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Outcomes of anterior cruciate ligament reconstruction

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Introduction Anterior cruciate ligament (ACL) rupture is a relatively common injury to the knee joint in individuals of active working age. As such, ACL injuries result in knee instability with concomitant injuries to the articular components aggravating functional performance. The ACL injury affects a person's ability to work and go in for sports. **Material and methods** Outcomes of 192 patients with ACL injury treated with hamstring tendon grafts using the semitendinosus and/or gracilis tendons were reviewed. **Results** The Lysholm knee score was used to assess the results of ACL reconstruction. Excellent and good results were observed in most of the cases (n = 173; 90.1 %) and 16 (8.3 %) patients had fair results. Three (1.6 %) patients had poor outcomes and two of those underwent revision arthroscopy due to infection. **Conclusion** ACL reconstruction with semitendinosus and gracilis tendon is an effective and less traumatic technique for restoring knee stability after ACL rupture. Such factors as femoral and tibial tunnels provided at isometric points of the native hamstring ligament insertion site, adequate autograft diameter depending on patient characteristics and proper implementation of ACL rehabilitation program play a role in successful treatment.

Keywords: anterior cruciate ligament, arthroscopic reconstruction, knee joint

INTRODUCTION

The anterior cruciate ligament (ACL) is the main intraarticular stabilizing structure of the knee joint. Of all injuries to capsule and ligament apparatus, ACL injuries account for 50 % [1]. ACL injuries occur most frequently in contact sports or strenuous physical activity [2, 3]. According to different authors, ACL injuries account for 65 % of all injuries to the knee joint [4, 5]. ACL ruptures mainly affect young, physically active individuals and athletic people. Males are more likely to injure ACL than females because participating in high-demand sports is more common for males [2, 3, 4].

ACL functional inability features disturbed biomechanics of the knee and exposure of the joint to stresses and chronic overloading result in instability of the limb [2, 3]. ACL tears lead to posttraumatic anterior instability, synovitis, gonarthrosis that cause patients' limited functionality, affect their working capacity and can result in disability. The above reasons determine high socioeconomic importance of the problem [4].

Treatment options include different ACL reconstructions using the patellar tendon and semitendinosus, gracilis, quadriceps tendons, donor allograft tissues, synthetic grafts with different types of fixation. Autografts and allografts have become the most popular choices for ACL reconstruction [1, 6, 7]. The advantages of allograft include avoidance of donor site morbidity, the availability of numerous grafts, shorter operating time, less pain postsurgery and early rehabilitation. ACL reconstruction with autograft has the advantages of earlier incorporation and no donor disease transmission [8]. The autografts must be compatible with specific requirements [4]. Although ACL reconstruction using the central third bone-patellar tendon-bone as a free autologous graft is now a widely used procedure semitendinosus and gracilis tendon autograft is also effectively employed due to the biomechanical and strength characteristics [3, 9, 10]. Improved graft strength is directly dependent on the transverse section that is determined by its diameter with use of multi-bundle semitendinosus and gracilis tendon autograft [2, 11]. The studies show the tensile stress of duplicated semitendinosus and gracilis tendons measuring 4800 N [12]. ACL reconstructions focus on restoring anatomy with whatever surgical technique used [7].

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MATERIAL AND METHODS

The study included 192 patients (163 males, 29 females) with ACL tears surgically treated between 2013 and 2016. Patients with combined tears of posterior cruciate, medial or lateral collateral ligaments were excluded from the review. Patient ages ranged from 16 to 56 years. ACL injury occurred from 1 month to 9 years. Isolated ACL tears were diagnosed in 68 cases. ACL injury was combined with meniscus tears (n = 124) including medial meniscus injury (n = 72), lateral meniscus injury (n = 25) and both menisci tears (n = 27). Different degenerative and arthritic changes were observed in the articular cartilage of patients treated at one year of ACL injury.

All patients underwent arthroscopic ACL reconstruction with semitendinosus and/or gracilis tendon autograft. One tendon was used with sufficient semitendinosus thickness and length and gracilis tendon was added with undersized semitendinosus to have autograft of about 7.5 to 8.5 mm in diameter. The autograft was doubled or tripled depending on patient's body mass index. We normally used authograft of 9.0–10.0 cm in length.

