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Case Report
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Anterior Cruciate Ligament Reconstruction in a Bilateral Below Knee Amputee: A Case Report

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Abstract

Anterior Cruciate Ligament (ACL) rupture is a frequent injury commonly treated surgically but in the amputee population is often misdiagnosed and not treated at all. We present a case of a 36 female patient who had a simultaneous below-knee amputation due to a severe injury. The patient used prostheses at both legs for walking. She was diagnosed with ACL rupture using Magnetic Resonance Imaging (MRI) and in our clinical examination the knee had severe instability. The injury was due to a fall she had 2 years after the amputation. The patient underwent an arthroscopic ACL reconstruction using a quadriceps tendon-bone autograft. Postoperatively she was advised to use the prosthetic leg and she was encouraged to perform active and passive knee extension and flexion exercises. The patient had no major complications and she restored her preoperative active range of motion at 6 months after the surgery. Proper diagnosis and treatment of knee ligamentous injuries in these patients can improve their quality of life and make easier their daily living.

Keywords: Anterior cruciate ligament; Knee amputee; Reconstruction in amputee; Amputation

Introduction

Anterior Cruciate Ligament (ACL) isolated rupture is a common injury and it is one of most reviewed injuries in orthopedic literature [1]. Ruptures predominantly affect young and active population and are a major contributor to chronic knee instability [2]. The magnitude of ACL biomechanics properties can be anticipated in anatomical studies. ACL is a major static stabilizer against anterior tibia motion in all range of motion of the knee. Also ACL is a considerable rotational stabilizer of the knee [3]. As far as lower limb amputations are concerned, knee ligamentous injuries are difficult to diagnose and proper treatment is essential for a safe return to active life [4]. Operative treatment of ACL ruptures is an accepted method with beneficial outcomes in literature [2]. In this paper we de-scribe the operative treatment of an ACL rupture in a patient with below the knee amputation at both legs.

Materials and Methods

Case report

A 36 female patient presented to our clinic reporting instability at her right knee after a fall she had 1 year before the examination. She described instability during walking, especially when changing direction and inability to rise from sitting position. The patient sustained a below knee injury at both legs due to a train accident 3 years before the examination. She was amputated below the knee at both of her legs. She did not report any instability before the fall. She has been using 2 sports below the knee prostheses during her daily activities. At physical exam she had two well formed amputation stumps. The right knee ROM was 0 to 120 degrees at active and passive motion; she had a positive Lachman test (test performed with the prosthetic leg). She had no atrophy at both her quadriceps muscles as measured at the thigh 15 cm proximal from the superior pole of the patella before surgery. ACL rupture was confirmed with MRI. No other lesions were reported at her MRI study (Figure 1). At her preoperative study it was decided that a Quadriceps bone Tendon (QT) [5] autograft would be harvested due to a possible hamstring atrophy after hamstrings autograft harvest [6] and due to the superiority of QT autograft outcomes. Furthermore, the authors concluded that a patellar bone-tendon-bone graft harvest would cause severe irritation at the harvest site because of the proximity of the prosthetic leg [7].

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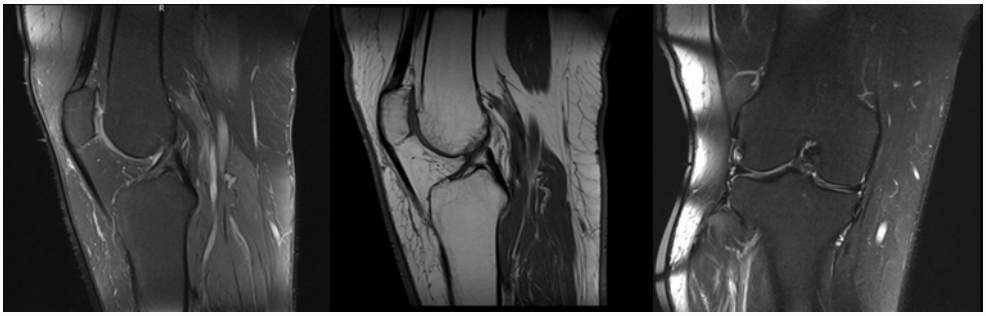

Figure 1: MRI assessment of the patient where an ACL rupture is described. No other interarticular lesions were notified.

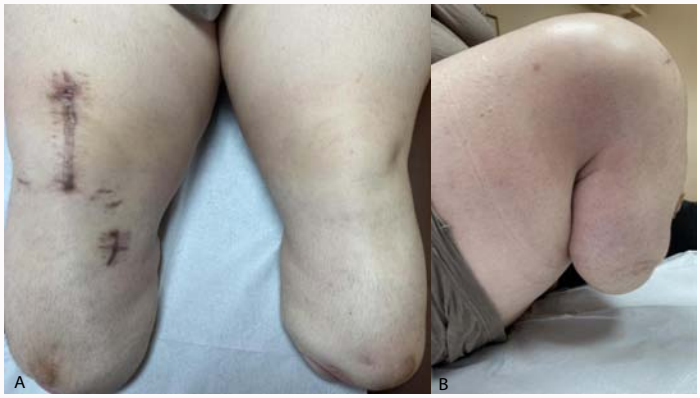

Figure 2: (A) Surgical site healed at 4 months, (B) Patient performing active knee flexion, 3 months post operatively.

