International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958

P-ISSN: 2706-6630

IJOS 2020; 6(3): 749-753

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www.orthopaper.com

Received: 16-04-2020

Accepted: 05-05-2020

Dr. Nagendra Prasad Kamalakar
Assistant Professor, Department
of Orthopaedics, MVJMC & RH,
Bengaluru, Karnataka, India

Dr. Sandeep Patil V
Assistant Professor, Department
of Orthopaedics, MVJMC & RH,
Bengaluru, Karnataka, India

Dr. Mohammed Tanzeem P
Post-Graduate, Department of
Orthopaedics, MVJMC & RH,
Bengaluru, Karnataka, India

**Dr. Vinodgouda Rangangouda
Patil**
Post-Graduate, Department of
Orthopaedics, MVJMC & RH,
Bengaluru, India

Dr. Sujai S
Professor, Department of
Orthopaedics, MVJMC & RH,
Bengaluru, India

Corresponding Author:

Dr. Nagendra Prasad Kamalakar
Assistant Professor, Department
of Orthopaedics, MVJMC & RH,
Bengaluru, Karnataka, India

Comparative study on bone patellar tendon bone graft and the hamstring tendon graft for reconstruction of anterior cruciate ligament and evaluation of results

**Dr. Nagendra Prasad Kamalakar, Dr. Sandeep Patil V, Dr. Mohammed
Tanzeem P, Dr. Vinodgouda Rangangouda Patil and Dr. Sujai S**

DOI: <https://doi.org/10.22271/ortho.2020.v6.i3l.2278>

Abstract

Objectives: To do detailed comparative study on bone patellar tendon bone graft and the hamstring tendon graft for reconstruction of anterior cruciate ligament and evaluation of results.

Materials and Methods: This was a prospective study comprising thirty patients who presented with knee instability and/or pain at MVJMC AND RH from June 2018 to June 2020. They were diagnosed clinically and confirmed by MRI to have anterior cruciate ligament tear. Patients with 18 to 40 years of age with ACL tear that occurred more than 4 weeks without previous surgery/ligament damage were included in study while patients with <18 or >40 years of age and evidence of osteoarthritis on plain radiographs were excluded. Outcome evaluation was done using Lysholm knee score and patients were followed up at 4,8,12 weeks, 6 months and 1 year.

Results: Mean post-operative Lysholm score in bone patellar tendon bone group was 85.6 with median value of 85 and scores ranging 65 to 98. Mean post-operative Lysholm score in Hamstring graft group was 88.9 with median value 88 and range 70 to 98. Complications like superficial or deep infections, ligament laxity, instability, arthrosis or revision were not seen in our study.

Conclusion: Arthroscopic anterior cruciate ligament reconstruction by either quadrupled hamstring tendon graft or bone patellar tendon graft gives satisfactory results in short term follow up in terms of patient satisfaction, activities of daily living and return to near normal activity. However, a large scale study with long term follow up is required to evaluate the long term results.

Keywords: Bone patellar tendon bone graft, hamstring tendon graft

Introduction

Anterior cruciate ligament (ACL) tear is the most common serious ligamentous injury to the knee joint^[1, 2]. The ACL is the primary stabilizer against anterior translation of the tibia on the femur and is important in counteracting rotation and valgus stress. Anterior cruciate ligament deficiency leads to knee instability. This results in recurrent injuries and increased risk of intra-articular damage, especially the meniscus^[3]. The goals of the ACL reconstruction are to restore stability to the knee; allow the patient to return to normal activities, including sports; and to delay the onset of osteoarthritis with associated recurrent injuries to the articular cartilage and loss of meniscal functions^[4]. During the past decade arthroscopically assisted techniques have been an accepted method of reconstructing the ACL^[5].

The advantages of arthroscopically assisted anterior cruciate ligament reconstruction include elimination of capsular incisions, decrease in trauma to the fat pad, avoidance of desiccation of the articular cartilage and a lower incidence of post-operative patellofemoral pain than with open reconstruction^[6]. The advantages of open procedure include better visualization of femoral condyles and technically less demanding procedure. The primary disadvantage of arthroscopically assisted technique is that the technique has a long learning curve and is a technically demanding procedure^[7].

