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Neglected Spontaneous Bilateral Quadriceps Tendon Rupture: An Uncommon but Important Complication of a Chronic Kidney Disease: A Case Report and Review of Literature

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ABSTRACT

Introduction: Uremic tendinopathy, a rare condition involving spontaneous tendon ruptures in quadriceps, triceps, and finger tendons, affects 15% of Chronic Kidney Disease patients on hemodialysis. It's often caused by trauma in older individuals and is linked to systemic illnesses.

Case Presentation: A 40-year-old female with neglected spontaneous bilateral quadriceps rupture and chronic kidney disease experienced pain, swelling and sudden weakness in both her knees while climbing stairs 2 months before coming to the hospital. She felt pain in the upper area of both knees for around three months before falling. The patient was later referred to our hospital for an MRI examination, which showed bilateral quadriceps tendon rupture. The patient was treated with bilateral transosseous repair of the quadriceps tendon. The patient could lift her leg one 1 month later and walk normally without aid 3 months later. The KOOS score of this patient was 78%, and the Kujala score was 79% in the fifth month after surgery.

Discussion: Quadriceps tendon ruptures occur during rapid muscle contractions, often due to falls or blows. Bilateral ruptures are rare and linked to systemic illnesses. Metabolic acidosis can cause tendon degeneration. Early operative repair is recommended, with transosseous suture technique being the most common treatment due to the lack of distal stump.

Conclusions: Spontaneous quadriceps rupture is a rare condition many chronic diseases can cause. Proper medication and surgery should be performed early. However, successful results have been reported in chronic cases with surgery performed as late as 1 year after injury.

Keywords: chronic kidney disease, quadriceps tendon repair, spontaneous bilateral quadriceps tendon rupture

INTRODUCTION

Spontaneous tendon ruptures involving quadriceps, triceps, and finger tendons, characterizing uremic tendinopathy, are seen in about 15% of patients with chronic kidney disease (CKD) on hemodialysis.[1] The quadriceps tendon is an important component of the extensor mechanism of the knee joint and is formed by three vast rectus femoris muscles just above the patella. Quadriceps tendon ruptures are uncommon, resulting from trauma in older people. Quadriceps tendon ruptures usually occur during a rapid, eccentric contraction of the quadriceps muscle, with a planted foot and partially flexed knee due to a fall or direct blow.[2] Bilateral ruptures are very rare and strongly associated with systemic illnesses like hyperparathyroidism, renal failure, rheumatoid arthritis, gout, obesity, systemic lupus erythematosus steroid use, and diabetes mellitus. The usual site of rupture is 0–2 cm from the upper pole of the patella through a weakened and degenerated tendon segment as a result of underlying systemic disease.[3]

Weakness and rupture of tendons in CKD are correlated with the duration of renal failure and length of treatment with hemodialysis. The resulting malnutrition, ß2 -amyloidosis, and accumulation of uremic toxins (all classical complications of long-term chronic hemodialysis) have been suggested to be causative factors for spontaneous tendon rupture.[3] Wani et al. reported that the unknown and untreated nature of renal failure with elevated serum PTH and low pH stresses the role of hyperparathyroidism and metabolic acidosis, the classical complications of renal failure, in the pathogenesis of uremic tendinopathy.[3] Metabolic acidosis may result in tendon degeneration due to disruption of the structure of the protein-polysaccharide complex, which is responsible for collagen maturation.[4]

Hyperparathyroidism in renal failure results from phosphate retention due to decreased glomerular filtration rate, with consequent hypocalcemia resulting in parathyroid gland stimulation.[4] Restoration of serum calcium and phosphate is at the expense of increased bone resorption due to high PTH. Secondary hyperparathyroidism causes dystrophic calcification and subperiosteal bone resorption, weakening the tendon and osteotendinous junction.[4] Relatively minor trauma can then cause spontaneous rupture of the tendon at the tendon-bone junction.[3]

CASE PRESENTATION

A 40-year-old woman presented with pain and swelling in both knees from the last 2 months that started suddenly while climbing upstairs. She could not extend her knees actively and could not stand without support. She felt pain in the upper area of both knees for around three months before falling. The patient came to our hospital with an examination of afebrile, asthenic and pale; pulse was 86 beats/min, and blood pressure was 143/87 mmHg. Both knees were swollen and tender, revealing defects above the low-lying patellae (Figure 1). No active extension against gravity; a patellar reflex could not be elicited on either side.

