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THERAPEUTICAL OPTION FOR THE INCOMPLETE QUADRICEPS MUSCLE RUPTURE – CASE REPORT

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Abstract: *The rupture of the rectus femoris muscle is a relatively rare entity and the delay of surgical treatment raises problems that are specific to the surgical technique. In this paper we report the case of a 53-year old male with chronic rupture of the rectus femoris by presenting a modified lengthening myoplasty technique having good results, as well as the theoretical considerations based on actual data from the specialised literature.*

Key words: *quadriceps muscle, rectus femoris rupture, surgical repair, myoplasty.*

1. Introduction

The quadriceps musculotendinous rupture is a rare anatomoclinical entity. The late surgical treatment raises delicate technical issues and supposes a sustained postoperatory rehabilitation programme.

In post-traumatic pathology, the seriousness of the injuries varies from minor traumas (muscular edema and capillary disruption) to complex traumas (muscular, tendinous or fascial ruptures, serious haemorrhage or compartment syndrome).

As the quadriceps muscle is in contact with the femur throughout its length, it is exposed to compression forces, the *rectus femoris* being the most vulnerable muscle segment due to its anterior position. Thus the distal part is commonly affected [6]. The *rectus femoris* muscle is particularly exposed to injuries because of some of its specific characteristics: most of its fibers are type II fast twitch, it produces eccentric contractions (lengthening the muscle under tension and as a result, producing an intense cellular friction) and it has two distinct joints [2], [10], [17].

2. Case report

The patient B.V., a 53-year old male, of urban provenience, an active military employee, was hospitalised in the 3rd Surgical Clinic of Iaşi between 10-16.07.2008, being diagnosed with left thigh rectus femoris muscular rupture. He was accusing pain in the left thigh in

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prolonged orthostatism and when making effort with limitation of the walking perimeter as a result of muscular overuse 5 months before.

An important factor in his personal pathological history was the gout – a predisposing condition for the musculotendinous ruptures (uric acid = 6.5mg %).

The clinical exam showed a normoponderal patient, in good general condition, without any other pathological elements.

On active mobilisation we noticed the impossibility of making a complete extension of the left thigh.

The local examination emphasized muscular defect in distal anterior thigh with mass in proximal thigh, with a muscular gap located in the region between suprapatellar and middle thigh area, without the modification of the suprajacent tegument (a pathognomonic sign for the musculotendinous tear) [5], [10]. On palpation we noticed the discontinuity of the quadriceps muscle in the distal part and the muscular mass retracting upwards when doing the knee extension manoeuvre.

Paraclinical exams showed a slight anemia (Hemoglobin = 12.6 g/dL, Hematocrit = 37%) and a mild hypocoagulation (Prothrombine Time = 62.8%).

The ultrasound examination detected a complete muscular rupture of the rectus femoris in the left thigh and the knee radiography did not show any bone lesions.

3. Treatment

During the surgical intervention we confirmed complete rupture of the supratendinous distal end of the rectus femoris muscle.

After the dissection and the medial reclination of the sartorius muscle we found the proximal end of the rectus femoris retracted at the middle third level of the thigh (Figure1).

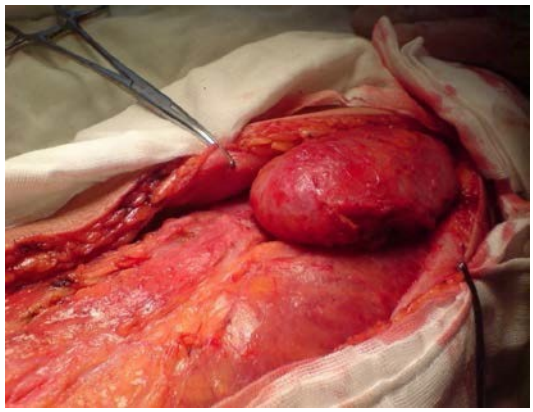

Fig. 1. *The retracted proximal end of rectus femoris*

A muscular plasty was performed by cleavage after an incision on the posterior part of the muscle (modified Scuderi technique, an adaptation of the knee surgery) (Figure 2).