Injured meniscus was partially excised. ACL remnants, the distal stump, in particular, were preserved in majority of the cases. Osteophytes in the medial and lateral femoral condyles were removed with notchplasty. Anteromedial approach was applied for reaming canal in the lateral femoral condyle. The tunnel was drilled at the insertion of ACL to the medial surface of the lateral femoral condyle. Femoral tunnel drilling through anteromedial portal was helpful to avoid vertical location of autograft in transtibial practice that could result in instability after ACL reconstruction. The tunnel drilled in the femur was 3 cm long and the diameter being dependent on the diameter of the autograft femoral portion. Autograft was fixed with biodegradable screws and femoral tunnel was 0.5 cm wider than autograft diameter to allow enough space for placing screws. The same technique was used for the tibial tunnel, however, tibial diameter was equal to autograft diameter in case of a low bone mineral density (BMD) since the normal proximal tibial epimetaphysis has lower BMD than the distal femur. Autograft was also fixed to tibia with biodegradable screws (Fig. 2).

Plaster cast was applied to the operated limb shortly after surgery for 1 week. Ice was placed to the operated site every hour for 15–20 minutes with the procedure gradually decreasing in time and frequency within 10 days to improve swelling and hemarthrosis. Isometric exercises were administered next day: patella movements, elevating the limb by 10–15 cm and tensioning quadriceps to prevent hypotrophy of femoral muscles. The cast was replaced with a splint or orthoses to allow adjustable range of motion after one week and exercise therapy administered. A 30–45º knee flexion was allowed in the first week after removal of the cast gradually increasing to 90º in the second week and onwards. Patients were encouraged to continue with special exercises aimed at preservation of femoral muscle tone. A special rubber device was recommended to strengthen femoral muscles after 1–2 months with gradual increase in loading. Since the time patient could have massage of the femur, physical procedures and exercise bicycle. Active sports were allowed following systemic rehabilitation after 8-11 months depending on the condition of the femoral muscles and stability of the knee joint.

MRI evaluation was performed at 1, 6, 12 and 18 months postsurgery (Fig. 3).

Table

Time of injury and types of ACL tears treated surgically

Time of injury	Isolated ACL tears	ACL injury and meniscus tears		
		Medial meniscus tears	Lateral meniscus tears	Both menisci tears
1–6 months	31	38	14	10
6 months – 1 year	23	22	5	8
1–3 years	9	8	3	4
3–9 years	5	4	3	4
Total number of patients	68	72	25	27

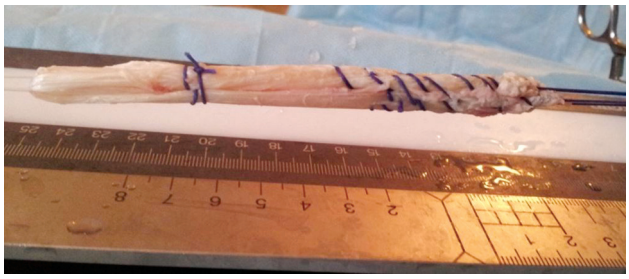

Fig. 1 Prepared autograft

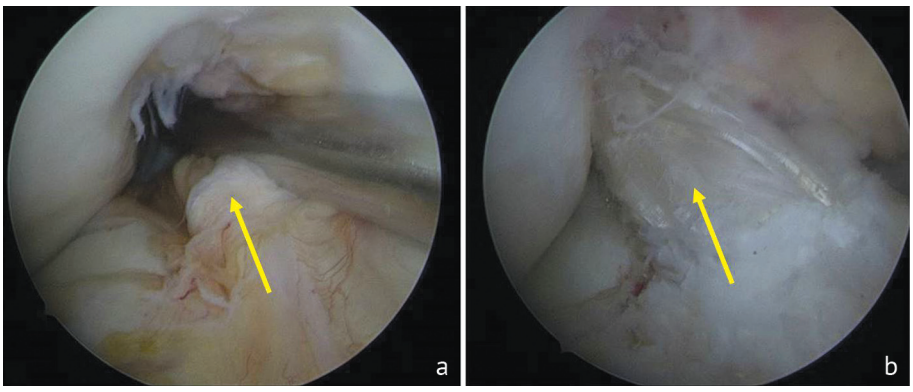

Fig. 2 Arthroscopic image showing (***a***) ACL tear (an arrow); (***b***) ACL injury repaired with autograft (an arrow)

