cleared the impingement.

Post-operative knee effusion was noted in 2 cases which subsided without any active intervention. One case of superficial infection at the bio-screw insertion site was found which healed on Antibiotics and regular dressing.

**OBSERVATION AND RESULTS:** The study consists of 30 cases of ACL injuries with associated meniscal injuries treated by arthroscopic ACL reconstruction with hamstring graft and partial meniscectomy with balancing. The age ranges from 18- 46 years with mean age of 26.36 years. 28(93%) patients were male and 2(7%) patients were female in our series of ACL injuries. ACL injuries are more common in males which may be reflection of male being more involved in aggressive sporting and outdoor that predispose to rotational injuries of the knee. Left side (60%) is more involved than right side (40%). 28 patients (93%) had complete ACL tears whereas only 2(7%) had partial tear.

The time elapsed between injury and operation varied from 6 weeks to 5 years. Maximum patients were operated between 3-6 months. The most common associated injury was meniscal injury. Out of the total 28 cases of meniscus injuries, 19 cases (68%) had medial meniscus injuries and the rest 9 cases (32%) had lateral meniscus injuries.

Intra operatively, in three cases, the size of the SMT harvest was inadequate to make it quadruple. In one of those cases, the SMT was made trifold and used whereas in the other two cases additional gracilis tendon was harvested. These two patients had mild pain with mild lack of

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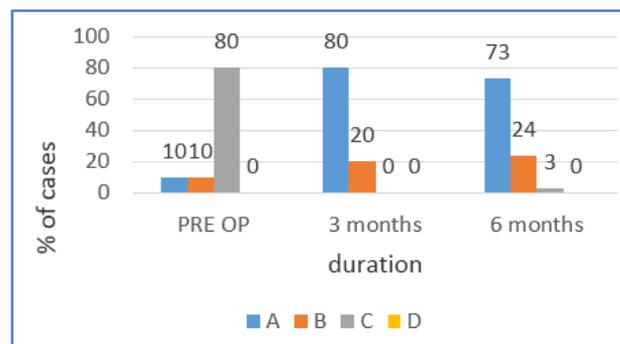
flexion in the early post-operative period but were symptom-free at 6 months. Intraoperative graft impingement was seen in one case where notchplasty was done.

MRI could detect 100% of the ACL tears in our study. Clinical tests failed to elicit signs of ACL insufficiency in 10% of ACL torn knees in our study. In our study, 2 patients were diagnosed as partial ACL tears which were found to be complete tears in arthroscopy. Similarly, 2 cases with MRI diagnosis of complete ACL tear were found to be single bundle tears only

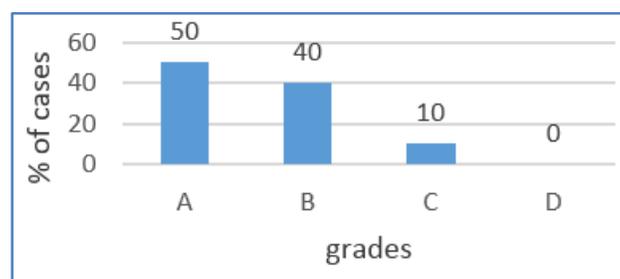
After 6 months of surgery, no patients had knee effusion, 87% patients had normal extension and 73% patients had normal flexion of knee. 73% patients had 0 grade of translation on anterior drawer test. 73% patients had 0 grade of translation on Lachman test. Only 2 patients had medial compartment findings at 6 months. After 6 months post-operative, no patients had any graft site pathology. In one leg functional hop test after 6 months, 70% were in grade A whereas rest 30% were in grade B.

Two patients had mild pain on knee extension with varus stress at post-operative follow-up. Both the patients were arthroscopically diagnosed to have osteochondral damage in medial femoral condyle. There were no anterior or lateral compartment findings in any of the patients

The pre-operative and post-operative Tegner scores were compared by Z test and significant difference was found between the two groups. The post-operative scores were much higher than the pre-operative scores. The final results were graded according to the Tapper Hoover system. The post-operative Tegner score was in the range of 3 to 8 with a mean of 5.8. At the end of 6 months, 47% patients had excellent results, 33% had good and 20% had fair result. No patient had poor result.