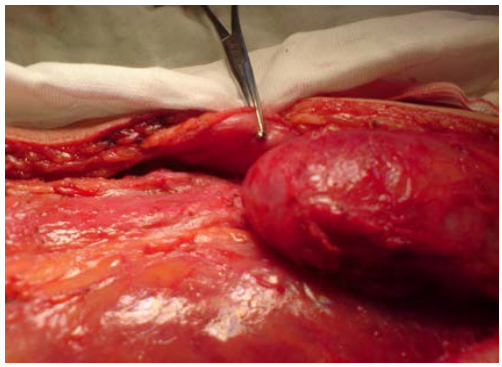

Fig. 2. *Musculare graft preparation-level of incision*

The extension made by posterior sectioning of the distal muscular end was necessary due to the need of preserving the fibrotic expansion anteriorly, this being more resistant to suture, as well as in the context of conserving vascularisation (Figure 3).

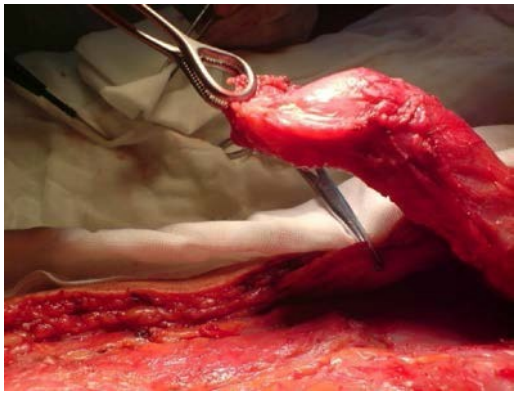

Fig. 3. *Musculare graft flap*

Subsequently, the suture of the muscular graft was performed with separate non-absorbable sutures in the suprapatellar musculotendinous distal area (Fig. 4-5).

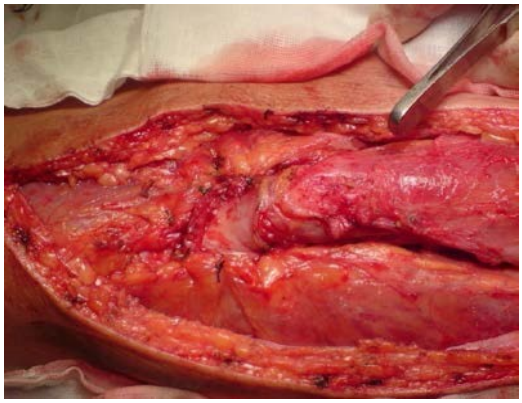

Fig. 4. *Musculare graft end-to-end suture*

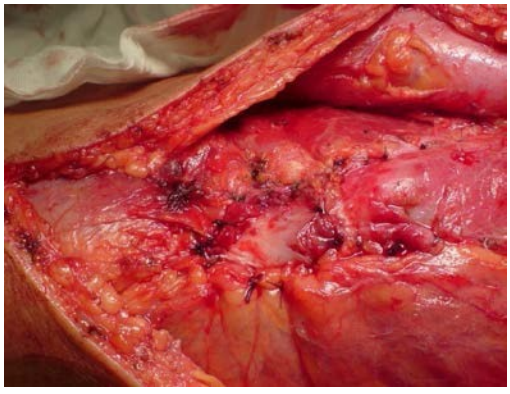

Fig. 5. *Musculare graft suture completed (detail)*

The cruropedious cast splint was applied and maintained for three weeks.

The postoperative evolution was favourable, with early mobilisation from the second day after the intervention and the patient's check-out in day 6.

The professional reinsertion was possible after three weeks, the patient undergoing recovery treatment which prevented the limitation of the shank flexion, as well as the muscular atrophy. After six months the patient did not feel any pain, the thigh had a normal aspect, with the persistence of a minimal flexion deficit and a low degree of muscular weakness on the affected side when actively extending the knee.

4. Discussions

The anatomical particularities of the thigh explain the ethiopathogenic mechanisms which are at the origin of the muscular tears.

The thigh muscles are organised in three different compartments as follows:

Anterior - quadriceps femoris muscle, femoral nerve and artery;

Posterior - semitendinosus muscle, semimembranosus muscle, biceps femorismuscle and sciatic nerve;

Medial - adductor muscles: pectineus, obturator externus, gracilis, adductor (magnus, brevis, longus) muscles and cutaneous branch of obturator nerve.

The quadriceps femoris muscle (quadriceps extensor) is the great extensor muscle of the leg that forms a large fleshy mass which covers the front and sides of the femur. It is subdivided into separate portions, including four muscles (rectus femoris, vastus lateralis, vastus medialis, vastus intermediaries), that have a common insertion (on the patella), but with separate origins.

The one occupying the middle of the thigh, in a superficial position, and

connected above with the ilium, is called from its straight course the rectus femoris. This muscle is the only one of the group that functions in both hip and knee joints [8].