Laboratory investigations revealed hemoglobin of 7.2 g/dL. Blood chemistry results were as follows: blood urea of 103. mg/dL, serum creatinine 11.5 mg/dL with estimated creatinine clearance of 3.69 mL/min; serum calcium was 9 mg/dL; phosphate was 6.3 mg/dL; blood pH was 7.43, bicarbonate level was 22 mEq/L, potassium was 2.95 mEq/L; sodium and liver function tests were normal. Serological tests did not suggest any evidence of hepatitis (B, C) or HIV infection; antinuclear antibodies and antidouble-stranded antibodies were absent.

X- ray of the knees showed a low-lying patella with diminished bulk of the quadriceps tendon just above the patella in either knee (Figure 2). T2-weighted MRIs in the sagittal plane revealed discontinuity in the quadriceps tendon in both knee joints (Figure 3). Other findings in MRI were partial tear of PCL, LCL, patellar tendon and lateral retinaculum of the patella. Small joint effusion was seen in the suprapatellar region.

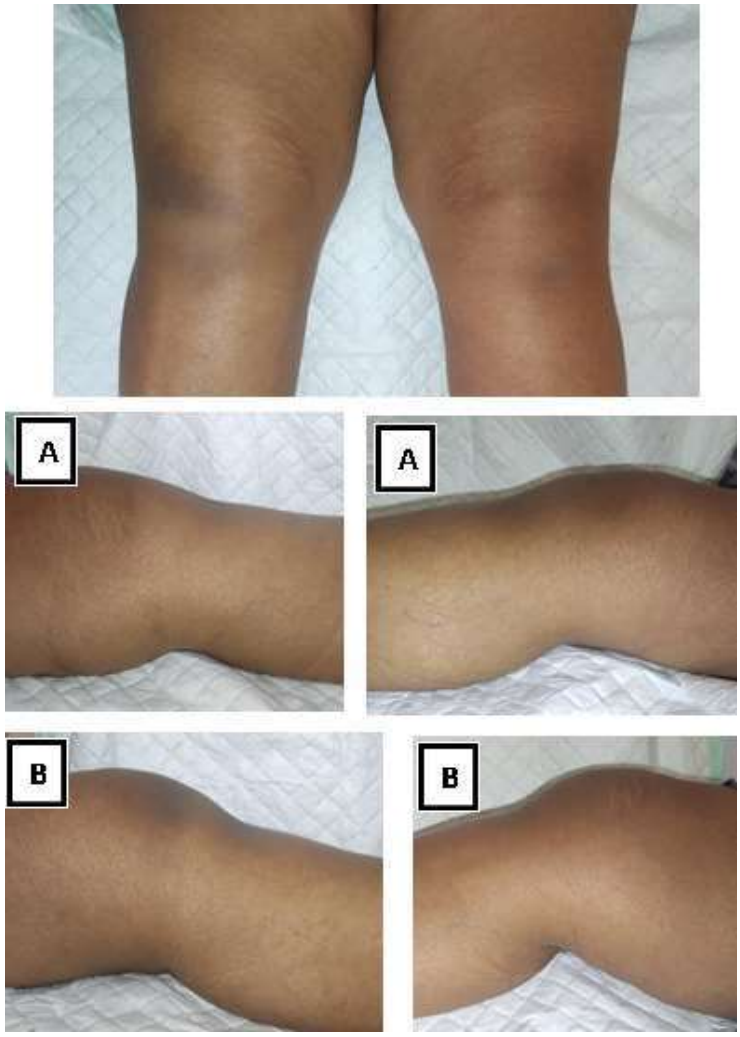

Figure 1. The clinical picture shows swelling and defects above low-lying patellae on the Left (A) and Right (B) knees.