The bone-patellar tendon-bone and the hamstring tendon are the two most commonly used Auto grafts for reconstruction.

Ideally, the graft used for ACL reconstruction should reproduce the anatomic and biomechanical properties of the native ligament, and allow solid fixation and rapid

biological integration, with minimal donor-site morbidity. To date, no graft fully meets all these desiderata. Both B-PT-B and HT transplants have their pros and cons that need to be taken into account in relation to the individual patient. There are presently no clear evidence-based guidelines in favor of one over the other^[8].

The two most commonly used grafts for the repair of a torn ACL are the central third of the patellar tendon, including its bone insertion sites, and the four-strand hamstring tendon graft made of the gracilis and semitendinosus tendons. The patellar tendon graft has been considered the ideal graft choice. It is accessible, has good structural and fixation properties, a potential for bone-to-bone healing, and a predictable success rate in the restoration of knee stability^[9, 13, 14, 15, 19, 21]. However, various donor-site problems have been reported after harvest of patellar tendon grafts. Anterior knee pain, loss of sensation, patellar fracture, inferior patellar contracture, and loss of extension torque impair knee function in spite of a successful replacement of the ACL^[10, 12, 18, 22, 24]. Therefore, use of the hamstring tendon graft has increased in popularity because of many reports that suggest its use incurs fewer donor-site complications^[11, 17, 20, 24]. The structural strength of a hamstring tendon graft with all four strands equally tensioned at time zero (4590 N) is superior to that of a 10-mm patellar tendon-bone graft (2977 N)^[14, 16]. The trend toward increased popularity of the hamstring tendon graft is also related to the development of fixation techniques better than those previously used compared with those used for fixation of the patellar tendon graft^[23].

Aims and Objectives

To do detailed comparative study on bone patellar tendon bone graft and the hamstring tendon graft for reconstruction of anterior cruciate ligament and evaluation of results.

Materials and Methods

This was a prospective study of thirty patients presenting with chief complaint of the knee instability and/or pain presenting to MVJ Medical college and Research Hospital from year June 2018 to August 2020 were diagnosed clinically by Lachman test, anterior drawer test, pivot shift test and confirmed by diagnostic arthroscopy or MRI to have anterior cruciate ligament tear. These patients were treated with arthroscopic anterior cruciate ligament reconstruction using either autologous ipsilateral hamstring or bone patellar tendon bone graft.

Inclusion Criteria

- Age of patients ranging from 18 to 40 years
- Anterior cruciate ligament tear that occurred more than 4 weeks
- No previous surgery performed on the affected knee
- No previous cruciate ligament damage sustained in the affected knee

Exclusion Criteria

- Patients less than 18 years of age and more than 40 years of age.
- Patients with multi ligamentous injuries and complex tears of the meniscus requiring additional procedures like meniscectomy
- Evidence of osteoarthritis on plain radiographs

Type of study: Prospective observational

Source of Funding: Nil

Conflict of Interest: Nil

Hamstring tendon graft harvest

Bone patellar tendon bone graft harvest

Arthroscopically assisted ACL reconstruction

Post op X-ray of ACL reconstruction with hamstring graft

Post op X-ray of ACL reconstruction with bone patellar tendon bone graft

Rehabilitation Protocol

Static Quadriceps and Static hamstring exercises are started immediately the next post-operative day. Knee bending was allowed on 3 weeks with range of motion exercise.

Statistical Analysis Methods

Statistical analysis was done using SPSS software (Statistical Package for Social Science, V 10.5 package). Within the same group preoperative variables versus post-operative variables comparison was done by Wilcoxon signed rank test and within same group variables correlation was done by spearman correlation test. Comparison of variables between groups was carried out by the Mann-Whitney U test. A P value of <0.05 was considered statistically significant.