**Bar diagram showing translation on Lachman test**



**The bar diagram showing IKDC score**

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The final IKDC knee evaluation grade was grade A (Normal) in 50% of cases, grade B (Near Normal) in 40% of cases and grade C (Abnormal) in rest 10% cases. Fareed H et al<sup>[6]</sup> And K Button & others<sup>[7]</sup> did similar studies on early results of ACL reconstruction in 2003 and 2005 respectively, and analysed their results with the IKDC ligament evaluation system. Comparison of their results with ours is tabulated below:-

Name of study	Fareed H et al	K Button & Others	Present study
Year of study	2003	2005	2012-13
Number of patient	25	48	30
Average follow up	25.4 weeks	20 weeks	24 weeks
IKDC A(Normal)	12(48%)	26(54%)	15(50%)
IKDC B(Near Normal)	12(48%)	18(38%)	12(40%)
IKDC C(Abnormal)	1(4%)	4(8%)	3(10%)

Table 1: Final comparison of results

**DISCUSSION:** Total 32 patients were enrolled in our study. 2 patients were lost in follow up. So we ended up in a sample size of 30 patients. The patients were aged between 18 to 46 years with majority of the patients in their twenties. None of the patients had undergone any prior surgery in the concerned knees before.

Most of the patients were males (93%).The female incidence was very low in our study when compared with the studies on ACL injuries published in the western world.<sup>[8,9]</sup> This male preponderance of ACL tears in our study was mainly because males are more involved in outdoor activities in this part of the world. This fact is supported by a study by Brown et al in 2009,<sup>[10]</sup> who concluded that though females are more prone to ACL injuries, the incidence of males are more because females are less involved in strenuous activities. They also found that limb differences had no influence in injury pattern or recovery. In our study, 60% had left sided ACL tears while the rest were right sided. Only two patients had partial ACL tears and all others had complete tears.

The cause of ACL tears were sports related, road traffic accidents or fall. Majority had sports related injury (60%) but interestingly most of them were only occasional sports players and not professionals. Only one of them was a professional athlete. This stresses the fact that ACL injuries are commoner in untrained non-professional sports players who lack the proper training and knowledge of body dynamics that is required to prevent injuries in high demand sports.

In our study, only 2 patients had isolated ACL injury. All others were associated with additional injuries like meniscal tears or degenerative changes or articular cartilage injuries. Associated meniscal injury was a common associated injury with incidence of 70% in our cases of which medial meniscal injury being commoner. Our study clearly showed that isolated ACL injury is rare and medial meniscal injury is the commonest associated intra-articular injury seen.

MRI is considered as the gold standard non-invasive investigation for the diagnosis of ACL tears. Literature supports it with sensitivity in the range of 92-94% and specificity of 95-100%. In

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June 2008, Vassilios S Nikolaou et al<sup>[11]</sup> conducted a retrospective study of the efficiency of MRI in diagnosing internal lesions of the knee and found that the accuracy rate was 98% for ACL tears. In our study, all the patients were later confirmed at arthroscopy to have ACL tears. So MRI had 100% positive predictive value in diagnosing ACL tears in our study. But, 2 patients were diagnosed as partial ACL tears which were found to be complete tears in arthroscopy. Similarly, 2 cases with MRI diagnosis of complete ACL tear were found to be single bundle tears only. So, it was found that though MRI was 100% specific in diagnosing ACL tear, it was not so accurate in describing the grade (severity) of tear. Our study clearly showed that arthroscopy is a very accurate and reliable tool in diagnosing as well as revealing the grade of ACL injury.

The single strand of semitendinosus and gracilis have a strength of 1216 N and 838 N respectively,<sup>[12]</sup> while the quadruple graft has the ultimate tensile load as high as 4108 N<sup>[13]</sup> which is almost 3 times that of normal ACL. The quadruple hamstring graft has a stiffness of 807 N,<sup>[14]</sup> nearly 3 times stiffer than normal ACL and nearly twice as stiff as 10 mm central third patellar bone-tendon bone graft.<sup>[12,14]</sup>

Post-operative laxity is a concern in hamstring reconstructed ACL. Pre-operatively, 80% patients had ligament laxity of 2+(5-10mm) on anterior drawer and Lachman test. It dramatically improved immediate post-operatively but at 6 months ended with 24% patients having grade 1+ laxity. One patient had grade 2+laxity. In 2007, Andrea reid et al<sup>[15]</sup> studied the 6 months follow-up results of ACL reconstruction using hamstring graft in 42 patients and found ligament laxity of Grade 0 (0-2mm) in 72% cases. Gulick TD<sup>[16]</sup> did a similar study in 2002 in 57 patients and found 74.6% had grade 0 laxity.

**CONCLUSION:** Arthroscopic ACL reconstruction by hamstring autograft is a viable option. After good rehabilitation program it effectively prevents translation and pivoting of the knee. Six months period is not long enough to analyze the final results. But in the short study period available, our patients showed very good outcome with respect to clinical and functional parameters. Due to minimal invasive nature of the procedure, the patients had less post-operative pain, low rate of infection and better and faster compliance with rehabilitation program.

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