The other three lie in immediate connection with the body of the femur, which they cover from the trochanters to the condyles. On the lateral side of the femur is vastus lateralis (the largest muscle of the quadriceps femoris). The vastus medialis muscles occupy a medial position along the thigh. In front, the muscle that lies deep to the rectus femoris is the vastus intermedius [19].

The rectus femoris - is a spindle-shaped bipennate muscle, possessing a complex constitution, which increases its section and thus its physiological and muscle strength . The tendon of origin has

2 heads (located on the coxal bone): vertical / anterior / direct head (tendon) and horizontal / reflected / rear / indirect head (tendon).

The tendon is attached directly to the iliac crest, and the one reflected above and behind the acetabular eyebrow. The two ends are joined in a common tendon approximately two cm from the origin and converge to the lower extremity and ends with an aponeurotic sheet - a component of the terminal tendon [14], [19], [20].

The quadriceps femoris extends the leg upon the thigh. The rectus femoris assists the psoas major and iliacus in supporting the pelvis and trunk upon the femur. It also assists in flexing the thigh on the pelvis, or if the thigh is fixed, it will flex the pelvis.

The musculotendinous ruptures appear as a result of a direct or indirect mechanism [7], [13]. The quadriceps muscle traumas involve the following clinical types: muscular contusion (the most frequent), muscular fascia rupture (hernia), partial or total rupture of the tendon insertion, partial or total muscular rupture and a special category – the post surgery musculotendinous tear (total knee replacement, anterior cruciate ligament or posterior cruciate ligament reconstruction). A sudden overuse or trauma can lead to complete tear while repetitive loading, especially eccentric contractions, can result in microfailure, leading to partial ruptures [6].

The quadriceps rupture affects two different categories of patients. Most ruptures appear at the elderly population (> 60 years old) with predisposing comorbidities (obesity, diabetes, gout, chronic renal failure, hyperparathyroidism, lupus eritematous, prolonged corticotherapy) [5- 7], [15].

The second category is represented by the active young population (sports persons) – in the Unites States of America, the Military Academy of West Point reports a yearly frequency of injuries as follows: rugby 4.7%, karate and judo 2.3%, soccer 1.6% and other sports less than 1% [1], [10]. Predisposing factors include muscle fatigue, insufficient warm-up exercises, overall poor muscle conditioning, and a previous tear.

There are several options in treating total or partial musculotendinous ruptures: procedures that include synthetic materials (Dacron, Mersilene) and, more frequently, tendinous allografts of different kinds: Scuderi, Codivilla, etc. [4], [11], [18]. The Scuderi technique involves prolonging the proximal edge through a triangular flap from the anterior side of the musculotendinous junction sutured at the distal edge. The Codivilla technique is indicated for chronic ruptures where the tendon edges cannot be opposed and it supposes a full thickness inverted V flap which ends above the rupture; the tendon edges are repaired with heavy suture.

The surgical treatment is recommended at an early stage as well as in chronic tendinous or muscular ruptures, being

followed by a complex rehabilitation programme that involves immobilisation in cast splint for 4-6 weeks, kinetotherapy and postoperative surveillance in order to prevent complications [3], [16]. According to DeBernardino et al. [6], a more particular complication that affects approximately 9% of the patients with quadriceps rupture is myositis ossificans traumatica, which occurs 3 months or later after the accident (injury). We have preferred the cast splint immobilisation for a limited period, encouraging the early start of the motor activity in order to get better functional results.

Although all of the above treatments have been used with good outcomes, the functional recovery of injured skeletal muscle and tendon remains limited. Early recognition is important, since the results of delayed surgery seem to be inferior to those of acute repair [5], [7]. As an argument in favour of early intervention, the present trends invoke a set of healing phases in the process of muscular repair: degeneration, inflammation, regeneration and fibrosis [9]. Nevertheless, some studies show similar results after late or early repair of a musculotendinous rupture on condition that the delay is less than 1 year [12].

5. Conclusions

Case particularity: presence of gout (favourising factor of musculotendinous ruptures).

Complete rectus femoris rupture is a rather rare lesion and the diagnosis requires a high index of suspicion. Treatment is always surgical. Most patients recover well with a good rehabilitation programme, but there is almost always a persistent deficit in quadriceps muscle mass and strength.

Choosing the modified myoplasty procedure offers the advantage of keeping the anterior fibrous expansion without affecting the vascularisation of the anterior flap.

Late repair of the rectus femoris rupture requires myoplastic extension procedures, and the final result is subsequently evaluated according to sustained rehabilitation procedures.

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