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Case Report

Musculoskeletal ultrasound as a diagnostic tool in quadriceps tendon rupture

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ABSTRACT

Quadriceps tendon ruptures are relatively rare injuries, particularly in young adults, and their diagnosis can be challenging. This case report presents a case of traumatic quadriceps tendon rupture in a young adult and highlights the use of ultrasound Imaging as a diagnostic tool. Quadriceps rupture is uncommon in young adults in contrast to patellar tendon rupture but in this case young patient presented with acute knee pain and an inability to extend the leg after a sudden H/o fall, leading to a loss of continuity between the quadriceps muscle and the patella. Musculoskeletal Ultrasound examination revealed a complete tear of the quadriceps tendon, confirming the diagnosis. The patient underwent surgical repair and achieved a favorable outcome with appropriate rehabilitation. This case report emphasizes the importance of considering quadriceps tendon rupture in the differential diagnosis of acute knee injuries and highlights the value of ultrasound in making an accurate and timely diagnosis.

Keywords: Quadriceps tendon rupture, Musculoskeletal diagnostic ultrasound, Young adult

INTRODUCTION

Among injuries to the knee, quadriceps femoris tendon tears are relatively uncommon but disabling condition with a reported incidence of complete rupture of 1.37 per 100,000 per year.[1] Early diagnosis and treatment helps in improved Functional outcomes for quadriceps tendon rupture, thereby avoiding tendon retraction and quadriceps atrophy that may occur with delayed repair.[2,3]

History of sudden fall followed by inability to walk and clinical examination are sometimes sufficient to confirm diagnosis of quadriceps tendon rupture but in cases of quadriceps tear, injury can encompass a range of severity from partial to complete damage.

Musculoskeltal ultrasound is well suited to evaluate extensor mechanism of knee because tendons are large and superficial. It plays key role in diagnosing several key features of quadriceps tendon like tendon integrity, torn ends of tendon, hematoma formation and associated muscle atrophy in chronic tear. In addition to this dynamic assessment and comparison with contralateral side adds further value in diagnosing these conditions.

CASE REPORT

A 23 year male presents with right knee pain and inability to walk after 2 months of injury. He had a history of fall on uneven ground followed by pain and swelling and inability to ambulate. He had treatment at some local hospital and now admitted with pain and inability to walk. On examination there was a visible defect just above patella with extensor weakness. The lateral radiograph of the knee showed that the left patella has dislocated around its horizontal axis and its articular surface is facing inferiorly. The upper pole of the patella is engaged in the intercondylar groove of the femur.

Diagnostic evaluation

Considering the mechanism of injury and clinical findings, a quadriceps tendon rupture was suspected. To confirm the

diagnosis, an ultrasound examination of the knee joint was performed.

Bed side ultrasound in emergency department demonstrated a large anechoic defect with proximal retraction of tendon was observed. Rectus femoris tendon was replaced by fibrous tissue on longitudinal scanning. Transverse scanning also confirmed anechoic defect. The contralateral knee was used as a reference for comparison. Magnetic resonance imaging (MRI) scan reported complete tear of quadriceps tendon with retraction of fibers of 3.3 cm.

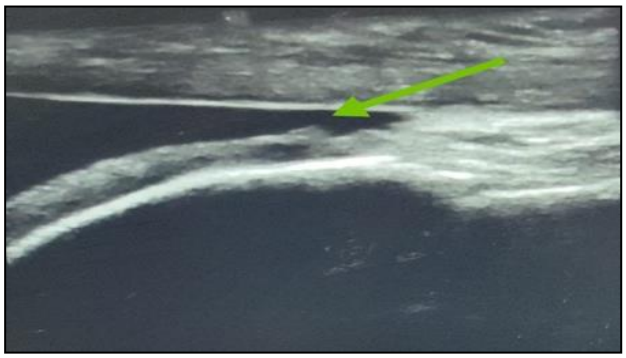

Figure 1: Proximal longitudinal scanning of suprapatellar region showing anechoic defect due to quadriceps tendon rupture.

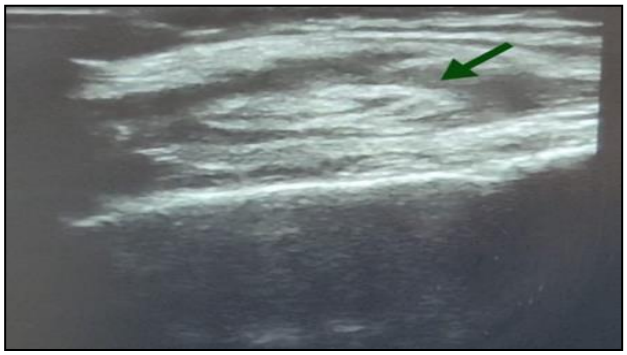

Figure 2: Proximal transverse scan of suprapatellar region showing anechoic defect.

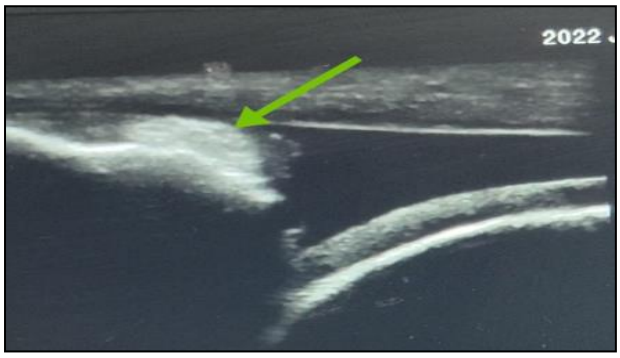

Figure 3: Distal longitudinal scan of quadriceps rupture.

