Anterior cruciate ligament reconstruction: The interest of the double-incision mini-invasive technique for bone-tendon-bone harvesting

Omar Mourafiq, Youssef Benyias, Jalal Boukhriss, Bouchaib Chefry, Ahmed Salim Bouabid, Driss Bencheba, Moustapha Boussouga

Department of Orthopaedic Surgery and Traumatology II, Mohamed V Military Hospital, Rabat 10000, Morocco.

Abstract

Background: Anterior cruciate ligament (ACL) reconstruction using the patellar tendon is the most used for a strong fixation and early rehabilitation.

Objectives: To carry out an epidemiological study and to assess the evolutionary profile of patients with anterior cruciate ligament (ACL) rupture treated by arthroscopic reconstruction of ACL by the patellar ligament, taken by the double incision technique.

Methods: This is a retrospective study of 60 patients with ACL rupture who underwent arthroscopic ligamentoplasty, using double vertical incisional patellar ligament in the department of orthopaedic surgery and traumatology II, Mohamed V Military Hospital- Rabat,over a four-year period from 2012 to 2016. This study involved 56 men and 4 women with an average age of 29.3 years.

Results: In the present study, at the subjective level: 54 patients (90%) estimated to have found a normal knee (International Knee Documentation Committee A (IKDC A), six patients (10%) estimated to have found a knee almost normal (IKDC B). Four patients (6.6% of cases) complained of mild patellar pain (IKDC B).

On the objective plane: 58 patients (96%) found normal knee joint mobility (IKDCA), and 2 patients (4%) kept a 10° flessum (IKDC C). The Lachman-Trillat test was negative in 56 cases (94%) (IKDC A). Thepivot shift was absent in 55 patients (92%) (IKDC A).

Conclusion: The arthroscopic reconstruction of the ACL by the patellar ligament, taken by the double incision technique remains the technique of choice in the surgical treatment of ACL ruptures, allowing a solid fixation with early rehabilitation.

Key words: Anterior cruciate ligament, Bone-Tendon-Bone, Arthroscopy, Double incision

Introduction

The rupture of the anterior cruciate ligament is a very frequent pathology, generally affects the young and sporty patient.[1] ACL rupture, exposes the knee to meniscal lesions, instability and early osteoarthritis.[2] ACL ligamentoplasty has undergone many changes over the past 30 years, from an open technique to an essentially arthroscopic technique.[3] The patellar ligament has long been considered the transplant of choice, it offers high mechanical strength, and a good quality of primary and secondary fixation thanks to its two sticks bone. But, the final result may be imperfect because of the anterior pain.[4] Gaudot et al.[5] show in their study that the double incision approach reduces anterior pain and decreases the frequency and surface area of hypoesthesia.

Our main hypothesis was that the double incision technique of graft harvesting reduced the incidence of anterior pain compared to the single incision.

Materials and methods

This is a retrospective study, involving 60 patients, operated for rupture of the ACL in the department of orthopaedic surgery and traumatology II, Mohamed V

Address for Correspondence:

Dr. Omar Mourafiq

Department of Orthopaedic Surgery and Traumatology II, Mohamed V Military Hospital, Rabat 10000, Morocco.
E-mail: omarmourafiq24@gmail.com

Military Hospital- Rabat, between January 2012 and December 2016. Inclusion criteria were patients with ACL rupture with or without meniscal lesions.

Patients with peripheral associated ligamentous lesions, associated posterior cruciate ligament lesions, external lateral ligament lesions, lesions of the posterior-external angle point, femorotibial osteoarthritis and those who have already undergone previous surgery on the same knee, were excluded from the study. The average age in our study is 29.3 years old. Our study includes 56 men (93.4%) and four women (6.6%). The left side was reached in 32 cases (54%). The mechanism of rupture of the ACL was often an indirect trauma: Valgus flexion external rotation in 32 cases (54%).Sport injuries were the most common cause of ACL rupture in our study (83%).The diagnosis of ACL rupture was selected based on clinical criteria (instability and Lachman tests and positive pivot shift), and paraclinical, MRI (magnetic resonance imaging) performed in all our patients. All patients were operated by the same surgical technique: arthroscopic ligamentoplasty using patellar ligament removed by double incision.

