MÆDICA - a Journal of Clinical Medicine

ORIGINAL PAPERS

The Advantage of Arthroscopic Anterior Cruciate Ligament Reconstruction with Autograft from the Tendons of the Semitendinosus – Gracilis Muscles for the Recovery of the Stability of the Knee

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ABSTRACT

Anterior cruciate ligament (ACL) injuries remain a common orthopaedic disease, particularly in young adults. The treatment of choice for ACL injuries is ACL reconstruction (ligamentoplasty). ACL reconstruction is the surgical intervention used to replace the damaged ACL with a bone-patella tendon-bone (BTB) graft or with soft parts (semitendinosus – gracilis muscles (ST-G) – a method more frequently used nowadays).

Materials and method: *In the Clinic of Orthopedics and Traumatology of the University Emergency Hospital of Bucharest, during the period 01.01.2009 – 01.03.2011, a number of 37 arthroscopic ACL reconstructions with ST-G were studied, performed to treat ACL isolated injuries or injuries associated with complex trauma of the knee.*

Results: *Clinical studies have shown that ACL reconstruction is highly superior to ACL repair (suturing). Arthroscopy was the main method of diagnosis in 28 cases, whereas the remaining ACL injuries were diagnosed using the MRI.*

Conclusions: *The rehabilitation of the patients who underwent arthroscopic ACL reconstructions with ST-G was easier and faster in comparison with that following the surgical interventions performed with BTB graft during the previous years.*

Keywords: ACL reconstruction, arthroscopy, semitendinosus-gracilis muscles, rehabilitation

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INTRODUCTION

The insertion of ACL at the femoral level is represented by an oval area at the level of the external medial condyle of the femur in the intercondylar fossa and extends up to the plateau of the tibia where its fibers are attached at the level of the triangular area between the two tibial spikes. In the anterior part of this area, the ACL fibers are attached in a fan and reinforce the anterior meniscal horns.

ACL is the major internal stabilizing ligament of the knee and its injury generates major instability.

ACL injuries occur more frequently as a result of sports injuries caused by brutal deceleration movements (sudden stop, pivoting, sudden change of direction, jumping). In some cases, the patient can resume his/her activity and several hours later a major local edema appears with joint effusion caused by massive hemarthrosis.

Very often, ACL injuries caused by direct trauma are associated with internal meniscal injuries and ICL (O'Donoghue's triad).

The diagnosis of ACL injuries is made by:

- symptomatology: pain at moderate physical effort and a "wobbly" feeling in the knee,
- clinical examination of the knee using the Lachman test, the anterior drawer test, the pivot-shift test and a jerk test (with positive results) (1),
- radiological examination in maintained position,
- MRI examination (Figure 1),
- exploratory arthroscopy.

Partial ACL injury can be supported up to a point by the quadriceps muscles, but the patient cannot resume his/her activity at a satisfactory level, especially in the case of sports (2). In time, due to the change of the normal biomechanics of the knee, injuries to the meniscus develop, as well as cartilaginous degenerative injuries, and this is why the current tendency in the case of ACL injuries is to perform a ligament reconstruction (3).

FIGURE 1. ACL injury diagnosed by MRI

Timing of the surgical intervention

According to the literature, it is recommended that the surgical intervention be performed at more than three weeks from the occurrence of the trauma (the patients so operated had better postoperative results with greater motion ranges, which were obtained faster than in the case of the patients operated during the acute phase, 1-3 weeks post traumatically, and did not require a surgical reintervention for the stiffness of the knee (4).

In our clinic all the surgical interventions were performed after more than three weeks from the onset of the symptoms. ❑

MATERIALS AND METHOD

In the Clinic of Orthopedics and Traumatology of the University Emergency Hospital of Bucharest, during the period 01.01.2009 – 01.03.2011, a number of 37 arthroscopic ACL reconstructions with ST-G muscles were studied and a number of 42 O-T-O ACL reconstruction, all performed to treat ACL isolated injuries or injuries associated with complex trauma of the knee.

Most of the patients were male, 35, and aged between 17 and 39 years (arthroscopic ACL reconstruction) and 39 male patients for the O-T-O reconstruction.

Sports trauma was the main cause of the ACL injuries.

