Original Article

Technique of anatomic single Bundle ACL reconstruction with Peroneus Longus Autograft

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Abstract

Anterior Cruciate Ligament (ACL) reconstruction is a common ligament reconstruction to restore functional knee stability. However, the site of graft harvesting is vulnerable to have donor site complications of management occurs in a number of cases, in this review we aimed to evaluate treatment of anterior cruciate ligament by reconstructed with peroneus longs autograft.

Introduction

The treatment of ACL should be individualized to the patient. The two options in ACL tear are

a. Activity modification: the patient must avoids heavy sports such as skiers and football but allowed for some sports such as cycling and swimming from contact sports. If there are no giving away episodes, then he can advised for conservative treatment.

b. ACL reconstruction: in order to prevent early degenerative arthritis and return to previous activity level, the patient is advised to undergo ACL reconstruction [(1)].

Technique

Rhatomy et al. [(2)] reported the usage of peroneus longus tendon as an autograft in ACL reconstruction with good clinical outcome and minimal donor site morbidity, but other studies did not concur due to donor site morbidity. **Mustamsir and Phatama** [(3)] reported there is no difference between peroneus longus and hamstring tendon tensile strength.

Rhatomy et al. [(4)] described the peroneus longus (PL) as a graft that has adequate biomechanical properties and is safe to use in ACLR without major biomechanical and kinematic repercussions for the foot and ankle from which it was harvested. Some studies have indicated high regeneration potential of the donor site after PL removal, which contributes to the selection of this type of graft.

Procedure Surgical Technique harvesting the Peroneus Longus Autograft

The procedure is performed with the patient in the supine position on the surgical table with the heels at the end of the table. The site to be approached is appropriately shaved using an electric shaver. A pneumatic tourniquet is placed proximally on both lower limbs and inflated after the placement of sterile drapes. The following anatomic points are identified with a surgical marking pen with 90° of knee flexion: patella, patellar tendon, proximal articular surface of the tibia, Gerdy tubercle, and fibular head [(4)].

PL Harvest

Peroneus tendon harvesting was done in ipsilateral leg. The incision location was marked at 2–3 cm above and 1 cm behind the lateral malleolus. The incision was made through the skin, subcutaneous tissue, and superficial fascia. Peroneus longus and peroneus brevis tendon were identified. The location of tendon division was marked at 2–3 cm above the level of lateral malleolus. Distal part of the peroneus longus tendon was sutured with end-to-side suture. Peroneus longus tendon was stripped proximally using tendon stripper until ±4–5 cm below the fibular head to avoid peroneal nerve injury. [(4)].

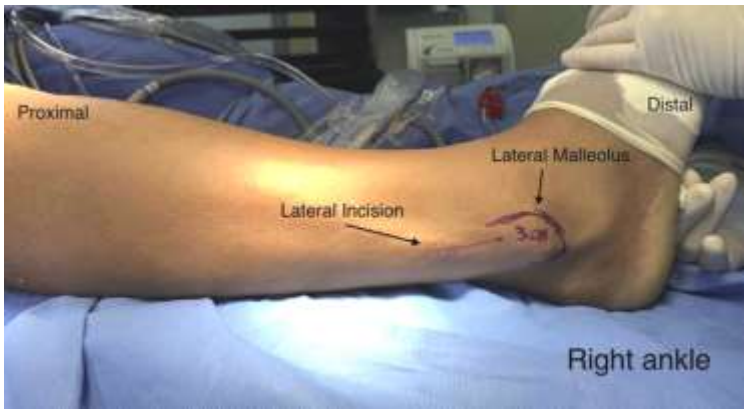

Figure (1) The right ankle showed the lateral malleolus and the incision site are traced. An incision in the skin is made 3 cm from the most distal point of the lateral malleolus[4]**.**

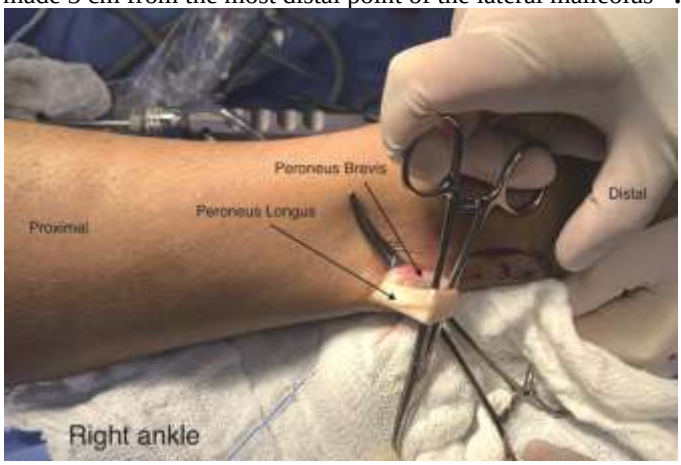

Figure (2) The right ankle showed A 3-cm incision is made proximal to the lateral malleolus. The peroneus longus and peroneus brevis tendons are identified and individualized [4]**.**

Figure (3) The right ankle showed both peroneal tendons are brought together in the most distal region of the incision using single sutures with No. 1-0 Vicryl thread [4].

