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Tendon lengthening repair and early mobilization in treatment of neglected bilateral simultaneous traumatic rupture of the quadriceps tendon

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Abstract Bilateral simultaneous traumatic rupture of the quadriceps tendon is a rare injury that is most frequently seen in elderly patients with predisposing diseases such as gout, hyperparathyroidism and diabetes. Delay in diagnosis is not uncommon. One of the main problems in treatment is loss of motion, especially flexion, after surgical repair. We report a case that was diagnosed 5 months after the trauma and was treated by Scuderi's tendon lengthening technique. Range-of-motion exercises were started early without using the generally recommended 4–6

weeks of immobilization in plaster cylinder or knee brace. Five years of follow-up showed full range of motion in both knees with sound tendons. Stable fixation makes starting early motion and accelerated rehabilitation feasible and thus the most common complication, loss of motion, is prevented.

Keywords Quadriceps · Rupture · Bilateral · Traumatic · Codivilla · Early motion

Introduction

Rupture of the quadriceps tendon is usually seen in patients older than 50 years who have systemic diseases such as gout, hyperparathyroidism or chronic renal failure [5]. It is not an uncommon event, but bilateral occurrence is rare. Diagnosis is frequently delayed because of the co-existing systemic illnesses, older age and the search for neurological causes of extension lag of the knees. Cases neglected for as long as 8 months have been reported [10]. All reports in the English literature recommend surgical repair followed by immobilization in extension either in plaster cylinder or a knee brace for 4–6 weeks [1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14]. Results of surgical repair are satisfactory, but loss of flexion after the treatment remains a common problem. The purpose of reporting the case was to indicate the positive effect of stable fixation followed by early motion on the result of treatment of even a very late case.

Case report

Our patient was a 68-year-old male. He had maturity onset diabetes. During a visit to a sacred place, due to anxiety, he let himself fall hard onto his knees. Although he had pain and was unable fully to extend his knees, he completed the 4-week trip. On his return, he sought medical help only after a 4-month period of religious observance and was referred to the neurology department. He received every possible neurological examination and test, and only after incidental discovery of bilateral quadriceps tendon rupture in MRI (Fig. 1) was he referred to our department. By then, more than 5 months had passed since the initial injury. The patient had suprapatellar gaps and extension lag in both knees. Active quadriceps muscle contractions were apparent. On lateral radiographs of both knees, the patella was displaced inferiorly and tilted forward. MRI revealed complete rupture of both quadriceps tendons. Serum uric acid and parathyroid hormone levels were normal.

The patient was taken for surgery on both knees at the same time, but treatment of the right knee had to be delayed for 3 weeks because of problems with spinal anesthesia and the unwillingness of the anesthetist to continue with general anesthesia due to possible pulmonary complications. There was a large gap between the ends of the tendon and fibrotic tissue in between, and thus primary repair was not feasible. The Codivilla tendon lengthening tech-

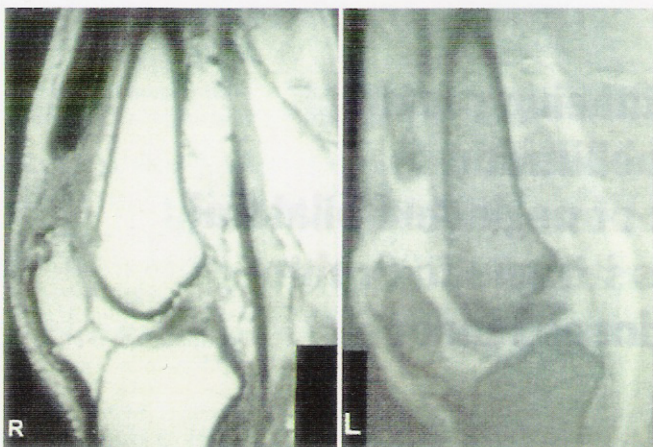


Fig. 1 MRI of the right and the left knees showing the rupture of the quadriceps tendons and fibrotic tissue between the ends