Arthroscopy was the main method of diagnosis in 57 cases, and in the other 22 cases an MRI examination was used.

The surgical intervention was performed for all 37 patients at more than 3 weeks from the occurrence of the trauma which caused the ACL injury.

Selection of the graft

For all the patients operated in our clinic (the ST-G arthroscopic ligamentoplasty), we chose to harvest a tendinous graft at the level of the semitendinous muscle and gracilis muscle

(ST, G) and not a bone-patella tendon- bone graft, for the following reasons:

- the harvesting is performed through a much smaller incision, which helps to reduce postoperative pain;
- the occurrence of dysfunctions of the extensor mechanism of the knee is avoided;
- the tendinous graft is longer and this makes it possible to double the thickness of the neoligament with increased resistance (4);
- biomechanical studies have shown that the manner of fixing the graft with endobutton or retrobutton is closer to the anatomical rigidity of native ACL;
- apparently the tendon regenerates at the harvesting site, and local pain and functional incapacity decrease in less than three months postoperatively (1);
- the disadvantage underlined by certain authors is that the period necessary for the integration of the graft is longer, the mechanisms for fixing the graft being subject to mechanical stress for a longer period of time.

Surgical Technique

Harvesting of the tendinous graft: a longitudinal incision of approximately 3-4 cm is made 4 cm distally from the articular line and 2 cm medially from the tibial tuberosity and the tendons of the two muscles (ST,G) are located and harvested using a stripper (4).

Preparation of the graft: the debris of muscle fiber is removed and the tendinous borders are equalized, the two tendons are placed under strain and sutured end-to-end (Figure 2), and afterwards the diameter (thickness) of the neoligament thus obtained is measured.

Shaving is performed arthroscopically and VAPR is used (Figure 3) to be able to see more clearly and to free the drilling sites for the bone tunnels.

FIGURE 2. Preparation of the graft

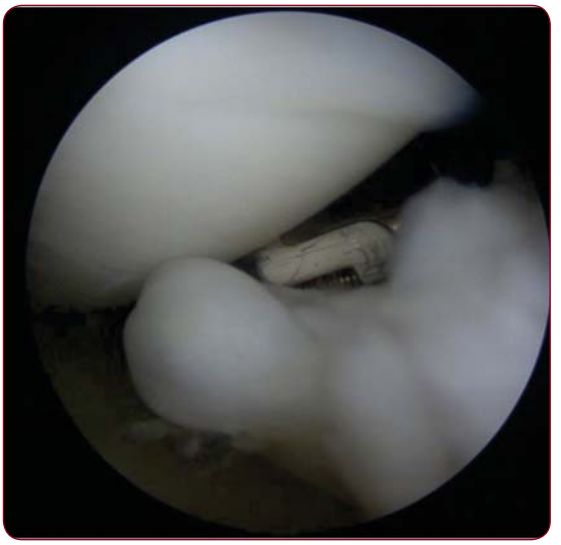

FIGURE 3. Intraoperative image. Guiding pins.

FIGURE 4. Intraoperative image. Insertion of neoligament.

Two (tibial and femoral) bone tunnels are drilled under specific guidance, with guiding pins (Figure 4) and the neoligament is inserted (Figure 5) and attached at the femoral level with an endobutton or retrobutton (Figure 6) and with a bioresorbable interference screw at the level of the tibia.

Treatment with antibiotics is administered for 48 hours (until the removal of the drainage tube) immediately postoperatively, as well as anticoagulant therapy for the prevention of venous thrombosis for 30-40 days.

The ST-G arthroscopic ligamentoplasty offers the following benefits:

- lowers the risk for postoperative infections, due to the abundant intraoperative lavage

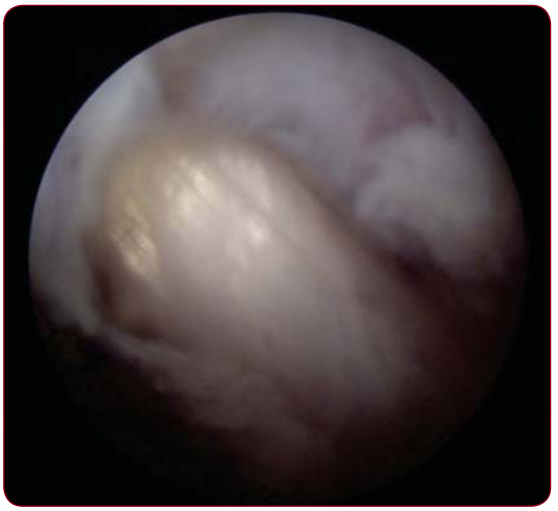

FIGURE 5. Arthroscopic image of the neoligament

FIGURE 6. Postoperative image

- clear sight of the inner components of the joint
- minimal size of the wound
- the decrease of the postoperative pain, though the decrease of the hospitalization costs
- faster rehabilitation