Operative strategy:

The removal of the transplant was performed by two vertical incisions, one on the tip of the patella, the other on the projection of the anterior tibial tuberosity. (fig1)

- After removal of the patella stick, we do the discision of the fibers of the patellar tendon to the anterior tibial tuberosity subcutaneously.
- Then the graft was emerged by the tibial incision, with a clamp slipped by the lower approach, respecting the peritendon. Lastly, the removal of the tibial rod.
- Ligamentoplasty was then performed normally using two anterolateral and anteromedial arthroscopic approaches. (fig2, fig3, fig4)
- The tibial tunnel was drilled from the first on the anterior tibial tuberosity (fig5, fig6, fig7)
- In our study, we prefer to realize independent tunnels, because it is more anatomical and posterior than the dependent tunnel. (Fig8)

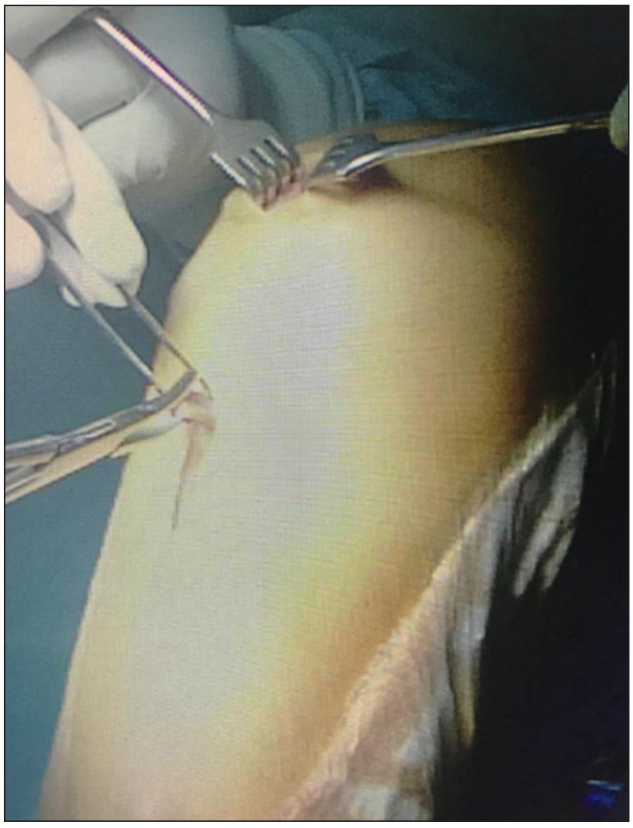

Figure 1: Image of double incision technique

Figure 2: Joint exploration (partial meniscectomy of the internal meniscus)

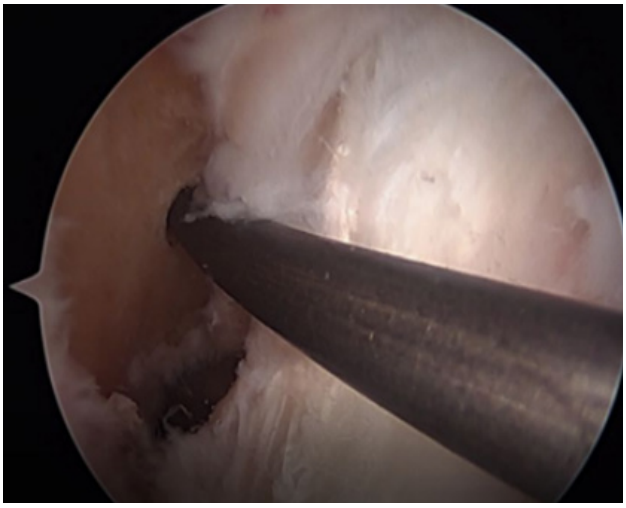

Figure 3: Placement of femoral tunnel guide pin using the anterior-internal approach on a knee in flexion at 120°