Figure (4) The right ankle after being combined with the peroneus brevis, the peroneus longus is incised and removed with the aid of a tenotome[(4)].

Graft Preparation

After being harvested, the peroneus longus tendon is sutured on the preparation table by suturing 2 to 3 cm from each end with nonabsorbable sutures. The borders of the intra-articular parts of the graft are marked with VICRYL absorbable sutures (Ethicon, Somerville, NJ) or with a marker, which was measured during the stage of diagnostic arthroscopy. One side of the tendon is sutured by 3 different-colored traction sutures at equal intervals, starting from the middle of the tendon, where the first traction suture is placed with a lasso loop.[7] The second and third traction sutures are placed midway between the central one and the VICRYL marks (Fig 5). The graft diameter is measured with a sizer [(5)].

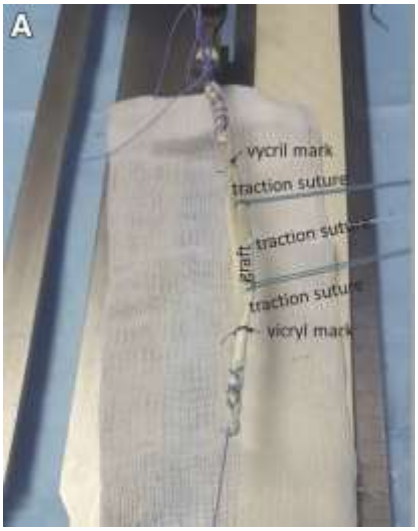

Figure (5) Peroneus tendon graft preparation in a live specimen (A) and model (B). The ends of the peroneus longus tendon are sutured with nonabsorbable stitches. Traction sutures and VICRYL marks are placed [(5)].

Arthroscopic Portals

Standardized anterolateral and anteromedial portals are used. We opt for a high anterolateral portal close to the patellar edge and flush with the patellar tendon. The anteromedial portal is created with care taken to form a good angle of inclination with the lateral intercondylar wall. The intercondylar notch was cleared from fibrous tissue to facilitate good visualization during preparation of the tunnels. ACL fibers were preserved as a reference for graft insertion. The femoral tunnel and the tibial tunnel were drilled independently. Graft tendon was implanted and tensioned using graft tensioner to prevent graft loosening in the future. Graft tendon fixation proceed using graft fixation in femoral side with button and using graft fixation in tibial side with bio absorbable screw [(4)].

ACL Tunnels

Reconstruction is performed through anatomic positioning to create the femoral and tibial tunnels, and guides (Acufex Pinpoint; Smith & Nephew, Andover, MA) are used to make the tunnels using the inside tibia -in technique. The size of the tunnels is based on the diameter of the quintuple graft obtained[4].

Rehabilitation after ACL reconstruction

Postoperatively, all patients followed the accelerated rehabilitation program of **Shelbourne et al., [6]** but without using a continuous passive motion (CPM) machine.

Day 1 after reconstruction

1. CPM.
2. weight bearing as tolerated with or without crutches.

2-3 days

1. CPM.
2. Passive range of motion 0-90 degrees (emphasis on full extension).

3-4 days

discharge from hospital (prerequisites for discharge):

1. Satisfactory pain management
2. Full extension
3. Able to do SLR
4. full weight bearing with or without crutches

7-10 days

1. ROM terminal extension.
2. prone hangs 2pounds.
   a. active assisted flexion.
   b. knee bends.
   c. step ups.
   d. calf raises.

2-3 weeks

1. ROM 0-110 degrees.
2. Unilateral knee bend.
3. Quarter squats.
4. Stationary bike.
5. Swimming.

5-6 weeks

1. ROM 0-130.
2. lateral shuffles.
3. light jogging.
4. jumping rope.

10 weeks

1. full ROM .
2. sport specific activities.

16 weeks

increased agility workouts.

4-6 months

return to full sport participation [6].

Ankle and foot rehabilitation [7]

This is a general conditioning program that provides a wide range of exercises. To ensure that the program is safe and effective.

Strength Strengthening the muscles that support lower leg, foot, and ankle to keep ankle joint stable. Keeping these muscles strong can relieve foot and ankle pain, prevent further injury, and promote lower limb health and stability.

Flexibility Stretching the muscles that you strengthen is important for restoring range of motion and preventing injury. Gently stretching after strengthening exercises can reduce muscle soreness and aid in joint mobility and muscle health.

Target Muscles The muscle groups of the lower leg are targeted in this conditioning program, as well as the tendons and ligaments that control movement in feet.