The technique depends of many factors, mandatory a good orthopedic department with arthroscopy devices well trained surgeons all those from above making difficult a large spreading of the method among the other hospitals in the territory.

Medical Rehabilitation

Medical rehabilitation is represented by a complex program adapted to every patient:

- ligamentoplasty performed with ST and G allows for early rehabilitation, after 24 hours or immediately after the removal of the drainage tube;
- isotonic and isometric contractions are used to preserve muscle tone and strength at the level of the quadriceps;
- assisted passive movements (passive motion therapy)
- good mobility of the knee is obtained of approximately 60 degrees at 24-48-72 hours;
- early mobilization, at the side of the bed, ± walking with light load bearing on the inferior limb;
- load bearing is done gradually according to the stability of the knee (50% - a crutch is used on the contralateral side of the leg);
- after the removal of the stitches, after 14 days, work in an open cinematic chain begins (the weight is attached at the level of the ankle and the knee is extended);
- the rehabilitation of the semitendinosus – gracilis muscles begins when postoperative pain at the level of the wound where the graft was harvested is minimum and consists in active flexion movements of the lower leg on the thigh ± a 1-2 kg weight;
- gradually, as the quadriceps muscles are tonified, the weight is increased to 3-4-5 kg;
- when the flexion angle of the knee exceeds 90 degrees, work proceeds in a semiclosed cinematic chain (ergometric bicycle with progressive loading);
- at 6 weeks the patient gives up both crutches and walks with total load bearing;
- after the load bearing is complete, neuroproprioceptive muscle rehabilitation is performed by working on an unstable plank. ❑

RESULTS

None of the cases needed revision surgery due to the increased strength of the neoligament. As this procedure is a minimal invasive one, allows the patient to be actively mobilized right after the removal of the drainage tube.

In all the patients, the postoperative pain level was as low as allowing the 60 degrees flexion of the knee in the first 24-48 hours. We consider this as a very good result.

Also the medication either AINS or analgesics, was administrated in a considerably lower dose. The complete postoperative rehabilitation was obtained in a short period of time, between 45-60 days.

DISCUSSION

There are many advantages of this method. We mention some of them:

- postoperative pain is greatly reduced due to the minimal invasive character of the surgical intervention (arthroscopy) and to the smaller size of the wound at the level of the harvesting of the tendons of ST and G muscles (1);
- the neoligament is more resistant due to its thickness and means of attachment;
- recovery is early, after 24 hours or immediately after the removal of the drainage tube;
- good mobility of the knee is obtained very rapidly, approximately 60 degrees after the first 72 hours;
- the active mobilization of the patient is early;
- the rehabilitation of the semitendinosus and gracilis muscles is fast: when the pain is at a minimum level (in approximately 30 days – sooner for some of the patients) the active flexion of the lower leg on the thigh with a 2 kg weight is attempted;
- through the faster postoperative recovery and the significant decrease of the postinterventional pain, the hospitalization costs are substantially decreased by lowering the dose of analgesics and anti-inflammatory medication, and particularly by reducing the period of hospital stay (from 7-9 days to 4-5 days on the average).

None of the patients needed revision surgery. As the clinical evolution was favorable there hasn't been performed second look surgery.

Regarding the postoperative evolution as well as the rehabilitation process for the patients with ST-G arthroscopic ligamentoplasty, the data we obtained are comparable with the one mentioned in the literature (5,6). ❑

CONCLUSION

Arthroscopic ACL reconstruction with autograft from the semitendinosus and gracilis muscles provides early recovery with minimum postinterventional pain, increased mobility of the knee as early as the first two weeks postoperatively and significant decrease of the hospitalization duration and costs.

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