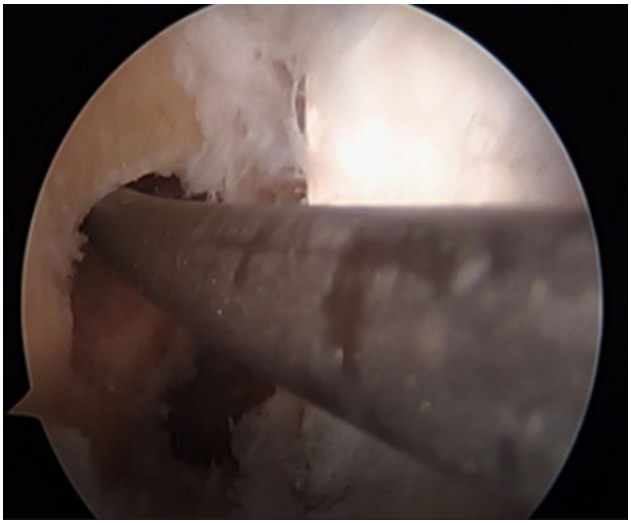

Figure 4: Realization of the femoral tunnel

Figure 5: Placement of the guide-pin for tibial tunnel drilling

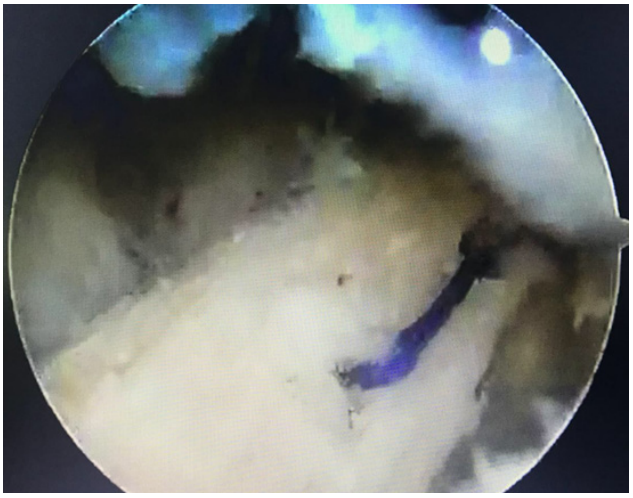

Figure 6: Introduction of the graft using the eye pin

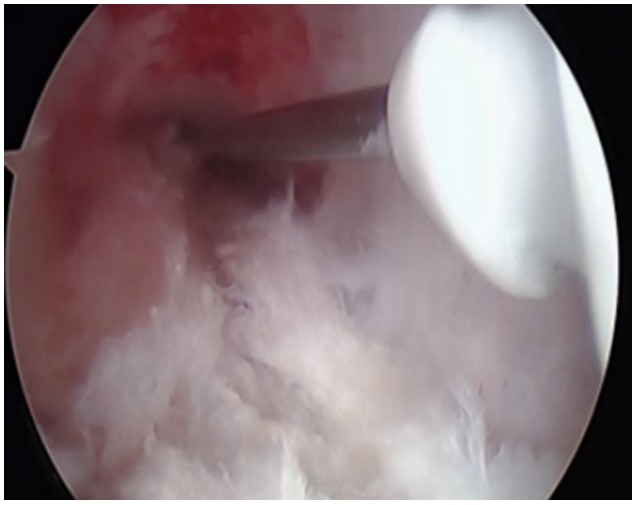

Figure 7: Fixation of the graft in the femoral tunnel by a resorbable interference screw.

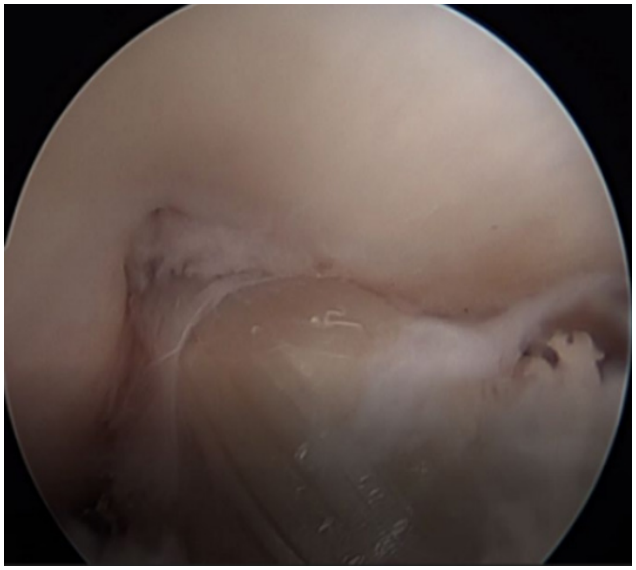

Figure 8: Final arthroscopic graft control.