Operative technique

Patient was positioned supine with the leg hanging using a post. A thigh tourniquet at 300 mmHg was used. Firstly, a quadriceps BT graft was harvested through a straight approach with a bone plug from proximal patella. The quadriceps tendon length was 100 mm, had 9 mm diameter at the tendon segment and 8 mm at the bone plug. After the harvest the graft was held in a solution of 100 mL saline with 500 mg of Vancomycin and the harvest site was sutured meticulously with absorbable sutures. Afterwards knee arthroscopy was performed using standard parapatellar portals at a pressure of 35 mmHg to 40 mmHg. ACL rupture was confirmed once again. Also a Grade I (Outerbridge Arthoscopic Grading System) was found at the non weight bearing of the medial femoral condyle. Debridement of ACL stumps and preparation of graft tunnels was performed. The knee was then maximally flexed to 120 degrees and a secure anatomic ACL tunnel could not be obtained so the surgeon decided that a transtibial technique could be used with safety. An 8 mm tunnel through the tibia and femur was performed first to accommodate the bone plug at the femoral side. The tibial tunnel was drilled again to 9 mm. After the tibial tunnel drilling a large amount of debris was present inside the joint and the surgeon had to remove it with the shaver. The graft was passed through the tunnels using sutures and was secured with a bio-absorbable (9 mm and 25 mm in length) interference screw at the femoral side and with a bio-absorbable (11 mm and 30 mm in length) interference screw at the tibial side. During tibial graft fixation knee was held at maximum extension. After the fixation knee arthroscopy was performed again and a notchplasty was carried out. All incisions were sutured with non absorbable sutures, a negative pressure drain was placed, and elastic band-age was used to drape the knee.

Postoperatively the patient was advised not to use the prosthetic leg on the operated side for one week. After that she was advised to walk with crutches and with weight bearing as tolerated. The patient was strongly encouraged to perform active and passive knee extension and flexion for the first 6 weeks. The following 6 weeks the patient was recommended to perform active and under resistance knee extension and flexion. After the 12th week post operatively the patient was advised to maintain the same exercise program to maintain her muscle strength. The patient was examined the 2nd, 6th, 12th week post-operatively and finally at 6 months after surgery.

Results

The patient had not major complications like pulmonary embolism and infection at surgical site incision. The graft harvest surgical site was healed 4 weeks after the surgery with no signs of infection (Figure 2a). Six weeks after surgery the patient had an active ROM between 0 and 90 degrees although passive ROM was 0 to 120 degrees. The patient although was advised to use her prosthetic legs, after the first week post-op, she finally used the prosthesis at 8th week post-op due to surgical site irritation from the prosthesis. The patient had to use a larger prosthesis because of local edema at her right knee. At the 3 month visit she had and active ROM of 0 to 110 degrees and the patient reported that she had no knee instability during daily activities (Figure 2b). At her last visit to the office which was 6 months after the surgery she had an active ROM between 0 and 120 degrees. Also both thighs had the same circumference (71 cm) as measured at the thigh 15 cm proximal from the superior pole of the patella [8].

Discussion

Ligamentous knee injuries in amputees are not widely investigated in literature so far. They are mainly reports about ligamentous knee injuries at the time of a traumatic amputation which often are

diagnosed during the rehabilitation period [4] and a few reports about ligamentous injuries after the amputation. The most common condition in below the knee amputees is patellar instability [9].

Perioperative care in an amputee with ligamentous knee injury who needs arthroscopic repair is certainly unfamiliar to the orthopedic surgeon.

Firstly, the choice of autograft is challenging. In patients with below knee amputations, hamstrings harvest site may be in close proximity with the amputations stump and there is evidence that thigh muscles could have some degree of atrophy [10]. Furthermore, decreased knee flexion torque and strength is described after ACL reconstruction using hamstrings autograft. The authors' opinion is that diminished knee flexion strength would prevent the patient from using properly her prosthetic leg and deteriorating more her gait [6]. What is more, patellar tendon autograft harvest is considered to predispose to anterior knee pain in high incidence thus the authors concluded that knee pain after the harvest would be exaggerated by the use of prosthesis [7]. As far as autograft selection is concerned, quadriceps tendon harvest is the optimal choice according to authors' opinion because of the relative distance from the amputation stump, the absence of atrophy at the quadriceps muscle and the relative limited site morbidity [11].

In addition, a low arthroscopic pressure of approximately 30 mmHg was maintained during the operation. It is rarely reported that in normal knees fluid may extravasate from the joint and cause massive swelling at the lower limb. In this manner, the authors concluded that a massive extravasation could be a serious complication in a patient with both legs amputated and thus the arthroscopic pressure was lowered as possible [12].

In literature, bone mineral density is studied among amputees. In several studies the outcome is that bone mineral density is decreased in the amputated leg and is strongly correlated to the time from amputation [13]. The authors noticed that during surgery the tunnels were drilled more easily than normal and a significant amount of debris were produced which could be a result of low bone density at the operated leg. Thus, it is of great significance that in amputated patients who undergo arthroscopic ACL rupture, drilling of osseous tunnels would be done in a meticulous way to avoid further damage to non-osseous tissues.

Conclusion

Patients with amputated legs need special care because ambulation is demanding. ACL ruptures in these patients could happen even a long time after amputation and are able to reduce their quality of life. Therefore, treatment should not be underestimated as it can improve significantly the daily living. The surgical team will encounter some technical difficulties that can be overwhelmed with optimized preoperative planning.

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