Analysis of Functional Outcome of Arthroscopic Anterior Cruciate Ligament Reconstruction using Quadrupled Semitendinosus and Gracilis Autograft - A Two Year Prospective study

S K Bhaskar¹, Abhishek Gupta², Pradeep Bagaria³

ABSTRACT

Background: The knee joint is frequently involved in sports injuries, road traffic accidents and during daily living activities. Anterior cruciate ligament is a very commonly involved ligament in these injuries. More and more cases of ACL tear are being diagnosed nowadays due to the increasing awareness among orthopaedic surgeon about importance of knee ligament injuries and also increasing availability of MRI as diagnostic tool.

Materials & Methods: The prospective study is conducted in Department of Orthopaedics, JLN Medical College and Attached Group of Hospitals, Ajmer from November 2014 to November 2016. All young and middle-aged patients presenting with unilateral knee complaints and history of trauma to the knee were evaluated by a thorough general and local clinical examination of the knee. In a relaxed patient and in supine position, the uninjured knee is examined first to establish reference values after which the affected knee is examined.

Results: The age of the patients ranged from 15–45 years with the mean age of 27.51 years. 37.1% of the patients in our study were in the age group of 20-25 years. The total of 20 cases (57.1%) of the right knees were involved and 15 cases (42.9%) of the left knee were involved in the study. The ratio of right knee to left knee involved in ACL injury was 1.33:1. After clinical, radiological and Arthroscopic examination we found that 51.4% (18 cases) patients had no associated injuries. Whereas rest 49.6% cases have associated meniscal injury (MM and LM or both).

Conclusion: ACL reconstruction using single stranded quadrupled semitendinosus and gracilis tendon autograft provide an intrinsically stable knee with full range of motion without any pain and with restoration of power.

Key words: Anterior Cruciate Ligament, Reconstruction, Autograft

INTRODUCTION

Arthroscopic-assisted reconstruction of the anterior cruciate ligament (ACL) using hamstring grafts is a well-known and widely accepted surgical procedure. The use of hamstring tendon autograft has been perceived to have less post-operative morbidities. The ACL is an important restraint to anterior tibial translation and tibial rotation and contributes to the overall stability of the knee. Subjects with ACL injury demonstrate laxity, an increase in tibia translation and knee instability. If an ACL insufficiency remains untreated, meniscal tear and cartilaginous damage of the joint may occur. Therefore, ACL reconstruction is generally recommended for active younger people to restore joint stability and prevent secondary arthritis. Lips Comb et al evaluated the peak torque value of hamstring strength after harvesting hamstring tendons and reported that no significant loss of hamstring strength occurred when the semitendinosus tendon and Gracilis tendon were used to reconstruct the ACL.

The semitendinosus and Gracilis tendon (STG) is found to be a very good autograft donor material, which may be used for the reconstruction of the ACL without disturbing the extensor mechanism. In ACL reconstruction using hamstring graft, only few reports are available on the postoperative incidence of area of hypothesias.

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The goal of the surgical treatment is to restore knee stability, thus preventing recurrent knee injury while allowing the patient to return to his pre-injury activity levels. Patients who are unwilling to modify their active lifestyle should be considered for surgical intervention. Obtaining the normal range of motion and regaining strength equal to uninjured leg are important. The present study is designed to analyze the post-operative outcome of arthroscopic ACL with quadrupled hamstring autograft fixed with endobutton in the femoral side and interference screw in the tibial tunnel. Therefore, this study was conducted with the aim

- To study the functional outcome of arthroscopic anterior cruciate ligament reconstruction using quadrupled semitendinosus and gracilis autograft.
- To study various complications following arthroscopic anterior cruciate ligament reconstruction using quadrupled semitendinosus and gracilis autograft.