Patients were followed for an average duration of 38 months (between 13 and 62 months), we evaluated at the last follow-up, by means of a functional examination, a systematic clinical examination and knee x-ray: the complication rate and the subjective and objective IKDC (International Knee Documentation Committee) score.

Results

The entire data was analyzed by the SPSS Statitics 20 software.

Quantitative variables with normal distribution have been described using averages and extreme values (minimum, maximum). The qualitative variables were described using numbers and percentages.

Subjectively: 54 patients (90% of the cases) estimated to have found a normal knee (IKDC A), six patients (10% of cases) estimated to have found a knee almost normal (IKDC B) and none of the patients had an abnormal knee (IKDC C). It should be noted that 4 patients (6.6% of cases) complained of mild patellar pain (IKDC B), and 56 patients (93.4% of cases) had no pain (IKDC A).On the objective plane: 58 patients (96% of cases) found normal knee joint mobility (IKDC A), and 2 patients (4%) kept a 10° flessum (IKDC C).The Lachman-Trillat test was negative in 56 cases (94%) (IKDC A) and estimated at one cross in 4 cases (6%) (IKDC B). The pivot shift was absent in 55 patients (92% of cases) (IKDC A), and rough in 5 patients (8%) (IKDC B).The X-ray analysis revealed normal X-ray in 57 cases (95%), early osteoarthritis in 2 cases (3.4%) and remodeled in one case (1.6%), and 96% of patients grade A and 4% were rated B according to the IKDC radiological score (Table 1).

Table 1: Subjective and objectives results according to the IKDC score

Subjective IKDC		Objective IKDC			
Pain	Function	Joint Mobility	Laxity		Radiology
			Lachman	Pivot Shift	
IKDC A (93,4%)	IKDC A (90%)	IKDC A (96%)	IKDC A (94%)	IKDC A (92%)	IKDC A (96%)
IKDC B (6,6%)	IKDC B (10%)	IKDC B (4%)	IKDC B (6%)	IKDC B (8%)	IKDC B (4%)

(IKDC :International Knee Documentation Committee).

A = normal, B = almost normal, C = abnormal, D = very abnormal.

In addition, no septic or thromboembolic complications were noted during follow-up.

The evolution in the long term is without particularity.

Discussion

The current techniques of ligamentoplasties are the result of a surgical history beginning with Jones,[6] in 1963 and taking a true growth in the 1980s. Noyesa et al have called the patellar ligament «gold standard».[7] Nonetheless the use of the bone-tendon-bone graft for ACL reconstruction is not devoid of certain complications, we can mention: the weakening of the extensor apparatus, delay of quadricipital muscular recovery,[8] and anterior pain whose incidence is extremely variable according to the authors, between 4 and 60%[9,10]. Lesions of the infrapatellar branches of the medial saphenous nerve are incriminated in the occurrence of disturbance of the anterior aspect of the knee, especially after ligamentoplasty type bone-tendon-bone.[4] The double incision approach reduces anterior pain and decreases the frequency and surface area of hypoesthesia. The effectiveness of the double track is the preservation of the infrapatellar branches of the medial saphenous nerve and perhaps a better trophicity of the tendon by the preservation of peritendon.[4]

In the Gaudot et al series,[5] the frequency of anterior pain in the double incision group (19%) was lower than that of the single incision group (58%) (p = 0.01).

In our study, the prevalence of anterior pain is low (6.6%) compared to conventional patellar ligament series (19%).[11] The functional results of this study are similar to the results published in the literature[12-13] with 100% of our patients ranked A or B in the IKDC score (excellent or good results). On the other hand, our anatomical results are better with a negative Lachman test and pivot shift test in 94% and 92% of patients respectively.

