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Spontaneous Quadriceps Tendinopathy Management and Prevention: A Case Report

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ABSTRACT

Introduction: Quadriceps tendon rupture is a rare injury that significantly impairs knee function, especially in patients with chronic kidney disease (CKD). This case report highlights the diagnostic and management challenges of spontaneous quadriceps tendon rupture in a patient with chronic kidney disease, considering systemic disease effects on injury risk and healing. It underscores the need for a multidisciplinary approach and timely surgical intervention to restore knee function and prevent complications like muscle weakness. ***Case Presentation:*** A 54-year-old male with stage V chronic kidney disease undergoing hemodialysis presented with spontaneous total rupture of the left quadriceps' tendon. The patient reported persistent pain, swelling, and inability to actively lift the left leg. MRI examination confirmed a complete quadriceps tendon rupture, moderate joint effusion, and soft tissue edema. The patient underwent arthrotomy and tendon repair using the transosseous tunnel technique, followed by structured rehabilitation. The outcome shows improvement in improvement in pain and mobilization. ***Discussion:*** Spontaneous total rupture quadriceps tendon is a rare but serious complication in patients with chronic kidney disease (CKD), particularly those undergoing hemodialysis. This condition is associated with systemic factors such as secondary hyperparathyroidism, uremic toxin accumulation, and β2-amyloidosis, which weaken tendon integrity and increase rupture risk. Early diagnosis using MRI and timely surgical repair are crucial for restoring knee function. Prevention focuses on controlling secondary hyperparathyroidism, optimizing CKD management, ensuring proper nutrition, and implementing muscle strengthening and fall prevention programs. ***Conclusion:*** Quadriceps tendon rupture in patients with CKD on hemodialysis is rare but significantly impairs knee function. Timely surgical repair with arthrotomy and trans, combined with structured rehabilitation, can lead to good functional recovery, as seen in this patient's improved knee flexion and active leg lifting. A multidisciplinary approach is essential for optimal management.

Keywords: spontaneous quadriceps tendon rupture; chronic kidney disease; arthrotomy; transosseous tunnel repair.

INTRODUCTION

The knee extensor mechanism, which includes the quadriceps femoris muscle, quadriceps tendon, patella, and patellar tendon, is essential for walking and maintaining stability of the knee joint. The quadriceps tendon, as the proximal component of this system, transmits force generated by quadriceps muscle contraction to facilitate knee extension [1], [2]. Although relatively uncommon, quadriceps tendon rupture significantly impacts knee biomechanics [1], [3].

The incidence is estimated at approximately 1.37 cases per 100,000 individuals annually. This injury predominantly affects individuals over 40 years of age and is rarely observed in the absence of underlying comorbidities. Established risk factors include rheumatoid arthritis, systemic lupus erythematosus, gout, chronic kidney disease (CKD), secondary hyperparathyroidism, diabetes mellitus, and peripheral vascular disease [4].

CKD is characterized by persistent structural or functional kidney abnormalities lasting at least three months, with significant health consequences [5]. Patients undergoing maintenance hemodialysis for CKD are predisposed to various systemic complications, including cardiovascular and musculoskeletal disorders, often related to secondary hyperparathyroidism [5], [6]. Alterations in bone metabolism, mineral homeostasis, and cardiovascular function are common in this population. These changes result in hypocalcemia and hyperphosphatemia, stimulating parathyroid gland hyperactivity, which promotes excessive calcium resorption from bone. Consequently, structural modifications occur at the enthesis, predisposing to avulsion injuries at tendon insertions [5], [7], [8].

The objective of this report is to underscore the diagnostic and therapeutic challenges associated with spontaneous total rupture quadriceps tendon in CKD patients, considering the systemic disease's impact on injury susceptibility and healing capacity. This case report highlights the diagnostic and management challenges of spontaneous quadriceps tendon rupture in a patient with chronic kidney disease, considering systemic disease effects on injury risk and healing. It underscores the need for a multidisciplinary approach and timely surgical intervention to restore knee function and prevent complications like muscle weakness. By documenting this case, we aim to enhance clinical understanding of spontaneous quadriceps tendon rupture management within the CKD population.

CASE PRESENTATION

A 54-year-old male patient presented with persistent pain and swelling in the left knee lasting for two months. The pain was continuous and worsened with activity. Two months prior, the patient experienced a sudden fall while walking in his yard, landing on his knee. Following the incident, he was unable to actively lift his left leg. The patient has a medical history of stage V chronic kidney disease (CKD) undergoing hemodialysis, hypertension, and cardiac disease, and is on regular medication. He is currently unemployed and has no known drug allergies. Physical examination revealed edema of the left lower limb, a palpable defect in the left suprapatellar region, and an absent extensor mechanism.

Initial radiographs of the left knee showed no abnormalities (Figure 1). Subsequently, magnetic resonance imaging (MRI) was performed, revealing a complete rupture of the quadriceps tendon, joint effusion, soft tissue edema, and scarring (Figure 2). Surgical intervention was planned, consisting of arthrotomy and transosseous tunnel repair of the ruptured quadriceps tendon (Figure 3).

