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Case Report

Simultaneous bilateral quadriceps tendon rupture in a uremic patient

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A B S T R A C T

Quadriceps is a part of extensor mechanism, and it is a strong muscle bundle for knee joint movement. It rarely ruptures in the general population. We present a case with simultaneous bilateral quadriceps tendon rupture and discuss the causes. A 45-year-old man had a history of end stage renal disease and received regular hemodialysis treatment for more than 12 years. He met with a stumbling accident while walking down stairs that resulted in painful swelling in both knees, which disabled him from walking. In the beginning, the radiogram showed no fracture, but magnetic resonance imaging examination showed bilateral quadriceps tendon rupture. Primary quadriceps tendon repair was performed, and the result was satisfactory after serial rehabilitation program. He was noted to have hypercalcemia 3 months later, and hyperparathyroidism with hypertrophic parathyroid gland was found on sonogram. Thyroidectomy was done, and postoperative status was uneventful. The range of motion of both knee joints got satisfactory recovery. The blood calcium level was well in control with vitamin D and calcium carbonate. No seizure occurred. Simultaneous bilateral quadriceps tendon rupture after trivial injury is uncommon. If it does occur, then the presence of some chronic underlying disease should be thoroughly investigated. Early treatment has a better result than the delayed cases.

1. Introduction

Quadriceps is one of the largest muscle in the body, and it is a strong muscle mass to motivate knee motion. Unilateral quadriceps tendon rupture is frequently seen in young adults during strenuous exercise, but simultaneous bilateral quadriceps tendon rupture is rare. Although there are some reports of bilateral quadriceps tendon rupture in amateur players,[1–3] they are just some sporadic reports. The occurrence of simultaneous bilateral quadriceps tendon rupture during daily activity is seen in adults older than 40 years, and they always have some chronic underlying medical disease. The most commonly linked diseases are chronic renal insufficiency, diabetes, hyperparathyroidism, anabolic steroids disuse, and alcoholism; obesity, lymphoma and ciprofloxacin, gout, osteogenesis imperfecta, and alkaptonuria have been identified[4–14] as the predisposing risk factors. Early diagnosis and surgical repair can produce satisfactory results.[15–17]

2. Case report

A 45-year-old man with end stage of renal disease (ESRD) received regular hemodialysis for more than 12 years; he suffered from a stumbling accident while walking down stairs on February 9, 2009. After the accident, there was painful swelling with ecchymosis over both knees (Fig. 1A) that disabled him from walking. He visited a regional hospital, and no fracture was diagnosed after radiographic examination (Fig. 2A). Conservative treatment was prescribed. Owing to persistent pain, he received magnetic resonance imaging (MRI) examination, and bilateral quadriceps tendon rupture was found (Fig. 2B). Hence, he was referred to our hospital for surgical treatment.

2.1. Surgical procedure

Under endotracheal general anesthesia, the operation was done through midline longitudinal incision. After dissecting the soft tissue, the ruptured quadriceps tendon was identified, and sharp tear through the tendon–bone junction could be seen (Fig. 1B). The tendon end was trimmed smooth. Subsequently, the tendon repair was done through Insall's transpatellar tunnel fixation method (Fig. 1C) with thick suture material (No.V Ethibond, Johnson-Johnson, USA), and we applied a circumferential wire to reinforce the suture site.