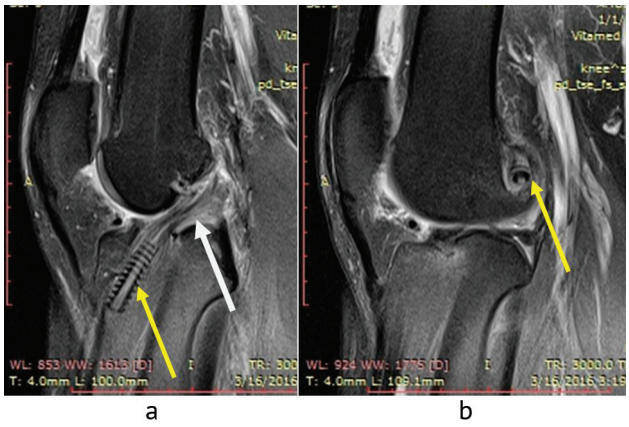

Fig 3 Postoperative sagittal MRI views of the knee showing biodegradable screws in tibial tunnel (yellow arrow) and autograft (white arrow)

RESULTS

Patients were followed up every month during 6 months and then every 3 months. The study included outcomes of patients seen 12-18 months after surgery. The Lysholm knee score was used to assess the results of ACL reconstruction. Outcomes were rated as excellent in 72 (37.5 %) patients, good in 101 (52.6 %) and fair in 16 (8.3 %) cases. Three (1.6 %) patients had poor outcomes and two of those underwent revision arthroscopy due to infection. The surgery included arthroscopic debridement, removal of autograft and screws followed by debridement of the joint. One patient of the group developed instability in the joint due to early (one month postsurgery) sports activities despite our recommendations.

DISCUSSION

Different studies report fair to excellent outcomes of ACL reconstruction at mid- and long-term follow-up [3]. Leys T. и Mascarenhas R. compared long-term follow-up of ACL reconstruction using semitendinosus/gracilis and patellar tendon autografts and detected no considerable differences [13, 14]. Wu W.R. et al. reported negative effect of concomitant meniscus tears and delayed ACL reconstruction as well as arthritis of the knee on clinical outcome of patients [15]. Our series included meniscus injury in more than two thirds of the patients who underwent arthroscopic meniscectomy. We found that meniscus injury had a negative effect on the knee joint in ACL reconstruction with subtotal meniscectomy, in particular.

Arthritis of the knee was likely to develop in patients with delayed ACL repair. Patients with evident arthritis of the knee Outerbridge grades II and III experienced difficulties regaining amplitude of motion, marked pain and limping during 3 months. From 192 patients of our series, 24 (12.5 %) sought medical assistance during 1–3 years of ACL injury, 16 (8.3 %) patients were seen 3–9 years following ACL injury. Nearly all patients of the last group were diagnosed with arthritis that resulted in fair outcomes of ACL reconstruction. Patients complained of pain and limited range of motion in the knee joint that indicated to negative effect of arthritis on the knee following ACL reconstruction. Patients who underwent subtotal meniscectomy reported pains at the site of subtotal meniscectomy at one-year follow-up. Revision procedures were performed for patients younger than 30 years. Two revision surgeries were produced due to infection developed after pneumonia (n = 1) and for unknown reason (n = 1). A young professional football player had a poor outcome with unstable knee due to early loading on the operated limb. This is the early weight-bearing that cause instability of the knee joint in young patients following ACL reconstruction [2].

CONCLUSION

ACL reconstruction using semitendinosus and gracilis tendon autografts has become the most popular choice for ACL injury repair. It is relatively less traumatic aesthetically. The technique provides stability of the knee and many athletes can return to active sports activity.

1. Arthroscopy is helpful in diagnosis of all intraarticular components of the knee joint.

2. The technique allows accurate identification of isometric centers of ligament insertion to drill femoral and tibial tunnels providing success to the surgery.

3. Semitendinosus and gracilis tendon autograft is now a widely used procedure being less traumatic in ACL repair.

4. Chondromalacia and osteoarthritis negatively affect ACL reconstruction.

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