Postoperatively, the patient was instructed to avoid weight-bearing and knee flexion. Weekly follow-up appointments were scheduled at the Orthopedic Outpatient Clinic of Wangaya Hospital, Denpasar. During these weekly visits, rehabilitation focused on restoring lower-limb mobility. In the first week, wound care was administered, followed by gradual adjustments to the knee joint's range of motion in the subsequent weeks. At the fourth week, the patient achieved 90 degrees of knee flexion and was able to perform active leg elevation (Figure 4).

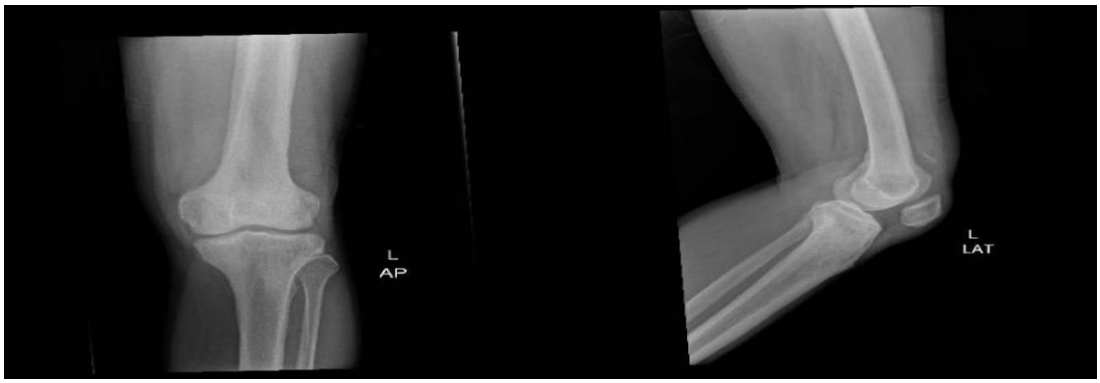

FIGURE 1: Patient's Left Knee X Ray in Anteroposterior and Lateral View.

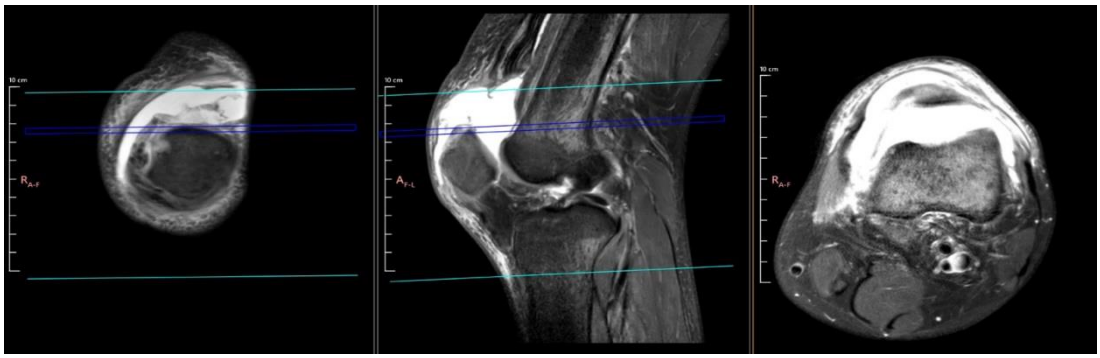

FIGURE 2: MRI result showed Total Tear Quadriceps Tendon, Moderate Joint Effusion and Soft tissue edema, and scarring.