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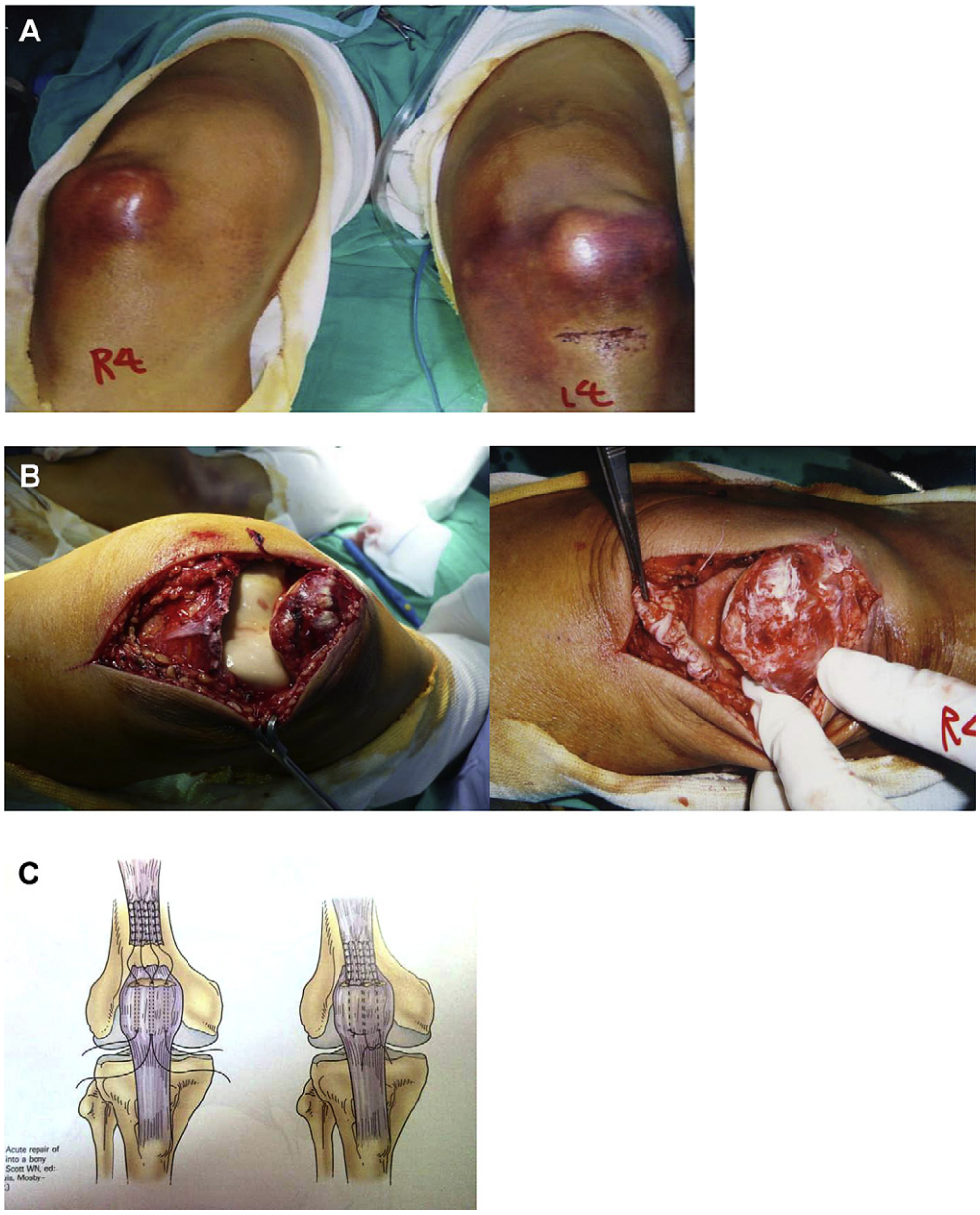

Fig. 1. (A) Bilateral knee swelling and ecchymosis and suprapatellar excavation are prominent. (B) Tendon rupture through tendon insertion site. (C) Operation method (Insall method): transpatellar tunnel fixation.

During the recovery period, he was put on bilateral knee brace and received pedestrian program, and the recovery was uneventful. Three months later, he could walk well, and the knee joint range of motion showed complete recovery (Fig. 3). Unfortunately, he was noted to have hypercalcemia at a clinic where he received regular hemodialysis. His blood biochemistry showed a elevated calcium level (11.5 mg/dL) (Fig. 4A), elevated phosphate level (7.4 mg/dL) (Fig. 4B), and intact parathyroid hormone (1000 pg/mL) (Fig. 4C). With the suspicion of secondary hyperparathyroidism, he was referred to another medical institution. Hyperparathyroidism with four hypertrophic parathyroid glands was found after sonographic examination. Subsequently, he received subtotal thyroidectomy on June 2, 2009, and one parathyroid gland was transplanted to the right forearm. After the surgery, the recovery status was smooth, and the blood calcium level was controlled with calcium carbonate and vitamin D. No seizure occurred after the operation.