Figure 2. X-ray of both knees on lateral view showing low-lying patella

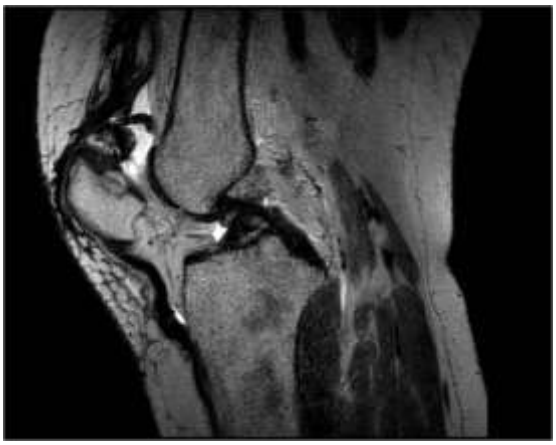

Figure 3. T2-Weighted MRI Sagittal section of right knee shows complete tear of the quadriceps tendon, a partial tear of PCL, LCL and patellar tendon

We diagnosed the patient with neglected spontaneous bilateral quadriceps tendon rupture with stage V chronic kidney disease. The patient was treated with intravenous fluid, blood transfusion and correction of hypokalemia. The patient then underwent surgery to repair the quadriceps tendon. The quadriceps tendon was repaired using the transosseus repair technique. The resistant, non-absorbable sutures are initially braided in the proximal stump of the tendon using the Whipstitch technique. Longitudinal drill holes are made in the patella, allowing the suture ends to be passed distally and tied with the necessary tension to bring the stump closer to its insertion point (Fig.4). The remaining proximal and distal end of the tendon is then repaired using direct technique. Knees were splinted in extension followed by gradual weight bearing after 4 weeks and complete weight bearing at 11-12 weeks. The Patient could walk without aid and returned to her work 5 months after surgery with a KOOS score of 78% and a Kujala score of 79%. The subtotal KOOS scores of this patient were: Symptoms + Stiffness subtotal: 79%; Pain subtotal: 89%; Function, daily living subtotal: 88%; Function, sports and recreational activities subtotal: 60%; Quality of life subtotal: 75%.

Figure 4. Quadriceps tendon repair using a transosseous technique with proximal end suture of whipstitch technique

DISCUSSION

A rupture of the quadriceps tendon results from an indirect force when a vigorous contraction of the anterior thigh muscles is exerted on the flexed knee with the foot resting on the ground (eccentric contraction).[5,6] The following functional disability is evident due to local inflammatory response: the formation of a tendon gap and deficit in the active knee extension. The vast majority of quadriceps tendon ruptures occur in men with a mean age of 60 years, and, as previously mentioned, there is a frequent association between ruptures of this tendon and the presence of comorbidities.[7] Several chronic diseases are capable of producing long-term changes in the tendon structure, resulting in its weakening and predisposing it to rupture. In this scenario, forces that do not exceed the physiological demands can cause discontinuity in the mid-substance of the tendon or avulsions at the enthesis (spontaneous ruptures). Among the possible mechanisms of intrinsic tendon injury, we can mention altered proteoglycan metabolism, hypo- vascularization, decreased collagen production, the formation of transubstantial calcifications and chronic inflammation. However, in patients with ESRD, the leading risk factor for rupture is secondary hyperparathyroidism.[7]

The first article reporting a ruptured quadriceps tendon in a patient with hyperparathyroidism secondary to chronic kidney disease was published in the early 1960s. Since then, numerous studies have confirmed this association. The increase in parathormone levels stimulates osteoclastic activity, which promotes bone resorption to balance serum calcium. Since resorption occurs diffusely in the skeleton, the areas of tendon insertion are not spared, resulting in weakness of the tendon-bone junction.[7] Although the exact mechanism is unclear, most researchers believe that secondary hyperparathyroidism or other hormonal imbalances caused by regular haemodialysis have an essential impact on the pathogenesis of tendon rupture. Vitamin D deficiency and secondary hyperparathyroidism may result in subperiosteal bone resorption, weakening the firmness between the quadriceps tendon and patella.8 The previous cases of quadriceps and patellar tendon rupture in CKD patients are listed in Table 1.

Early operative repair is indicated for all acute complete quadriceps tendon ruptures, provided the patient is a suitable surgical candidate. Surgery is also indicated for most chronic complete quadriceps ruptures. Although repair/reconstruction is technically more difficult and results are inferior to early repair, successful results have been reported with surgery performed as late as 1 year after injury. Partial tears may be treated nonoperatively unless they are refractory to a long course of conservative management. No contraindications for acute quadriceps tendon rupture repair exist, provided the patient is an adequate surgical candidate. For delayed repair/reconstruction, no contraindications for surgery appear to exist up to 1 year following injury. The authors must be aware of any literature on operative management performed by 1 year following rupture. With the growing popularity of suture-anchor fixation in other aspects of orthopaedic surgery, more research will probably follow better to define this technique's role in quadriceps tendon ruptures. Several techniques are used for treating quadriceps tendon rupture: direct repair, transosseus repair, suture anchor repair, and autologous tendon reinforcement.

