

FUNCTIONAL RESULTS AFTER SURGICAL REPAIR OF QUADRICEPS TENDON RUPTURE

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We present the long-term results of surgical repair of a traumatic rupture of the quadriceps tendon in a group of 24 patients with a mean age of 58 years. There were 21 male and 3 female patients.

Fifteen patients were seen for clinical control after a mean follow-up of 75 months and they all presented with some quadriceps muscle atrophy. Twelve patients had normal knee mobility, three had a flexion deformity of 10° and two had less than 120° of knee flexion. Active knee extension was normal in all patients. Three patients experienced some decrease in stability of their knee joint. Subjectively all patients were satisfied with the result. Nine patients underwent a Cybex-test for evaluation of the isokinetic force of knee flexion and extension, with a comparison between the injured and the uninjured side. For concentric force there was a mean deficit at low speed of 36.1% for the quadriceps muscle ; at high speed it was 28.2%. For the knee flexors, the deficits were 30.7% and 27.2% respectively. Regarding eccentric force, the mean deficit for knee extensors was 13.8% and 0.25% respectively and for knee flexors 6.5% and 5.5% respectively.

Keywords : quadriceps tendon rupture ; surgical repair ; isokinetic force.

Mots-clés : rupture du tendon quadricipital ; réparation chirurgicale ; force isocinétique.

disposing medical condition, such as obesity, diabetes, gout, chronic renal failure, hyperparathyroidism, lupus erythematosus or prolonged use of steroids (1, 2, 3). Age-related degeneration with decreased elasticity, degenerative changes in collagen fibers and decreased vascular supply probably plays a role in this population group (3, 4).

The second category of patients consists of the younger athletic population where QTR is often the end stage of a chronic inflammation of the extensor mechanism (jumper's knee) (1, 4, 9). Sports involving risk are mainly basketball, volleyball, soccer, high-jump, body-building and weight-lifting (3, 9). For the last two, systemic use of anabolic steroids needs to be considered as an additional risk factor (3, 7). Direct steroid injection into the quadriceps tendon is another known risk factor (5, 6).

The mechanism of injury is a sudden violent contraction of the quadriceps mechanism with the knees semi-flexed (1, 8, 11). According to the literature, a bilateral QTR is not an uncommon event, mainly in the older patient population with pre-existing medical risk factors (2, 5). The disruption usually occurs at the tendo-osseous junction with some fragments of adjacent bone avulsed from the

INTRODUCTION

Quadriceps tendon rupture (QTR) is a rather rare condition, affecting two different categories of patients. The majority of ruptures is seen in the elderly population (> 60 years), often with a pre-

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superior pole of the patella. In younger patients however rupture is more often in the mid-tendinous area (11).

The diagnosis requires a high index of suspicion and is clinically based on the presence of an effusion around the knee, a palpable gap just proximal to the upper pole of the patella and inability to voluntarily extend the knee, which is the cardinal symptom of the condition (1, 2, 8, 13). Radiographic findings are : obliteration of the quadriceps tendon, a poorly defined suprapatellar mass, suprapatellar calcific densities, an anterior superior patellar spur at the quadriceps tendon insertion, joint effusion and patella infera. When in doubt, diagnosis is confirmed by ultrasound, MRI or arthrography (1, 2).

Treatment of a complete QTR is always surgical, consisting of direct suture at the site of rupture, reinforced by transosseous sutures and if necessary some kind of quadriceps tendon plasty (13). Early recognition is important, since the results of delayed surgery seem to be inferior to those of acute repair (1, 2, 10, 12). Functional outcome is often satisfying if an intensive postoperative rehabilitation program is followed (11).

Partial tears of the quadriceps tendon usually respond well to cast immobilisation and physical therapy without any residual disability (1).

We have reviewed the results of 24 patients treated in the orthopaedic department of the St-Pierre Hospital in Ottignies over the last 25 years.