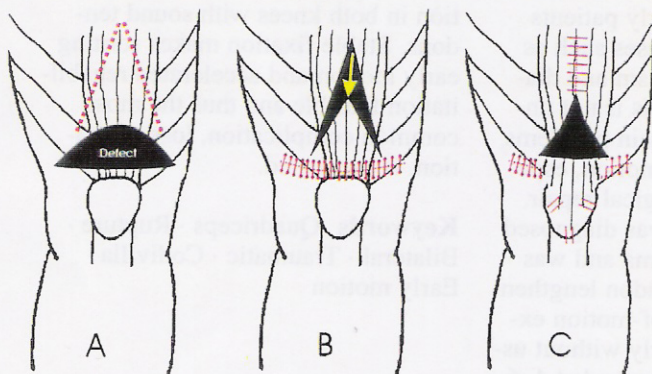
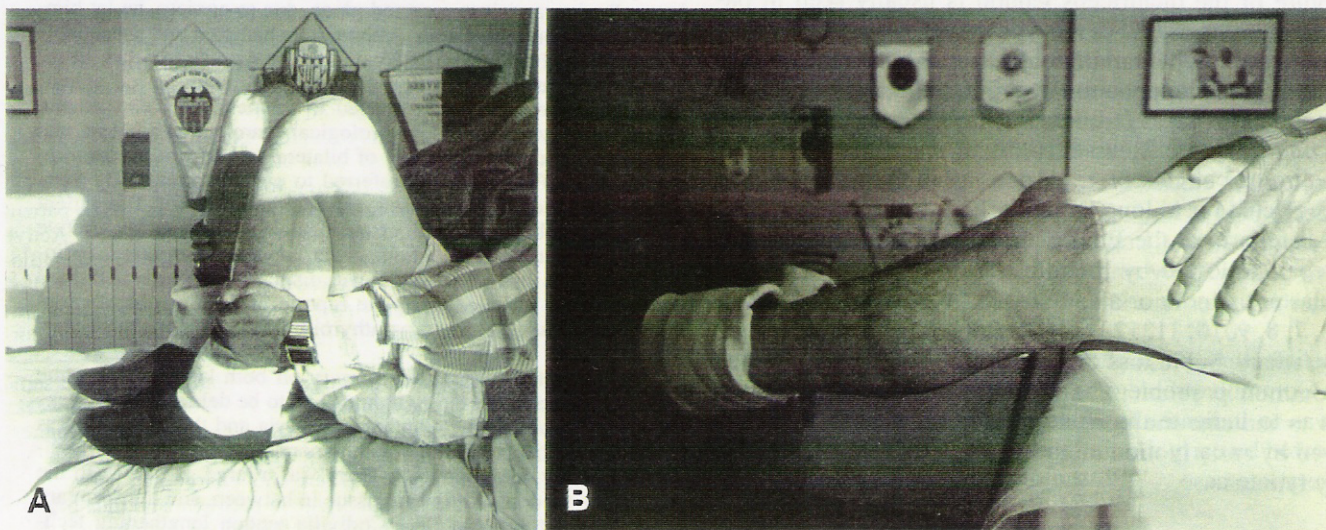


Fig. 2 A, B, C Codivilla tendon lengthening technique [redrawn from Scuderi C, Schrey E (1950) *Arch Surg* 61:42]

Fig. 3 A, B Range of motion of both knees at postoperative week 8



nique described by Scuderi (Fig. 2) [13] was used. In this technique, an inverted V is cut through the full thickness of the proximal segment of the quadriceps tendon with the inferior ends of the V ending 1.5–2 cm proximal to the rupture (Fig. 2A). The triangular flap thus fashioned is split into an anterior part of one-third of its thickness and a posterior part of two-thirds. The tendon ends are then apposed with interrupted non-absorbable sutures, and the anterior part of the flap is turned distally and sutured (Fig. 2B, C). The open upper part of the V is closed with interrupted sutures. Stability of the tendon ends is observed and the wound is closed in regular fashion.

A controlled motion brace locked to 0 degrees of extension to 70 degrees of flexion was used, and CPM was started as soon as the patient felt comfortable, i.e. at postoperative day 2. During the first 3 postoperative weeks the range of motion was increased to 90 degrees. Active exercises were started on postoperative day 10 and were increased progressively. At postoperative week 6, weight lifting exercises were started and increased gradually. The patient was allowed to bear weight progressively, starting from postoperative week 3 and the brace was removed at week 6.

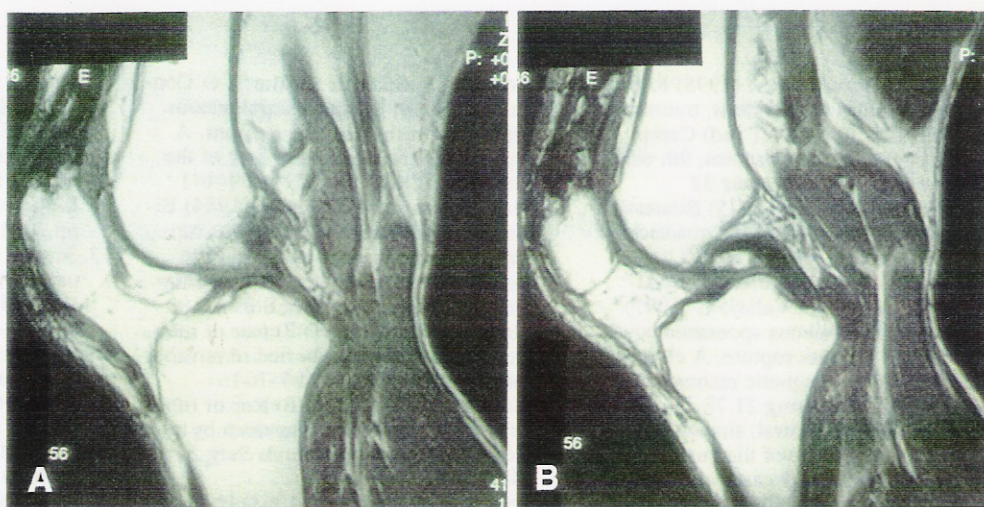
At week 6, superficial infection was noted in the surgical wound on the right side. The patient underwent further surgery for localised debridement and the tendon was seen to have healed well. The patient responded to the operation and application of the appropriate antibiotic treatment and symptoms resolved in a week.