**Methods**
The prospective study is conducted in Department of Orthopaedics, J.L.N. Medical College and Attached Group of Hospitals, Ajmer from November 2014 to November 2016. All young and middle-aged patients presenting with unilateral knee complaints and history of trauma to the knee were evaluated by a thorough general and local clinical examination of the knee. In a relaxed patient and in supine position, the uninjured knee is examined first to establish reference values after which the affected knee is examined. The following specific tests are performed for diagnosing anterior cruciate ligament deficiency:

1. Lachman’s test
2. Anterior drawer test
3. Lateral pivot shift manoeuvre

Manual knee laxity test was performed in all cases of ACL injury. First it was performed in normal knee which was taken as standard of that patient than it was performed on injured side. It is recorded as +, ++, +++ (if positive) and - (if negative). Injuries to the associated structures were assessed by performing the following clinical tests:-

1. Valgus / Varus stress test (for collateral ligaments)
2. McMurray’s test (for menisci)
3. Posterior drawer test (for posterior cruciate ligament)
4. Reverse pivot shift test (for posterolateral complex)

Routine skiagram of both knees in standing position in antero-posterior view and lateral view of the affected knee were taken and lower view in 45° of flexion of the affected knee was also done. MRI of the knee was done in all cases with clinical findings. Diagnostic arthroscopic examination of the knees was used as last resort for patients with negative or equivocal clinical and radiological findings but consistent symptoms suggesting anterior cruciate ligament deficiency.

**Patient Preparation:**
After giving the anesthesia (spinal, epidural or general) patient is placed in supine position on the operating table with the non-operative limb positioned in a well leg holder in a flexed and abducted position. The affected knee is examined, doing the relevant clinical tests, now under anaesthesia, to confirm anterior cruciate ligament deficiency.

Pneumatic tourniquet is applied to the operative leg after the limb was exsanguinated. The affected leg is then secured with lateral thigh post, which allows the movement from full extension to full flexion, the foot is also secured and supported.

**Initial Arthroscopy**
Diagnostic arthroscopy is performed through an anteromedial and anterolateral portal. Integrity of ACL, PCL meniscus cartilage covers over the tibial and femoral condyle. Patella is inspected, and any chondral or meniscal procedures are performed at this time.

**Results**
All the patients were kept on same type of diet for the period of every 24 hours. Urine collection, in the intervening period the patients were advised to continue same diet to which they were accustomed, that is no dietary restrictions were imposed which might influence the 24 hours excretion of the various parameters investigated. It was planned to try and include cases from all age groups in the study and that is why the cases are showing wide range of variations in their ages and body surface area. The age ranged from 9 to 70 years and men was 35.45 (+15) years. The body surface area ranged from 0.63 to 1.60m² and mean was 1.53 (+0.25) m². The individual stone formers showed large variation in their 24 hours urinary output. The lowest 24 hours volume in the 1st sample (pre-operative) was 320 ml and highest was 2300 ml, mean being 2000 ml in volume. In IIrd samples (post-operative) the 24 hours urine volume ranged from 560 to 2250 ml, mean being 1338 (+515) ml. Three urine samples measured more than 2000 ml in volume. In IIId samples (post Dolichos) the urinary volume ranged from 600 to 2620 mm l/24 hours, mean being 1494 (+565) ml and four urine samples measured more than 2000 ml. (Table: 2)

The statistical evaluation of various parameter before and after Dolichos ingestion is given in table No. 3 to 5, except citric acid (P < 0.05) statistically none of them is significant.

**Graft Harvest and Preparation**
After carefully identifying each tendon, place an umbilical tape around the gracilis tension, place a double Krackow-type whipstitch with vicryl near the insertion of the tendon and release its fibrous extensions to the gastrocnemius and semi-membranous muscles. Ability to bear weight (graded as full, partial, or impossible) was assessed post-operatively and at one, three and six months. Difficulty with squatting (assessed as no problem in flexing the knees greater than or equal to 90 degrees, ability to flex the knees greater than or equal to 90 degrees with slight difficulty, unable to flex the knees greater than or equal to 90 degrees, or unable to squat) was assessed at the preoperative, three, and six months visits.

