Spontaneous Rupture of the Quadriceps Tendon: Ten Case Reports and a Review of the Literature with a Hypothesis of a New Classification of Causes

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Abstract. Ten cases of spontaneous rupture of quadriceps tendon were presented, and the English literature of 7 isolated case reports was reviewed. The age incidence ranged between 17 and 82 years. There were causes of rupture other than those reported in the literature (e.g., advanced rheumatoid arthritis and its complications; osteoporosis, manipulation under anesthesia for ankylosed disused weak knee joint, and blunt trauma at the tendinous junction of the quadriceps tendon in a normal healthy person. The cardinal features were diffuse swelling around the knee, a visible or palpable suprapatellar defect, and inability to lift the straight leg despite a functioning quadriceps and normal activity in all other muscle groups in the leg. In all patients operative repair was undertaken, followed by 6 weeks immobilization in plaster and subsequent physiotherapy. Although late repair was associated with successful rehabilitation of the patient and a return to useful function, the results of early repair were much better and the time of physiotherapy was shortened.

Introduction

Rupture of the quadriceps tendon is an uncommon injury. It is commonly known as an avulsion of the rectus femoris. Scuderi [1] presented the largest series (20 cases) in 1958. There were only 7 previous single case reports of bilateral quadriceps tendon rupture in the English literature [2–8].

The reported causes of rupture of the quadriceps tendon in all the previous literature proved to be spontaneous without preexisting pathology, and may be due to the presence of gout [6] or hyperparathyroidism [4].

Here is the first Egyptian report of 10 cases of quadriceps tendon rupture due to new or unreported causes.

Case Reports

A summary of the case reports is given in Table 1. Since 1982, 10 cases of quadriceps tendon rupture were collected. Their ages ranged between 17 and 82 years with an average of 42.5 years. There were 6 males and 4 females, and there was an equal distribution between unilateral and bilateral cases.

Case 1

A 21-year-old man was suffering from monoarticular rheumatoid arthritis with marked synovial thickening of his right knee that required surgical synovectomy. By mistake, manipulation of the stiff knee under general anesthesia was first performed after 6 weeks fixation in a plaster cast. After recovery from anesthesia, walking was not easy because of the severe pain accompanying and following the manipulation. Rupture of the quadriceps tendon after the third week following manipulation was manifested by presence of a transverse depression at the suprapatellar pouch. There was inability for full knee active extension. The operative repair was carried out on the day following diagnosis through longitudinal incision. Complete rupture of the quadriceps tendon was found. Repair was performed by sutures through drill holes in the upper border of the patella, and the limb was immobilized in a long leg cast cylinder for 6 weeks, after which time physiotherapy was started. The range of knee flexion ranged from 0–70° after 10 months of physiotherapy.

Case 2

A 32-year-old woman with advanced rheumatoid arthritis as well as psychological problems necessitated repeated sessions of electroconvulsive therapy (ECT). The ECT may have been so strong that rupture of both quadriceps tendons took place. Active extension of both knees was lost, so that the patient had difficulty in standing up from a chair.

The operative exploration and repair of the ruptured tendon was performed to the right knee on the second day after diagnosis while the left side was repaired 7 weeks after diagnosis.
Both were sutured through drill holes in the upper margin of the patella followed by plaster cast fixation for 6 weeks.

Physiotherapy continued for 9 months to the right knee and 11 months for the left side, but the patient did not regain the full range of knee motion. The right knee returned to its original mobility, but there was a 10° reduction in flexion compared with the previous mobility of the left side.

**Case 3**

A 38-year-old weight-lifter was injured during training when the metal bar of the weight fell down suddenly on the anterior aspect of his thigh near the knee. He sustained severe agonizing pain, with inability to walk or stand up. A depression was noticed at the upper margin of the patella with a diffuse swelling of the knee.

X-rays revealed no bone fracture around the knee. Diagnosis of rupture of the quadriceps tendon was made on the day of injury.

The operative repair was performed on the day of injury, and the tear was sutured by nylon sutures No. 4 placed through drill holes from the distal pole of the patella and in a figure 8 manner in the quadriceps tendon. Immobilization by plaster cast cylinder was continued for 6 weeks, followed by physiotherapy. The range of knee flexion was 0–130° after 8 months of physiotherapy.