MATERIELS AND METHODS

Between 1976 and 2001, 24 patients were operated for acute QTR. There were 21 male and 3 female patients. The right side was involved in 10 cases, the left in 14 cases. There were no bilateral ruptures in our patient group. Mean age at time of surgery was 58 years (13-85). Two patients suffered from diabetes. In 23 cases the rupture was the result of a low-energy trauma, including 9 falls down the stairs. One patient (a 13-year-old girl) had a severe open QTR associated with major soft tissue trauma after a car accident. Two patients had had some pain episodes around the insertion of the quadriceps tendon before rupture ; in one patient degenerative changes were noted in the quadriceps tendon at operation and one patient showed necrosis of the tendon

at operation. This patient had undergone a total knee arthroplasty one year before. Most patients were operated within two weeks following injury ; in two patients the diagnosis was initially missed and surgery was performed only 3 and 5 months respectively after trauma.

During surgery, transosseous reinsertion of the tendon was performed in all cases ; in three cases some form of quadriceps tendon plasty was used. In two cases the suture was reinforced with a metal cerclage wire. Mean postoperative immobilization time in a knee brace or plaster cast was 4.5 weeks (0-7). All patients followed a knee rehabilitation program, starting with passive mobilisation from 0° to 90°. This was followed by passive mobilisation beyond 90° and isometric active contraction at different amplitudes. Finally isotonic exercises were introduced in the program. During the whole rehabilitation program pain-relieving physiotherapy was done as well.

For this review all patients were retrospectively contacted (November and December 2000). Two patients had died and seven others were lost to follow-up. Fifteen patients were seen for a clinical check-up. Mean follow-up was 75.3 months (range : 3 to 288 months).

Of these fifteen patients, nine underwent evaluation of their tendon force during a Cybex examination. The test was set up as an isokinetic evaluation, which means that the patient exerts a maximal force during the whole cycle of movement, at a constant speed of movement. The apparatus makes correction for gravity and measures work, peak force and peak torque, at two different speeds : 60°/sec and 240°/sec. At low speed the test is done three times, at high speed it is done five times and the best value is taken into account by the apparatus.

RESULTS

All fifteen patients seen for clinical check-up after a mean follow-up of 75.3 months (3-288) presented with reduced muscular mass of their injured thigh compared to the uninjured side. Four patients complained of a painful sensation appearing from time to time around the patella or underneath the scar and three others experienced mild hypersensitivity after intensive activity. Three patients experienced diminished stability of their knee joint.

In twelve patients, mobility of the knee joint was symmetrical, with complete extension and more than 120° of knee flexion. Three patients lacked 10° of terminal extension and two of them also

showed less than 120° of knee flexion. These two patients were known to have osteoarthritis of the knee joint, which until now has not been surgically treated. No patient presented an extension lag.

Before their lesion, seven patients took part in sports on a regular and recreational basis. Six of them resumed their sports at the same level about one year after the quadriceps rupture. The one patient who failed to reach the same level, had sustained a severe open QTR with major associated soft tissue trauma of the upper leg.

One early postoperative wound infection was successfully treated with oral antibiotics.

Nine patients underwent an evaluation of the isokinetic force of their knee flexion and extension during a Cybex test with comparison between the injured and the uninjured side. Results mentioned here are for concentric force at low (60°/second) and high speed (240°/second), both for knee extensors and knee flexors. One patient showed a better score for his knee flexors at the two speeds, compared to the uninjured side. For his knee extensors there was a small deficit at low speed and no deficit at high speed. He was a highly motivated patient who followed a very intensive rehabilitation program. All other patients tested for their postoperative force by isokinetic evaluation showed some degree of deficit compared to the uninjured side.

The mean degree of deficit for the quadriceps muscle at low speed was 36.1% (range : 11%-72%) and at high speed it was 28.2% (range : 0%-64%). The mean degree of deficit for the knee flexors at low speed was 30.7% (range : minus 7% to plus 54%); at high speed it was 27.2% (range : minus 8% to plus 57%).

Six patients also underwent eccentric evaluation of their isokinetic force. Two patients showed better scores for their injured side compared to their uninjured side. The other patients again showed some deficit. Mean deficit of the quadriceps muscle at low speed was 13.8% (range : minus 36% to plus 62%); at high speed it was 0.25% (range : minus 39% to plus 37%). For the knee flexors, mean deficit at low speed was 6.5% (range : minus 28% to plus 31%); at high speed it was 5.5% (range : minus 13 to plus 30%).

Subjectively, most patients were quite pleased with their functional result after surgical repair of a complete QTR.