Since the first report of a quadriceps tendon rupture associated with hyperparathyroidism and chronic kidney disease by Preston and Adicoff in 1962,[23] the transosseous suture technique has been the most used treatment for the disorder, As the majority of quadriceps injuries in this group of individuals occur at the tendon insertion, there is no distal stump for the direct suture to be safely performed. The preferred procedure to circumvent this difficulty has been to reinsert the tendon at the upper pole of the patella. In the transosseous suture technique, resistant, non-absorbable sutures are initially braided in the proximal stump of the tendon. This step can be completed according to the surgeon’s preference, but the Krackow type of suture has been the most used procedure.

Longitudinal drill holes are made in the patella, allowing the suture ends to be passed distally and tied with the necessary tension to bring the stump closer to its insertion point. To promote healing of the tendon-bone junction, old ruptures or those associated with tissue degeneration may require additional reinforcement as previously described for the direct repair technique.[7]

Table 1. Previous cases of quadriceps and patellar tendon ruptures in chronic kidney disease patients

No	Study	Year	Case	Contents
1	Damir Matokovic, et al.[9]	2010	1	Spontaneous concurrent bilateral rupture of the quadriceps tendons in a patient with chronic renal failure
2	Yong Hwan Kim, et al.[10]	2006	1	Spontaneous and simultaneous rupture of both quadriceps' tendons in a patient with chronic renal failure
3	Chris H. L. Lim, et al.[11]	2016	1	Simultaneous bilateral quadriceps tendon ruptures in a patient with chronic renal insufficiency
4	Weiqian Wu, et al.[5]	2019	1	Simultaneous spontaneous bilateral quadriceps tendon rupture with secondary hyper-parathyroidism in a patient receiving hemodialysis
5	Maofeng Gao, et al.[12]	2013	1	Simultaneous bilateral quadriceps tendon rupture in a patient with hyperparathyroidism undergoing long-term hemodialysis
6	Nisar A Wani, et al.[13]	2011	1	Simultaneous bilateral quadriceps tendon rupture in a patient with hyperparathyroidism undergoing long-term hemodialysis
7	Jin Hee Park, et al.[14]	2013	2	Spontaneous and serial rupture of both Achilles tendons associated with secondary hyperparathyroidism in a patient receiving long- term hemodialysis
8	Chusheng Seng, et al.[15]	2015	2	Spontaneous disruption of the knee extensor: the first patient had connective tissue disease and long- term steroid use, and the second patient had endstage renal failure with tertiary hyperparathyroidism and was on hemodialysis
9	Adnan Kara, et al.[16]	2013	1	Osteotendinous repair of bilateral spontaneous quadriceps tendon ruptures with the Krackow technique in two patients with chronic renal failure.
10	Byung Soo Kim, et al.[17]	2012	1	Simultaneous bilateral quadriceps tendon rupture in a patient with chronic renal failure
11	Yunseok Lee, et al.[18]	2011	1	Simultaneous bilateral quadriceps tendon rupture in a patient with chronic renal failure
12	Giuseppe Grecomoro, et al.[19]	2008	1	A 48-year-old man with chronic, spontaneous and simultaneous quadriceps and contra-lateral patellar tendon rupture
13	Cemil Kayali, et al.[20]	2008	1	Simultaneous bilateral quadriceps tendon rupture in a patient on chronic haemodialysis
14	Martin Rysavy, et al.[21]	2005	1	Spontaneous and simultaneous quadriceps and patella tendon rupture in a patient on chronic hemodialysis
15	Hasan Hilmi Muratli, et al.[22]	2005	1	Simultaneous rupture of the quadriceps tendon and contralateral patellar tendon in a patient with chronic renal failure

CONCLUSION

Spontaneous quadriceps rupture is a rare condition many chronic diseases can cause. Proper medication and surgery should be performed early. However, successful results have been reported in chronic cases with surgery performed as late as 1 year after injury.

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