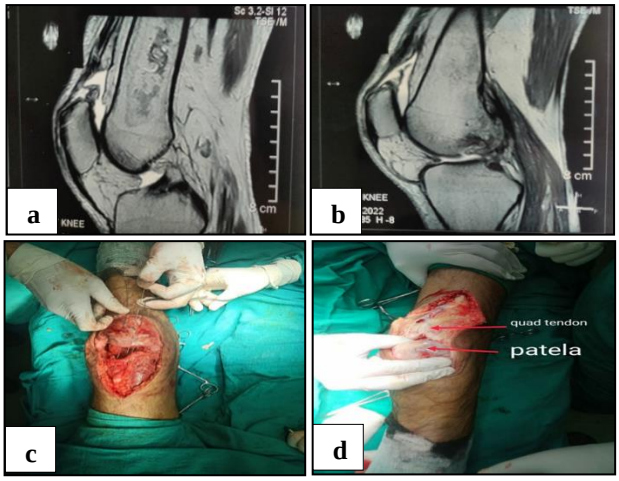

Figure 4: (a and b) Sagittal scan of knee showing complete tear of quadriceps tendon; (c and d): surgical repair of quadriceps tendon.

Treatment and outcome

The patient was scheduled for surgical repair of the quadriceps tendon rupture. Under spinal anesthesia, the tendon ends were identified and meticulously debrided. The quadriceps tendon was then repaired using non-absorbable sutures through transosseous tunnels. Postoperatively, the patient underwent a comprehensive rehabilitation program that included range of motion exercises, progressive strengthening, and gait training. The patient achieved excellent functional recovery and returned to his pre-injury activity level within six months.

DISCUSSION

The quadriceps tendon is derived from the muscular junction of the rectus femoris, vastus lateralis, vastus medialis, and vastus intermedius muscles at the anterior superior pole of the patella. A rupture of this central tendon drastically hinders knee extension and hence affects functionality. Minor tendon tears may have minimal impact on extensor function, while complete tendon tears may totally impede lower leg extension.[4-6]

Quadriceps tendon ruptures have a positive correlation with age and multiple medical comorbidities. This injury historically is more prevalent in males with a male-to-female ratio of 8:1. The susceptibility increases proportionally with age after 40 years.

Certain medical conditions pose a higher risk for quadriceps tendon ruptures, such as diabetes mellitus, hyperparathyroidism, gout, chronic kidney disease, obesity, and hypercholesterolemia, in addition to multiple connective tissue disorders, rheumatoid arthritis, systemic lupus erythematosus, and osteogenesis imperfect. Other risk factors involve medications such as anabolic steroids, corticosteroids, and fluoroquinolones.[7] Intra-articular

injections carry a 20 to 33% risk of quadriceps tendon rupture.

Pathophysiology

Quadriceps tendon ruptures are due to violent eccentric loading of the knee extensor mechanism as a direct result of a sudden and strong contraction of the quadriceps muscle from a jump and land mechanism or a sudden change in direction while running, or attempting to regain balance to avoid a fall.[8] Most quadriceps tendon ruptures occur at the myotendinous junction, with patellar tendon ruptures occurring most commonly within the tendon itself.

The quadriceps tendon has been subdivided into three zones based on the distance from the superior pole of the patella.[10] With zone 2 being the most commonly involved - zone 1: 0 to 1 cm, zone 2: 1 to 2 cm, and zone 3: is located >2 cm from the superior pole of the patella.[11] Zone 2 as seen in our patient, has been reported to be a hypovascular zone and correlates with the spontaneous ruptures of the quadriceps tendon reported in the literature.[10]

Plain radiographs are rarely sufficient to make the definitive diagnosis. MRI can be considered as the gold standard imaging modality; however, it rarely provides additional information that would change management. It is expensive, time consuming, and often unavailable in the ED.

Quadriceps tendon ruptures are typically diagnosed based on clinical presentation and physical examination findings. However, in cases where the diagnosis is uncertain or to evaluate the extent of the injury, ultrasound can be a valuable diagnostic tool. Ultrasound provides real-time imaging and allows for dynamic assessment of the quadriceps tendon, aiding in the accurate diagnosis of tendon rupture, evaluation of retraction, and associated injuries, such as patellar displacement. Infact dynamic imaging during evaluation of quadriceps tendon is often helpful in diagnosis of full thickness tear because of lack of tendon movement across the abnormal segment or movement of tendon stump away from patella indicates complete tear. It is a cost-effective and non-invasive modality that can be performed at the bedside, making it particularly useful in the acute setting.

Bedside ultrasound is a rapid, noninvasive, and inexpensive diagnostic modality without any contraindications. A study by Bianchi et al showed ultrasound is a highly sensitive and specific modality of tendon assessment.[12,14] Ultrasound can delineate the location of the tear as well as help differentiate complete from partial tears.[12,13]

In this way by doing bedside ultrasound examination, we can assess about tendon integrity if complete tear or partial and in cases of complete tear retracted ends can be assessed. Dynamic assessment and contralateral comparison are exclusive features of ultrasound scanning.

CONCLUSION

Point-of-care ultrasound should be looked upon as the initial modality to make this diagnosis. At a time when health care costs continue to rise and health care resources are limited, ultrasound is an excellent modality choice for the bedside clinician. It can be done both rapidly, at the bedside, and in conjunction with the initial clinical evaluation, thus not delaying the diagnosis.

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