DISCUSSION

Most knees seem to do well subjectively, but some loss of strength on objective testing is almost unavoidable. These data are confirmed by comparable studies published in the literature, although Konrath *et al.* found lower strength deficits in a review of 51 QTR's (5). Contrary to literature, almost every patient in our study presented with some atrophy of the quadriceps musculature (5, 11).

Range of knee motion does not seem to be a problem postoperatively and, as confirmed by other studies, all patients seem to regain good active knee extension after surgical repair (5, 12).

Most patients returned to their previous occupational activities, but return to pre-injury competitive sports levels is reportedly difficult and rare. Return to pre-injury recreational sports activity did not seem to be a problem in our study, contrary to the results of Konrath *et al.* (5).

The two patients in our study in whom the diagnosis was made only a few months after the traumatic event and where surgical repair was delayed, seemed to do quite well. This was also noted in the study of Konrath *et al.*, but several other publications reported opposite findings (1, 2, 5, 6, 10, 11, 12).

CONCLUSION

Complete QTR is a rather rare lesion and the diagnosis requires a high index of suspicion. Treatment is always surgical and with a good rehabilitation program most patients do well, but there is almost always a persistent deficit in quadriceps muscle mass and strength.

There is controversy in the literature as to whether or not delayed repair adversely affects functional outcome.

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SAMENVATTING

T. DE BAERE, B. GEULETTE, E. MANCHE, L. BAR-RAS. Functionele resultaten na chirurgisch herstel van quadricepspeesruptuur.

De resultaten op lange termijn na chirurgisch herstel van een traumatische ruptuur van de quadricepspees worden voorgesteld aan de hand van een groep van 24 patienten

met een gemiddelde leeftijd van 58 jaar, waarvan 21 mannen en 3 vrouwen.

Vijftien patiënten werden teruggezien op raadpleging na een gemiddelde follow-up van 75 maanden en elk van hen vertoonde een zekere graad van quadricepsatrofie. Subjectief gezien waren alle patiënten tevreden over het resultaat. Twaalf patiënten hadden een normale beweeglijkheid van het kniegewricht, 3 patiënten vertoonden een flexiecontractuur van 10° en twee hiervan hadden minder dan 120° knieflexie. De actieve knie-extensie was normaal bij alle patiënten. Drie patiënten ervaarden een zekere instabiliteit van hun kniegewricht.

Van 9 patiënten werd de kracht van knieflexie en -extensie getest door middel van een Cybex-toestel, met vergelijking tussen normale en geopereerde knie. Bij lage snelheid is er voor de concentrische kracht van de quadriceps een gemiddeld deficit van 36,1%; bij hoge snelheid is dit 28,2%. Voor de buigspieren zijn deze verschillen respectievelijk 30,7% en 27,2%. Wat eccentriche kracht betreft bedraagt het gemiddeld deficit voor de quadriceps 13,8% en 0,25% en voor de buigspieren 6,5% en 5,5% respectievelijk.

RÉSUMÉ

T. DE BAERE, B. GEULETTE, E. MANCHE, L. BAR-RAS. Résultats fonctionnels après réparation chirurgicale d'une rupture du tendon quadricipital.

Les auteurs présentent les résultats à long terme du traitement chirurgical d'une rupture traumatique du tendon quadricipital. Il s'agit d'un groupe de 24 malades (21 hommes et 3 femmes) dont l'âge moyen était de 58 ans.

Quinze patients ont été revus avec un recul moyen de 75 mois: ils présentaient tous une certaine atrophie musculaire du quadriceps. La mobilité du genou était normale chez 12 patients; trois présentaient un flexum de 10° et deux avaient moins de 120° de flexion. L'extension active était normale dans tous les cas. Trois patients signalaient une certaine instabilité du genou. Sur le plan subjectif tous étaient satisfaits du résultat.

Neuf patients ont été testés sur un appareil Cybex pour évaluer leur force isocinétique et la comparer à celle du genou normal. En ce qui concerne la force concentrique, il existait pour le quadriceps un déficit moyen à vitesse basse de 36,1%; ce déficit était de 28,2% à vitesse élevée. Pour les fléchisseurs de genou, les déficits étaient de 30,7% et 27,2% respectivement. Pour la force excentrique, les déficits moyens étaient de 13,8% et 0,25% pour les extenseurs et de 6,5% et 5,5% pour les fléchisseurs.