In postoperative week 8, the patient had full flexion but was having difficulty in the terminal 5 degrees of active extension of both knees (Fig. 3A, B). Muscle power in both quadriceps was 5/5. The patient was followed-up for 5 years. At the last control visit the lateral radiograph of the right knee revealed ectopic calcification at the repair area, but he had no symptoms. The patient had full range of motion of both knees and had no complaints. Control MRIs were taken and the repaired tendons were observed to be sound (Fig. 4A, B).

Discussion

The mechanism of this type of injury is usually an eccentric overload to the extensor mechanism with the foot planted and the knee partially flexed [1]. Patellar tendon rupture or avulsion is more common in patients younger than 40 years of age, whereas quadriceps tendon rupture is more common in older patients and in those with sys-

Fig. 4 A, B MRI of both knees at the last control visit, showing healed tendons bilaterally



temic disease or degenerative changes [1]. Systemic diseases such as lupus erythematosus, diabetes, gout, hyperparathyroidism, uremia and obesity have been associated with disruption of the quadriceps mechanism [5]. The case reported here had diabetes, which is known to cause ischemic areas in the substance of the tendon [2]. One of MacEachern and Plewes' series of six cases was also thought to be predisposed by diabetes [7]. In 1975, Brotherton and Ball described a case with intra-tendon diabetic arteriosclerosis and bilateral spontaneous rupture of the quadriceps tendons [2]. Another possible mechanism of weakening of the tendon was described by Goodfellow et al., where prolonged times spent in more than 90 degrees of flexion prohibited the separating effect of the patella, and the tendon was kept under pressure by the distal femur, causing prolonged ischemia [5]. Our patient used to pray for at least five times daily in the kneeling posture.

Extensor mechanism disruption should be suspected in elderly patients with swelling, pain and dysfunction of the knee, especially if a history of jumping, squatting or stumbling is reported [1]. Diagnosis, as reported here, may be delayed for months while the physician looks for causes such as rheumatoid arthritis, mild stroke or other neurological disorders [4, 6, 7, 11]. During physical examination, a palpable gap in the quadriceps tendon can be discovered, and the patella can be displaced inferiorly. Swelling and ecchymosis may be present. The quadriceps muscle can achieve active contraction. Straight leg raising reveals a significant extension lag [12].

MRI was first used in diagnosis of bilateral quadriceps rupture in 1997 by Calvo et al. [3]. Bilateral occurrence obscures comparative physical examination and the suprapatellar gap may be hidden by the swelling [3]. Thus, MRI and ultrasonography are the most accurate diagnostic tools for these injuries, and especially are useful in determining the extent of injury in late cases.

Addition of wire pullout sutures is recommended in the techniques described by McLaughlin and Scuderi [8, 9,

13]. However, like some other authors [4], we believe it is not necessary to use wire, with the need for a second procedure for its removal, since repairs with other types of suture yield similar results.

Especially in late, neglected cases of quadriceps tendon rupture, loss of flexion is a common problem [4, 6, 7]. Despite lack of rerupture in properly treated cases, all reports in the English literature regarding bilateral quadriceps tendon rupture recommend immobilization in extension with a plaster cylinder or a knee brace for at least 4–6 weeks [1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14]. Thus, as expected, flexion becomes limited. Because the Codivilla technique is a tendon lengthening procedure, defect in extension can also be a problem. Physical therapy is applied to regain flexion following discontinuation of the plaster or brace. Nevertheless, most reports on the subject report loss flexion even in the last follow-up control [4, 6, 7].

Our case was more than 5 months old and there were defects in the tendons that prohibited primary repair; thus we had to use a tendon lengthening technique. In contrast to general recommendations, because the intraoperative stability and strength of the repair seemed satisfactory, we allowed early motion of the knee. As far as could be ascertained, there is only one report, by Wick et al. [15] in the German literature, recommending stable fixation and early motion after surgical treatment of quadriceps tendon rupture. We used a controlled motion brace and started early motion with accelerated rehabilitation. We could obtain full range of motion and had only 5 degrees of extension lag that resolved in several weeks and resulted in full range of motion. Although the case was a late one and was bilateral, excellent results were obtained with stable fixation plus early motion. We feel that it would be appropriate to try this protocol on more cases with quadriceps rupture and compare late results with those of classical postoperative rehabilitation protocols.

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