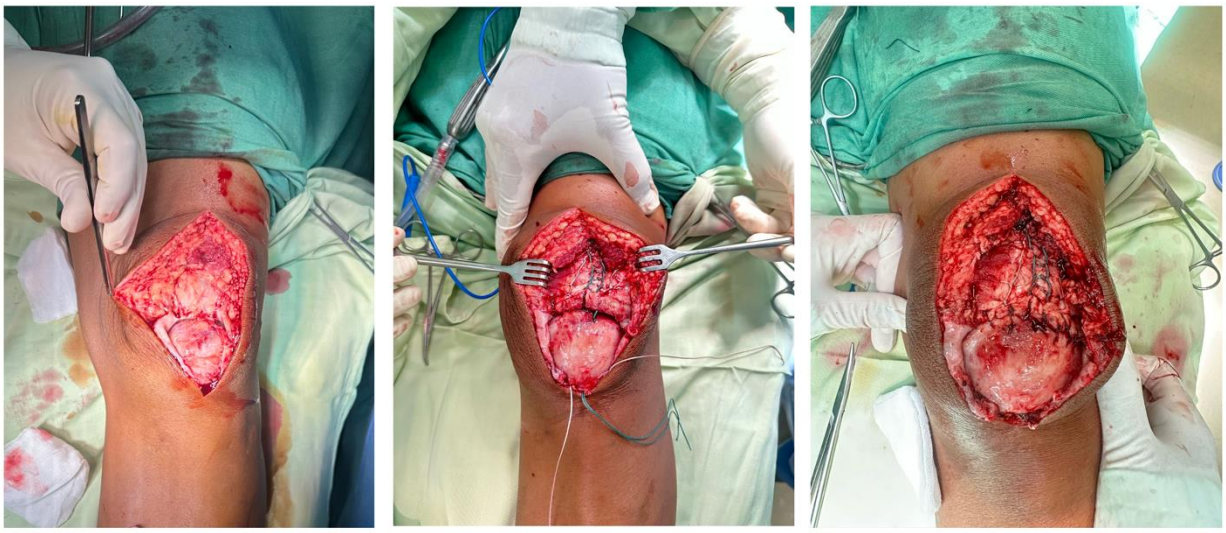

FIGURE 3: Intraoperative Left Arthrotomy and Repair Quadriceps Tendon Procedure.

FIGURE 4: Follow Up 4 Weeks after the surgery, the Patient demonstrates approximately 90 degrees of knee flexion and an active straight leg raise with full knee extension in a side-lying position.

DISCUSSION

Spontaneous total rupture quadriceps tendon is a rare but serious complication in patients with chronic kidney disease (CKD), particularly those undergoing hemodialysis. As a load-bearing tendon, alongside the patellar and Achilles tendons, the quadriceps tendon is more predisposed to rupture [9].

The clinical presentation typically includes a local inflammatory response, the formation of a tendon gap, and deficits in knee extension capability. The majority of quadriceps tendon ruptures occur in older males, with a mean age of approximately 60 years. Risk factors for extensor tendon rupture include both systemic and local factors. Systemic factors involve obesity, diabetes mellitus, hyperparathyroidism, and chronic kidney disease (CKD). Local factors involve direct trauma, repetitive microtrauma, and degenerative changes in the tendon tissue due to overuse [3]. Comorbidities such as CKD and its associated dialysis have a strong association with quadriceps tendon rupture, as demonstrated in this case [10].

Additional mechanisms contributing to quadriceps tendon rupture in CKD patients include elevated uremic toxins that impair collagen integrity, hemodynamic changes reducing blood flow to the joint, β2-amyloidosis weakening tendon structure, inflammation, and nutritional deficiencies that compromise the natural repair of repetitive microtrauma [8], [10], [11].

In patients with CKD on hemodialysis, the quadriceps tendon shows several changes including increased tendon thickness, calcific deposits, abnormal peritendinous tissue, and structural changes. These changes are more frequent in older patients and those with longer durations of dialysis. Elevated levels of calcium, phosphate, and the calcium-phosphate product are strongly associated with these tendon abnormalities. The underlying pathophysiology is attributed to the degeneration of tenocytes and collagen fibers together with the buildup of lipids, extracellular matrix components like glycosaminoglycans, and calcium deposits, these

changes can happen separately or simultaneously and are often associated with modifications in the blood vessels that supplying tendon or its surrounding paratenon [12].

Imaging evaluation for quadriceps tendon rupture is performed after clinical suspicion arises from local inflammatory signs, palpable tendon gap, and limited extension function. Magnetic resonance imaging (MRI) offers the highest sensitivity and specificity among available modalities, although plain radiographs can assist in assessing patellar position and excluding differential diagnoses [13]. In cases of complete rupture, such as this one, prompt surgical intervention is required. The most commonly employed procedure is transosseous suture repair through longitudinal drill holes in the patella. In this case, a transosseous tunnel technique was utilized. Early mobilization with full weight-bearing and progressive range of motion exercises are recommended during postoperative rehabilitation [4], [10].

Preventive strategies for tendon rupture in patients with CKD focus on optimizing the management of CKD to reduce uremic toxicity, which in turn helps prevent tendon damage. [10]. Adequate nutritional support, particularly protein and vitamin D supplementation, is also advised to mitigate mineral and bone metabolism disorders [5]. Patient education focusing on muscle strengthening exercises, strategies for fall prevention, and abstaining from smoking is important to decrease the risk of tendon injuries, particularly in the quadriceps tendon [10], [14].

CONCLUSION

Quadriceps tendon rupture in patients with CKD on hemodialysis is a rare but significant condition that adversely affects knee function and quality of life. This case highlights the increased risk of tendon rupture in CKD patients due to mineral metabolism disturbances, secondary hyperparathyroidism, and tissue integrity impairment caused by uremia. Accurate diagnosis through clinical evaluation and imaging, particularly magnetic resonance imaging (MRI), is crucial to confirming complete quadriceps tendon rupture. Surgical intervention using arthrotomy and transosseous tunnel techniques, followed by structured rehabilitation, has proven effective in restoring knee function, as seen in this patient's improved knee flexion and active leg lifting by the fourth postoperative week.

This case underscores the importance of a multidisciplinary approach involving orthopedics, nephrology, and physical medicine and rehabilitation in managing patients with complex comorbidities. Preventing similar injuries in CKD patients requires optimal management of systemic risk factors, such as controlling hyperparathyroidism and improving nutritional status. Documentation of this case aims to raise clinical awareness regarding the diagnostic and therapeutic challenges of quadriceps tendon rupture in the CKD population.

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