**Case 4**

An 82-year-old diabetic man stumbled while leaving mosque during Haji period. He was diagnosed as having
### Table 1. Case reports of quadriceps tendon rupture

<table>
<thead>
<tr>
<th>No</th>
<th>Age and sex</th>
<th>Onset diagnosis and time of operation</th>
<th>Side affected</th>
<th>Precipitating factor</th>
<th>Preexisting pathology</th>
<th>Method of repair</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21 ♂</td>
<td>3W + 1 day</td>
<td>Unilateral</td>
<td>Manipulation under G.A. after synovectomy</td>
<td>R.A.</td>
<td>Sutures through patellar drill holes</td>
<td>0-70° flex after 10 months</td>
</tr>
<tr>
<td>2</td>
<td>32 ♂</td>
<td>Same day + Rt 1 day + Lt 7w’s</td>
<td>Bilateral</td>
<td>E.C.th.</td>
<td>R.A.</td>
<td>Sutures through patellar drill holes</td>
<td>Rt returned to its original measures after 9m’s. Lt 10° limitation than its previous measures after 11m</td>
</tr>
<tr>
<td>3</td>
<td>38 ♂</td>
<td>Same day + 1 day</td>
<td>Unilateral</td>
<td>Blunt trauma (fall of heavy object)</td>
<td>Normal</td>
<td>Nylon sutures through drill holes around the patella</td>
<td>Full range (80-130°) after 8 months</td>
</tr>
<tr>
<td>4</td>
<td>82 ♂</td>
<td>5w’s + 5w’s</td>
<td>Bilateral</td>
<td>Mild trauma</td>
<td>G.A. + D.M.</td>
<td>Patellar sutures of its upper margin</td>
<td>0-130° after 8 months</td>
</tr>
<tr>
<td>5</td>
<td>61 ♂</td>
<td>Same day + 5w’s</td>
<td>Bilateral</td>
<td>Slipped</td>
<td>Osteoporosis</td>
<td>Nylon sutures through drill holes around the patella</td>
<td>Lt→110° flex 15 ext. lag 17 M’s Rt→105° flex. at 20 ext. lag</td>
</tr>
<tr>
<td>6</td>
<td>26 ♂</td>
<td>3w’s + 5w’s</td>
<td>Unilateral</td>
<td>Severe blunt trauma motorcycle accident</td>
<td>—</td>
<td>Nylon sutures through drill holes around the patella</td>
<td>Lt→ 0-130° → 5 m’s</td>
</tr>
<tr>
<td>7</td>
<td>76 ♂</td>
<td>6D’s + 1 day</td>
<td>Bilateral</td>
<td>Mild trauma (slipping)</td>
<td>Gout</td>
<td>Nylon sutures through drill holes around the patella</td>
<td>0-125° → 7 m’s</td>
</tr>
<tr>
<td>8</td>
<td>17 ♂</td>
<td>1 day + 6 m’s</td>
<td>Unilateral</td>
<td>Manipulation</td>
<td>R.A.</td>
<td>Nylon sutures through drill holes around the patella</td>
<td>10-100° (8 months)</td>
</tr>
<tr>
<td>9</td>
<td>48 ♂</td>
<td>1 day + 1 day</td>
<td>Unilateral</td>
<td>Trauma by blunt object</td>
<td>—</td>
<td>Drill holes (upper margin)</td>
<td>0-125° → 7 M’s</td>
</tr>
<tr>
<td>10</td>
<td>41 ♂</td>
<td>1 day + 8 m’s</td>
<td>Bilateral</td>
<td>Mild trauma</td>
<td>Hyperparathyroidism</td>
<td>Drill holes (upper margin)</td>
<td>10-45° → 8 m’s</td>
</tr>
</tbody>
</table>

a mild stroke. He was unable to walk for 5 weeks. Bilateral spontaneous quadriceps tendon ruptures were diagnosed and he was admitted to the hospital for repair. The operative repair was carried out the following day through transverse skin incisions. Complete ruptures of the quadriceps tendon were found. The tendons of both sides were repaired at the same operative sitting with sutures passed through drill holes in the upper margin of the patella, and the legs were immobilized in a plaster cast cylinder for 6 weeks. He then started physiotherapy, and after 8 months had a range of flexion 0-80° in the right knee and 0-60° in the left knee. He had difficulty in standing up from a chair but he was otherwise mobile. One year later another rupture of the long head of the biceps on the right side was discovered. At that time his serum uric acid was estimated at 11 mg/ml.

**Case 5**

A 61-year-old obese woman weighing 128.5 kg had fallen onto her knees on the day of diagnosis. On examination supra patellar defects could, with difficulty, be felt, and she was unable to lift her heels from the couch with a mobile flexion deformity that could be corrected passively.