3. Discussion

Quadriceps is composed of vastus medialis, vastus lateralis, vastus intermedius, and rectus femoris, which insert into the superior pole of patella through tendinous part of rectus femoris. It is a strong muscle mass to initiate knee flexion and extension. The unilateral quadriceps tendon rupture is usually seen in young atheletes during strenuous exercise, but some bilateral quadriceps tendon ruptures were reported in young amateur players.[18] The mechanism of quadriceps tendon rupture results from foot stepping on the ground and a bended knee with a forceful contraction of quadriceps muscle.[19] The patient typically presents a fall with his or her knees flexed with a sudden, sharp pain above the patella and is unable to stand without assistance.[20–22] Physical examination shows that the patient cannot actively extend his knee and often has a palpable gap above the patella, the so-called “sulcus sign” or “gap

Fig. 2. (A) Radiogram showed no fracture but a lower position of patella. (B) Magnetic resonance imaging showed quadriceps tendon rupture through patellar margin.

test."[22] They composed the triad of quadriceps tendon rupture. Jollis et al[23] recommended a needle test to catch the diagnosis easily. Plain radiographic picture often shows nonspecific change and only indirect signs of rupture, such as soft tissue swelling, knee effusion, calcifications, low-lying patella, or a forward-tilted patella.[21,24] Ultrasound is another accessible device in diagnosing tendon rupture at the bedside.[13,21,25] MRI is particularly useful for getting preoperative details. It allows better visualization of soft tissues and anatomical details, and the precise location and extent of rupture can be identified.[26–28] Early surgical treatment with rehabilitation protocol supervised by physical therapist can lead to good results.[15–17]

The pathogenesis of simultaneous bilateral quadriceps tendon rupture is still controversial. In 1949, Steiner and Palmer[20] reported the first case of simultaneous bilateral quadriceps tendon rupture in a chronic renal failure patient; there are some sporadic case reports since then. Most of the cases have underlying chronic medical disease, and the most commonly related conditions are chronic renal failure with long-term hemodialysis[4,6,14,15,20,22] and hyperparathyroidism.[29–31] Because the cases of spontaneous bilateral quadriceps tendon rupture usually occur in patients older than 40 years and with chronic renal failure, degenerative change was thought to be the cause of tendinopathy, which finally leads to tendon rupture. Three factors for spontaneous tendon ruptures have been proposed especially for patients with chronic renal failure[32]: (1) degeneration caused by chronic acidosis, leading to elastin deposition in the tendons, predisposing them to rupture; (2) beta-2 microglobulin amyloidosis; and (3) weakness of the bone–tendon junction caused by increased osteoclastic cortical bone resorption in secondary hyperparathyroidism. Most of the recent reports point out that hyperparathyroidism was the leading cause of spontaneous bilateral quadriceps tendon rupture.[30,33] Masonis and Frick[34] reported that a healthy patient suffered from spontaneous bilateral quadriceps tendon rupture; amyloidosis was found on tendon pathologic picture. However, Shiota et al[33] reported seven spontaneous major tendon ruptures in five patients on chronic hemodialysis; the pathologic examination found no amyloid deposit, but these patients had radiologic signs of hyperparathyroidism and increased alkaline phosphatase and parathyroid hormone serum levels. In our patient, the surgical photograph showed both quadriceps tendon ruptured through the upper margin of patella that coincided with the description of weakness at tendon–bone junction.

Ryuzaki et al[35] found that there was a gradual increase in serum alkaline phosphatase level in hyperparathyroidism patient with a tendon rupture. According to De Franco et al,[30] the highest levels of serum parathyroid hormone and alkaline phosphatase occurred in the month before tendon rupture. He reported two cases of chronic renal failure patients with secondary hyperparathyroidism and simultaneous bilateral tendon rupture; the serum parathyroid hormone level was greater than 1300 pg/dL. In another report by Chen et al,[29] the parathyroid hormone level was elevated to 1940 pg/dL. De Franco et al[30] commanded that serum parathyroid hormone level elevated to 500 pg/dL is a significant elevation, adequate to cause histologic evidence of severe osteitis fibrosa because of secondary hyperparathyroidism. In this case, we reviewed the past data and found that he had increased alkaline phosphatase level (980 IU/L); the serum parathyroid hormone had elevated to 1598 pg/dL for 1 year, and there was elevated serum calcium level that indicated an elevated bone resorption rate. The long-term hyperparathyroid status resulted in weakening at the tendon–bone junction and

Fig. 3. The postoperative result is good on muscle power and range of motion.