The results are evaluated by **LYSHOLM KNEE SCORE**
The age of the patients ranged from 15-45 years with the mean age of 27.51 years. 37.1% of the patients in our study were in the age group of 20-25 years. The total of 20 cases (57.1%) of the right knees were involved and 15 cases (42.9%) of the left knee were involved in the study. The ratio of right knee to left knee involved in ACL injury was 1.33:1. There were no bilateral cases in this study.
Table 1: Showing age and Body surface area of the stone formers.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Age group (in years)</th>
<th>No. of patients</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15-19</td>
<td>2</td>
<td>5.7</td>
</tr>
<tr>
<td>2</td>
<td>20-25</td>
<td>13</td>
<td>37.1</td>
</tr>
<tr>
<td>3</td>
<td>26-30</td>
<td>11</td>
<td>31.4</td>
</tr>
<tr>
<td>4</td>
<td>31-35</td>
<td>5</td>
<td>14.3</td>
</tr>
<tr>
<td>5</td>
<td>&gt; 35</td>
<td>4</td>
<td>11.4</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>35</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2: Mode of Injury

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Joint Involved</th>
<th>No. of patients</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sports injury</td>
<td>16</td>
<td>45.7</td>
</tr>
<tr>
<td>2</td>
<td>RTA</td>
<td>9</td>
<td>25.7</td>
</tr>
<tr>
<td>3</td>
<td>Fall</td>
<td>10</td>
<td>28.6</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>35</td>
<td>100</td>
</tr>
</tbody>
</table>

In this study sports injury in 16 cases (45.7%) of patients while 9 cases (25.7%) were due to Road Traffic Accident. Injury due to fall was 10 (28.6%) of patients. After clinical, radiological and Arthroscopic examination we found that 51.4% (18 cases) patients had no associated injuries. Whereas rest 49.6% cases have associated meniscal injury (MM and LM or both).

Table 3: Associated Clinical Findings

<table>
<thead>
<tr>
<th>Clinical signs</th>
<th>Cases</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effusion</td>
<td>25</td>
<td>71.4</td>
</tr>
<tr>
<td>Joint line Tenderness</td>
<td>5</td>
<td>14.3</td>
</tr>
<tr>
<td>&lt; 100-degree flexion</td>
<td>7</td>
<td>20.0</td>
</tr>
</tbody>
</table>

Table 4: Pre-Operative Manual Knee Laxity Test

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lachman’s</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Anterior Drawer</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>29</td>
</tr>
<tr>
<td>Pivot shift</td>
<td>0</td>
<td>7</td>
<td>16</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 5: Post-Operative Manual Knee Laxity Test

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lachman’s</td>
<td>22</td>
<td>8</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Anterior Drawer</td>
<td>20</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pivot shift</td>
<td>27</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

The results were evaluated statistically between manual knee laxity test before ACL reconstruction and manual knee laxity after ACL reconstruction using the paired T test at 5% level of significance, the results were found to be significant. The results of pre-operative Lachman’s Test and post-operative Lachman’s test were statistically evaluated, and the mean of pre-operative Lachman test was 2.89 ± 0.32 SD and post-operative Lachman’s Test has mean 0.41 ± 0.71 SD with significant p value 0.001.

Similarly, the results of pre-operative Pivot Shift Test (PST) and post-operative Pivot shift test were statistically analysed. The mean pre-operative PST was 2.14 ± 0.73 SD and post-operative was 0.19 ± 0.47 with significant p value <0.001.

Table 6: Lysholm Score

<table>
<thead>
<tr>
<th>Lysholm Score</th>
<th>Pre-Operative cases</th>
<th>Post-Operative cases at 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of patients</td>
<td>Percentage</td>
</tr>
<tr>
<td>&lt;65</td>
<td>24</td>
<td>68.57</td>
</tr>
<tr>
<td>65-83</td>
<td>11</td>
<td>31.43</td>
</tr>
<tr>
<td>84-94</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&gt; 95</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Result of ACL reconstruction with quadrupled semitendinosus and gracilis tendon autograft were evaluated by Lysholm Score pre-operative and 6 months of rehabilitation and the results after 6 months were observed 34.38 percent (11 cases) having excellent result with overall Lysholm Score greater than 95 (Table 6). 17 cases (53.12%) were designated as good and 3 cases were fair and only 1 case does not follow proper rehabilitation schedule having poor result. Thus, we found that in our study 28 cases (87.5%) were having satisfactory result in Lysholm Score. The overall mean pre-operatively was 44.43 ± 15.39 and post-operatively Lysholm Score was 88.63± 7.82.