At the same time, she complained of a severe dorsal and dorsolumbar back pain that necessitated x ray to the whole spine and both knees. There was signs of osteoporosis affecting the dorsal and dorsolumbar spine (multiple wedging of the vertebrae, fish-tail appearance of vertebral bodies, and generalized rarification of the whole spine). Both knees showed generalized rarification with its characteristic glassy appearance. There was rupture of both quadriceps tendons with tiny avulsion fracture of the top of both patellae. All the patient’s laboratory results were normal, including serum uric acid, calcium, phosphorus, parathormone hormone, rheumatoid factor (RF) and E.S.R. As the diagnosis of osteoporosis to that menopausal woman was confirmed, it seemed logical to treat osteoporosis prior to surgical repair of the rupture of the quadriceps tendon.

A dose of 100 IU calcitonin was injected subcutane-
ously daily for 5 injections and every other day for 10 injections, combined with a decadurabolin injection intramuscularly, as anabolic hormone and estrogen tablet as a replacement therapy that was supplemented by calcium, vitamin D, and vitamin C. Some physiotherapeutic exercises were applied to the knees and the whole back.

After 5 weeks, the follow-up radiographs showed increased mineralization density of the spine and knees, especially both patellae.

At operation (after 5 weeks) the ruptures were repaired with nylon sutures placed circumferentially around the distal pole of the patella and in a figure 8 manner in the quadriceps tendon.

Plaster cylinders were retained for 6 weeks, during which time the regimen for osteoporosis was continued. Seven months after operation, the left knee had 110° flexion with an extension lag of 15°, while the other knee had 105° flexion with a 20° lag of extension. She walked independently, but using a cane.

Case 6

A 26-year-old laborer was in a motorcycle accident. He was thrown onto the ground and stopped by the edge of the pavement, which injured his right knee. He had severe pain at his right knee, together with severe abrasions and an inability to walk.

Radiographs showed normal bony articulation with no fracture affecting any of the knee bony components. The injured leg was put in plaster for 3 weeks, and after its removal there was an inability to raise the affected leg actively, except by carrying it with the other leg. There was a palpable depression above the patella, and the diagnosis of rupture of the quadriceps tendon was obtained. Two weeks later, active and passive knee mobilization was continued prior to surgery. The operative repair was carried out using No. 3 nylon sutures passed through drill holes at the upper margin of the patella. A plaster cylinder was worn for 6 weeks, followed by a physiotherapy program of gradually increasing intensity. At 5 months, he walked without canes with knee range of movement 0°–130°.

Case 7

A 76-year-old woman with a history of multijoint pain and resistant elevated serum uric acid slipped on a step and fell to the floor. She was mistakenly thought to have bilateral traumatic knee effusion. After 6 days the diagnosis of rupture of the quadriceps tendons was suspected; she was operated on on the next day. Sutures were placed through drill holes at the upper margin of the patella using nylon sutures No. 3. This was followed by fixation in a plaster cylinder for 6 weeks. Physiotherapy was instituted, and after 7 months there was no extensor lag to both knees with a range of flexion of 0°–125°.

Case 8

A 17-year-old man suffered advanced rheumatoid arthritis affecting all his joints, which were severely ankylosed. Although he was treated by systemic corticosteroids for a prolonged period, he was bedridden with stiff, ankylosed joints, including both knees. In an attempt to mobilize the ankylosed and rarified knees under general anesthesia, a click was felt during manipulation of the left knee that was attributed to fracture patella. On recovery, the patient lost active knee extension, although pain was controlled by lumbar epidural analgesia.

A diagnosis of rupture of the quadriceps tendon was confirmed. For 6 months before surgical repair, efforts were made to correct the patient's general condition (rheumatoid arthritis and the accompanying osteoporosis). The operative repair was started using nylon sutures No. 4 placed circumferentially around the distal pole of the patella and as the figure 8 manner in the quadriceps tendon. Fixation was continued for 6 weeks in a plaster cylinder. At the eighth postoperative month, the patient gained 100° flexion with a flexion deformity of 10°.

Case 9

A 48-year-old woman was hit with a blunt object (stick) to the dorsum of her thigh near the knee. The right knee was swollen and the patient lost her ability for active knee extension.

The diagnosis of rupture of the quadriceps tendon was considered, especially as there was no bony fracture affecting the patella. On the second day, she was operated on for suture of the quadriceps tendon. It was performed using nylon suture No. 3 passed through drill holes in the upper margin of the patella, and the knee was fixed by plaster cylinder for 6 weeks. After 7 months, she regained a movement of 0°–125° and she was able to walk independently without the aid of crutches.

Case 10

A 41-year-old man's knee "gave out" on stepping from a moving bus. Bilateral spontaneous rupture of the quadriceps tendons was diagnosed, and the patient was prepared for operative repair. During preoperative preparation, a raised serum calcium level with impaired renal function was noticed, a hyperparathyroidism was diagnosed, and parathyroid adenoma was located and removed.