Conclusion: The reconstruction of the anterior cruciate ligament by bone-tendon-bone graft using the double incision technique remains the technique of choice in the surgical treatment of ACL ruptures, allowing a solid fixation with early rehabilitation, and significantly decreases the surface of sensory disorders and discomfort to kneeling.

References

1. *Duchman KR, Lynch TS, Spindler KP . Graft Selection in Anterior Cruciate Ligament Surgery : Who gets What and Why? Clin Sports Med. 2017 Jan;36(1):25-33. PMID:27871659 DOI:10.1016/j.csm.2016.08.013*
2. *Arifeen KN, Chowdhury AZ, Sakeb N, Joarder AI, Salek AK, Selimullah AM. Comparison of arthroscopic anterior cruciate ligament reconstruction by bone-patellar tendon-bone graft with or without using interferential screw in general population. Mymensingh Med J. 2015 Jan;24(1):59-69. PMID: 25725669*
3. *Branam BR, Utz CJ. Indications for Two-Incision (Outside-In) Anterior Cruciate Ligament Reconstruction . Clin Sports Med. 2017 Jan;36(1):71-86. PMID:27871662 DOI:10.1016/j.csm.2016.08.004*
4. *Drain O, Beaufils P, Thevenin Lemoine C, Boggione C, Katabi M, Charrois O, Boisrenoult P. Mini-invasive technique for bone patellar tendon bone harvesting. Journal of Orthopedic and Traumatological Surgery RCO 2007; 93:836-841.*
5. *Gaudot F, Leymarie JB, Drain O, Boisrenoult P, Charrois O, Beaufils P. Double-incision mini-invasive technique for BTB harvesting: Its superiority in reducing anterior knee pain following ACL reconstruction. Rev of orthopedic and traumatological surgery 2009;95: 28-35.*
6. *Jones KG. Reconstruction of the anterior cruciate ligament using the central one-third of the patellar ligament. J Bone Joint Surg Am 1970;52:838—9.*
7. *Noyes FR, Butler DL, Grood ES, Zernicke RF, Hefzy MS. Biomechanical analysis of human ligament grafts used in knee-ligament repairs and reconstructions. J bone joint surg Am 1984;66:344-52.*
8. *Dejour D, Potel JF, Gaudot F, Panisset JC, Condouret J. Symposium, SFA congress, Lyon, December 2007: which plasty of the ACL, for which laxity, for which patient? The rupture of the anterior cruciate ligament, from the preoperative analysis of the type of rupture to the final evaluation at two years, resonance according to the chosen transplant on the subjective and objective results. Rev Chir Orthop Reparatrice Appar Mot 2008; 94:356-61.*
9. *Plancher KD, Steadman JR, Briggs KK, Hutton KS. Reconstruction of the anterior cruciate ligament in patients who are at least 40 years old. A long-term follow-up and outcome study. J Bone Joint Surg Am 1998;80:184-97.*
10. *Shaieb MD, Kan DM, Chang SK, Marumoto JM, Richardson AB. A prospective randomized comparison of patellar tendon versus semitendinosus and gracilis tendon autografts for anterior cruciate ligament reconstruction. Am J Sports Med 2002;30:214—20.*
11. *Hulet C, Lebel B, Burdin G, Regeasse A, Galaud B, Locker B, et al. Meta-analysis comparing the patellar tendon and the tendon of the pesanserinus in the treatment of chronic anterior laxity . Rev Chir Orthop 2005;91(suppl6):S149.*
12. *Chambat P, Vargas R, Fayard JM, Lemaire B, Sonnery-Cottet B. Result of reconstructions of the anterior cruciate ligament under arthroscopic control with a retreat greater than 15 years. In Chambat P, Neyret P, editors. Knee and sport, from ligament to prosthesis. Montpellier: Sauramps Médical; 2008. p.147-52.*
13. *Hulet C, Lebel B, Colombet P, Pineau V, Locker B. Surgical treatment of anterior cruciate ligament lesions. EMC 2011; 44:780.*

Date received: December 15th 2018
Date accepted: December 28th 2018

Conflict of interest: Nil
Source of funding: Nil