Study duration & sample size: 2 years with 30 patients

Follow Up: 4,8,12 weeks, 6 months, 1 year

Outcome Evaluation: Lysholm knee score

Results

The study included 30 patients who had undergone anterior cruciate ligament reconstruction surgery from June 2018 to June 2020. Most of the patients presented in the 20 to 35 years of age group. The average age was 27.6 years. Out of 30 patients operated, 3 were women and 27 were men. Right side anterior cruciate ligament deficiency was seen in twenty one (70%) patients while nine patients (30%) had left side involvement. Number of patients presented with only complaint of pain was 17. Number of patients presented with only complaint of giving away was 5 and number of patients presented with complaint of pain associated with giving away

was 8. Out of 30 patients, 14 had valgus external rotation, 8 had varus internal rotation, 6 had extension internal rotation and 2 had acceleration deceleration type of injury in extension.

Pre-Operative Lysholm Scores

Range was 15-80 with mean value of 49.9 and median value of 55.

Time from Injury to Surgical Intervention

Time period from injury to surgical intervention was between 1.5 months to 90 months with mean of 15.483 months and median of 10 months.

Post-Operative Lysholm Scores

Mean post-operative Lysholm score in bone patellar tendon bone group was 85.6 with median value of 85 and scores ranging 65 to 98. Mean post-operative Lysholm score in Hamstring graft group was 88.9 with median value of 88 and scores ranging from 70 to 98.

Post-operative range of motion

Out of 15 patients operated with hamstring graft 1 had fixed flexion deformity of knee and active range of motion of 0-120 in 1 patient and 0-140 in 13 patients.

Out of 15 patients operated with bone patellar tendon bone graft 2 had fixed flexion deformity of knee and active range of motion of 0-120 in 3 patients and 0-140 in 10 patients.

Discussion

In meta-analyses by Mohtadi *et al.* and Tashiro *et al.* residual laxity, Lachman test and negative pivot-shift favored B-PT-B graft [25, 26]. In a meta-analysis by Samuelson *et al.*, there were no differences in anterior laxity or pivot shift [27]. In our study we found no significant differences in laxity between the two groups.

A recent meta-analysis found higher osteoarthritis rates in B-PT-B than HT graft (3 out of 5 series), in both patellofemoral and medial compartments [28]. In our study we found no arthritic changes radiographically in both group of patients. The meta-analyses by Mohtadi *et al.* [25] and Xie *et al.* [29] found no significant difference in graft tear rates between HT and B-PT-B. The Swedish and Norwegian registries reported higher revision rates with HT graft [30, 31]. However in our study there was no graft tear in the either groups and none of our cases required revision.

Spindler *et al.* found that kneeling pain was significantly more common in BPTB autografts than HT autografts [32]. Poolman concluded that "the currently available best evidence, derived from a methodologically sound meta-analysis, suggests that HT autografts are superior for preventing anterior knee pain [33]. In our study 5 out of 15 patients with B-PT-B graft had anterior knee pain and difficulty with kneeling and 2 out of 15 patients with HT graft had anterior knee pain and difficulty in kneeling.

Kim HJ *et al.* in their short study reported 7 cases (7.1%) of infection (5 deep and 2 superficial) in 98 cases of anterior cruciate ligament (ACL) reconstruction using hamstring autografts in a 17-month period [34]. Judd *et al.* reported that hamstring grafts were associated with a higher incidence of infection [35]. In our study there was no superficial or deep wound infection in the either group.

Lysholm scoring scale in our study showed that hamstring quadruple (Semitendinosus and gracilis) autograft in anterior

cruciate ligament reconstruction had slightly better scores compared to bone patellar tendon bone group.

Conclusion

Our study comparing HT and B-PT-B graft found no significant difference in subjective result. We also found no significant difference in knee range of motion, laxity and re-tear after a period of 2 years. Donor-site morbidity and especially risk of anterior pain and discomfort kneeling were less with HT graft. However, a large scale study and a long term follow up is required for a better comparison.

Successful ACL reconstruction depends on a number of factors: patient selection, surgical technique, including graft choice and management of associated meniscal and ligament lesions, and postoperative rehabilitation.

Technically, the most important points are good tunnel positioning, harvesting technique, treatment of all associated lesions and especially occult meniscal lesions and rotational laxity related to anterolateral capsule-ligament deficiency, which may require associated extra-articular ALL-plasty. Graft choice between HT and B-PT-B is secondary apart from in a few rare situations where it is determined by patient characteristics (growing child, frequent kneeling, MCL laxity).

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