In our study we found that effusion in 25 cases (71.4%) this is the common finding associated with ACL tear and 5 cases (14.3%) associated with joint line tenderness and in 7 cases have flexion less than 100°. 
The results of Lysholm scoring were analyzed and were highly significant with p value less than <0.0001. We found that in our study only 7 cases (30.43%) complain of knee pain and sensory loss were found in 5 cases (21.74%) and in 4 cases (17.39) there was difficulty in regaining full range of motion.

DISCUSSION

Knee joint is frequently involved in sports injuries, mostly we got the sports injuries in defense personals during their training commonly during long jumps and running, however in our study road traffic accidents especially two wheelers and daily living activities commonly loss of balance and fall were equally involved. Anterior cruciate ligament is a commonly injured ligament in these injuries. More and more cases of ACL tear are being diagnosed now a days due to the increasing participation of people in sports, increasing road traffic accidents and due to the increasing role of arthroscopy and MRI (magnetic resonance imaging) as a diagnostic tool.

The two most commonly used autografts for intraarticular reconstruction of ACL are the central one third of patellar tendon and combined semitendinosus and gracilis tendon. We used quadrupled hamstring graft (gracilus plus semitendinosus) in this study to reconstruct the torn ACL using endobutton and interference screw for graft fixation on femoral and tibial side respectively in 25 patients.

In the present study age of patients ranged from 15 to 45 years with mean age of 27.51 years which matches with the mean age (27.1 years) of Lewis et al, Nikolaus et al mean age (29.0 years) and Siebold et al mean age (28 years).14-17. In the present study males outnumbered females where males constituted 33 (94.3%) cases and only 2 (5.7%) cases were female. Siebold et al, Lewis et al and Nikolaus et al also observed the predominance of males in their study. More involvement of males in the study can be explained by the fact that they are more involved in sports, outdoor activity and in road traffic accidents and thus are more vulnerable to knee injury.

In the present study left knee was involved in 42.9% cases where as right knee was involved in 57.1% cases. No definite dominance of any knee was observed. Similar were the observations of Siebold et al and Jomha et al.17-18

Most common associated injury in our study was medial meniscal (34.3%) injury followed by lateral meniscus injury (5.7%) which is in accordance with meta-analysis of Lewis et al in which the most common injury was medial meniscus injury (39%). Robert et al also had medial meniscus (27.02%) as most common associated injury.

In our present study results ACL reconstruction for Lachman test were 68.75% (22 cases) negative, 25.00% (8 cases) + positive and one case (3.13%) was ++ positive and one case showed +++ positive which is in accordance with Lewis et al meta-analysis study in which 59% were negative, 36.9% were +, and 2.87% showed ++.

While our results for anterior laxity are equivalent with Lewis et al, however, in comparison with the studies of Nikolaus et al which had 80% negative, 17% + and 3%++ and Robert et al which had 83% negative, 14% +ve and 3%++ our results showed greater anterior laxity.14-16

We did not find any correlation between anterior laxity and Lysholm scores.

One important finding of our study was the influence of rotational stability on the incidence of the functional subjective outcome. Patients having a negative pivot shift test showed better functional assessment scores. This is in line with the results published by Jonsson et al and others who suggested a positive pivot shift test as a predictor of later osteoarthritis based on the results of long term radiographic evaluations. Also, Kocher et al. reported a significant relationship between the pivot shift test grades and patient satisfaction, whereas anterior posterior laxity did not influence the patient subjective assessment two years postoperatively.

In view of these observations it seems to be clear that one of the main targets of any outcome evaluation of ACL treatment should be the precise documentation of transverse plane rotatory stability.

In our study 7 (21.88%) cases complained of knee pain. 2 (6.25%) cases developed superficial stitch infection which healed with the help of antibiotics and daily dressing. 5 (15.63%) complained of numbness around knee joint.

CONCLUSION

ACL reconstruction using single stranded quadrupled semitendinosus and gracilis tendon autograft provide an intrinsically stable knee with full range of motion without any pain and with restoration of power.

REFERENCES