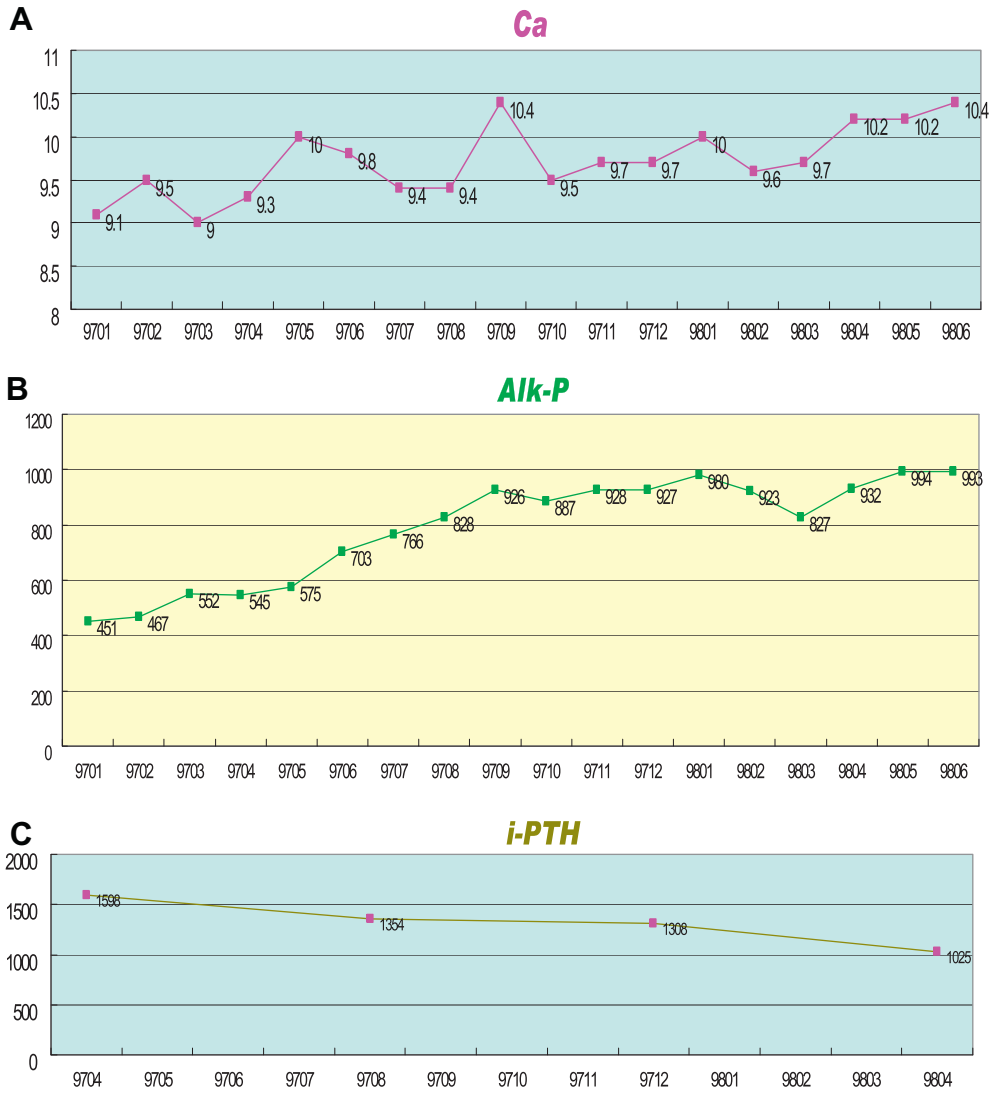

Fig. 4. (A) Serum calcium level (mg/dL). (B) Serum alkaline phosphatase level (IU/L). (C) Serum parathyroid hormone level (pg/dL).

eventually resulted in bilateral spontaneous quadriceps tendon rupture while he suffered from a trivial stumbling.

4. Conclusion

This is a case of ESRD with long-term hemodialysis with secondary hyperparathyroidism, which was neglected till bilateral quadriceps tendon rupture. The diagnosis of quadriceps tendon rupture needed more attention. The radiographic pictures are nonspecific, and sonography or MRI is helpful if the diagnosis is questionable. Early surgical intervention is needed, and the rehabilitation protocol must be obeyed to get perfect result. In addition to the tendon problem, the underlying disease must be sought and treated at the same time. The parathyroid hormone level must be carefully evaluated and treated if hyperparathyroidism was found, especially in ESRD patients.

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