Length of program This foot and ankle conditioning program should be continued for 4 to 6 weeks. After recovery, these exercises can be continued as a maintenance program for lifelong protection and health of feet and lower legs. Performing the exercises 3 to 5 days a week will maintain strength and range of motion in foot and ankle [(7)].

Complications

Complications of ACL surgery

Various complications may be encountered during ACL surgery. It Can be classified into one of the following groups

Preoperative phase[(8)]

Those items should be avoided and recognized preoperatively to prevent possible complication.

1) Time of surgery: It is important to allow resolution of the acute inflammatory response prior to ACLR to avoid arthrofibrosis.

2) ACL reconstruction is deferred until the swelling has subsided after an acute injury. Performing the surgery too early may lead to knee stiffness after the ACL reconstruction.

Intraoperative phase

A. **General complications**

General complications can occur during ligament reconstructive surgery. These include cartilage damage, instrument breakage, nerve injury (tourniquet aralysis), vascular injury and anesthesia complication. [(9)]

B. Specific complications

1. **During graft harvest**
   a. **Nerve injury**
      Graft harvesting may be associated with some rare complications like peroneal nerve injury as reported in the present case [(10)].
   b. **Premature graft amputation**
      Resistance from a fascial band or accessory insertion may cause the tendon stripper to be misdirected and transect the tendon prematurely resulting in a shorter graft and necessitating an alternative graft choice. [(10)]
2. **Graft placement**
   If the tibial tunnel is positioned too far forward, graft impingement may occur on the roof of the intercondylar notch causing limitation of extension. If femoral tunnel placement is too anteriorly this will restrict flexion and lead to stretching and rupture of the graft. [(10)]
3. **Complications of graft fixation**
   a. **Screw fixation**
      Screw fixation may cause graft malposition due to the rotation of the graft around the screw. The national guide wire can become entrapped in the fibers of the ACL graft .Screw divergence can significantly affect the ultimate failure load; screw divergence of more than 15° lowered the ultimate load failure up to 50%. The most important factor to be considered when choosing a screw for the femoral fixation is the risk of posterior wall blowout. [(8)]
   b. **Button fixation**
      Lateral cortical blow out can greatly diminish the strength of fixation for button device. If this happens, two options are available, either the use of an implant with a longer button or use of supplementary femoral fixation with a screw. [(8)]

Postoperative phase

1. **Hematoma and hemoarthrosis**
   Hematoma can sometimes occur and can be avoided by releasing the tourniquet and performing meticulous coagulation prior to closure. (102)Hemarthrosis is a frequent complication of ACL reconstruction. Leaving a drain in the wound for 12 to 24 hours is helpful in decreasing the incidence of tense effusions. [(11)]
2. **Wound Healing Problems**
   Excessive retraction of wound edges can sometimes lead to skin necrosis and should be avoided. [(9)]
3. **Deep venous thrombosis (DVT)**

DVT and pulmonary embolism are rare complications due to the young average age of ACLR and the early mobilization [9].

4. **Infection**

   The clinical signs of infection 5 days or more after surgery include increased pain, diminished ability to bear weight, loss of motion, and the persistence of a large effusion. [11]

5. **Loss of knee motion**

   Extension loss of more than 10 degrees is a clear impairment for normal ambulation and may preclude participation in daily activities and sports a flexion loss is noticeable when there are greater than 10 º loss as compared with the contralateral side. Different cause for loss of ROM such as technical error in graft fixation, impingement, arthrofibrosis and others. Treatment should be directed to the cause. [11]

6. **Patellofemoral pain**

   Unfortunately, patellofemoral pain is a common occurrence with ACL injuries. It is better to be identified before surgery and a rehabilitation program initiated to improve the knee before reconstruction. [12]

7. **Effusion**

   Effusion is noted frequently following ACL reconstructions. The effusion commonly occurs in the early postoperative period and persists for the first 4 to 8 weeks. Most effusions can effectively be treated with ice, elevation, and compression. [12]

8. **Reflex Sympathetic Dystrophy (RSD)**

   RSD is defined as an excessive or exaggerated response of an extremity to injury, manifested by four or more characteristics: (a) intense or prolonged pain, (b) vasomotor disturbances, (c) delayed functional recovery, and (d) associated atrophic changes. [12]

9. **Degenerative arthritis**

   Degenerative arthritis can be caused by the trauma of original injury, by giving way episodes prior to surgery, or by the change in forces caused by reconstruction. Concomitant with many ACL injuries are chondral or meniscal lesions, which may contribute to the development of degenerative changes. [13]

10. **ACL failure** [9]

    General categories responsible for graft failure are

    a. Failure to recognize or treat posterolateral instability: can result in failure of the ACLR as a result of the tendency of the knee to go into hyperextension.
    b. Inadequate graft source: The hamstring tendons may not be used for ACL surgery if there was previous pes anserinus transfer, old MCL repair or previous hamstring tendons harvest.
    c. errors in surgical technique,
    d. trauma.

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