The patient had a previous history of epigastric pain and ulcerations that was treated by partial gastrectomy and selective vagotomy. Operative repairs were carried out successfully 8 months after the rupture using nylon sutures No. 3 passed through drill holes in the upper
margin of the patella. The range of knee motion was 10–45° after 8 months of physiotherapy.

Discussion

Only 7 single case reports of bilateral quadriceps tendon rupture have been previously reported in the literature [2–8]. The ages of these patients ranged from 33 to 82 years and all were male. Also, 4 of these cases reports appear to be spontaneous and without preexisting pathology. One [6] occurred in a patient with gout, and another in a patient with hyperparathyroidism [4].

Our study, 10 new case patients to those other non-mentioned causes of quadriceps rupture in a younger age group.

In the previous literature, all the patients were male, and most were over 33 years of age. In our case reports, the age incidence was much younger, as the youngest patient was 17 years old, and 4 female patients were encountered. Also, 5 cases of 10 were unilaterally affected, while previous case reports were bilaterally affected.

MacEachern [8] stated that the most common cause of bilateral simultaneous rupture appears to be sudden violent contraction of the quadriceps mechanism with the knees slightly flexed and the feet fixed. Also, it was thought to be due to weakness of the quadriceps tendon resulting from one of several causes, including obesity, degenerative changes, and repeated minor injury [9]. Other possible predisposing factors include gout and the calcification associated with hyperparathyroidism. Although cases of quadriceps rupture due to hyperparathyroidism (case No. 10) and gout (cases No. 5 and 7) were found in our series, other causes of rupture were encountered. In our series, two main kinds of rupture were found reported. Namely, rupture in a normal healthy person and rupture due to the presence of a preexisting pathology. Blunt trauma represented the chief cause of rupture of the quadriceps tendon in a normal healthy person (cases 3, 6, and 9).

Advanced neglected rheumatoid arthritis represented the most common cause of weakness of the knee extensor mechanism as a preexisting pathology. Although the precipitating factor was varied in such cases (e.g., forced manipulation under G.A. or electroconvulsive therapy), the cause of weakness in rheumatoid arthritis is most probably due to disuse atrophy of the muscles and tendons and due to secondary osteoporosis that may be due to rheumatoid arthritis itself or prolonged recompency or as a result of prolonged intake of corticosteroid.

Senile osteoporosis was represented in one case. In cases of osteoporosis it was noticed during surgical repair that the quadriceps tendon was avulsed rather than ruptured. It might be due to the relative weakness of bone intensity. For this reason we preferred management of osteoporosis prior to surgical repair. Also, it was thought that repair with nylon sutures passed through drill holes around the lower pole of the patella was more stable than suturing through drill holes at the upper margin of the patella.

Also, it was clear that cases of quadriceps tendon rupture due to the presence of preexisting cause were bilaterally affected except that case that ruptured during manipulation under general anesthesia. On the other hand, unilaterally affected cases were purely traumatic, either with or without a preexisting pathology.

Finally, a hypothesis of a new classification of the causes of quadriceps tendon rupture can be summarized (Table 1). Category 1 includes cases of rupture without the presence of a preexisting pathology and a rupture caused by a blunt trauma. Category 2 includes cases of quadriceps tendon rupture in the presence of a preexisting pathology that can be considered as gout, hyperparathyroidism, advanced or neglected rheumatoid arthritis, and osteoporosis. The precipitating pathology is minor trauma, manipulation under G.A., or electroconvulsive therapy.

References


Table 2. A new or a recent classification of causes of quadriceps tendon rupture

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>I. Without a preexisting pathology and a precipitating factor of blunt trauma</td>
<td></td>
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<tr>
<td>II. With a preexisting pathology of</td>
<td></td>
</tr>
<tr>
<td>1. Gout</td>
<td></td>
</tr>
<tr>
<td>2. Rheumatoid arthritis (advanced or neglected)</td>
<td></td>
</tr>
<tr>
<td>3. Hyperparathyroidism</td>
<td></td>
</tr>
<tr>
<td>4. Osteoporosis (any kind) and a precipitating factor of</td>
<td></td>
</tr>
<tr>
<td>a. Electroconvulsive therapy</td>
<td></td>
</tr>
<tr>
<td>b. Manipulation under G.A.</td>
<td></td>
</tr>
<tr>
<td>c. Minor trauma</td>
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around the lower pole of the patella was more stable than suturing through drill holes at the upper margin of the patella.