



Case report

Considerations in spontaneous quadriceps tendon rupture repair in end-stage renal disease patients: A case report[☆]

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ABSTRACT

Introduction: Spontaneous quadriceps tendon rupture (SQTR) is a rare injury to the knee extensor mechanism that is usually associated with systemic diseases such as end stage renal diseases (ESRD) and it is more prevalent in the elderly. Due to the underlying pathology, quadriceps tendon rupture warrants special considerations and management in its repair.

Case report: We present two cases of quadriceps tendon rupture in end-stage renal disease (ESRD) patients. The first case; a 57 years old female who had bilateral SQTR and is undergoing hemodialysis. The second patient, a 26 years old male had unilateral quadriceps tendon rupture caused by minimal trauma.

The first patient had a trans-osseous repair by direct suturing the quadriceps tendon stump to the proximal pole patella. The second patient was repaired with a modified Bunnel suture and anchor placement on the proximal pole patella. The first case had a re-rupture of the right quadriceps tendon and the second case has recovered with improved outcomes.

Discussion: Spontaneous quadriceps tendon rupture is usually underlined by degenerative changes of the tendons. Special care is needed to address the pathologic tendon underlying SQTR. The current surgical literature still lacks the statistical data that shows which surgical approach is most optimal for SQTR in ESRD patients.

Conclusion: SQTR rupture is generally an injury of brittle tendons caused by underlying diseases. A multidisciplinary and comprehensive approach including a proper surgical approach and postoperative managements are crucial for good functional outcomes of the extensor mechanism.

1. Introduction

The quadriceps muscles are the main extensor of the knee and act as a patellar stabilizer along with the patellar ligament [1]. It is a rare injury more commonly affecting men [2]. Spontaneous Quadriceps tendon rupture (SQTR) usually happens in the degenerative tendons of patients caused by systemic diseases such as end-stage renal disease (ESRD), rheumatoid arthritis, diabetes mellitus, gout, autoimmune disease, and long-term steroid use.

In a review by Neubauer, out of 28 patients with SQTR; 12 of them are associated with ESRD and obesity. SQTR is also prevalent in the elderly. An epidemiological study by Aleksy Reito states that by 2013,

patients above 60 years old have more than thrice the incidence of SQTR compared with patients below 40 years [3].

We present two cases of spontaneous and minimal trauma quadriceps rupture underlying by degenerative processes. These brittle tendons are attributed to several underlying pathologies associated with ESRD such as disturbed hormones, homeostasis, and toxin accumulation. There are important factors in the pathogenesis of SQTR such as long-term hemodialysis, insufficient dialysis, secondary hyperparathyroidism, β -2 micro-globulin associated amyloidosis, chronic acidosis, osteoporotic bone, and disturbed vascularization of the damaged area. It is not the same as a 'normal' traumatic tendon rupture. It will need special considerations in its management [4].

[☆] Our work has been reported in accordance with the SCARE 2020 Criteria: Agha RA, Franchi T, Sohrabi C, Mathew G, for the SCARE Group. The SCARE 2020 Guideline: Updating Consensus Surgical CAse REport (SCARE) Guidelines, International Journal of Surgery 2020; 84:226–230 [16].

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2. Case 1

A 57-year-old diabetic nephropathy female, on hemodialysis (HD) for the last 6 years was brought to our hospital after a spontaneous fall and inability to walk. She reported pain and showed a bilateral palpable defect in the quadriceps tendon and inferior displacement of the patella. There was extension lag on both knees. The x-ray showed calcification deposits around the quadriceps tendon with inferior displacement of the patella. The diagnosis was confirmed with an ultrasound. Laboratory showed high intact parathyroid hormone (1848 pg/ml), alkaline phosphatase (487 u/l), phosphate (6,4 mg/dl), calcium (10.4 mg/dl), and beta 2 micro-globulin (54.4 mg/l). The ESRD was managed by our internal medicine department.

Surgical repairs were done by an orthopaedic consultant. A transosseous repair by direct suturing the tendon stump to proximal patella pole with double PDS 0, placed in 4 points fixations distanced 1 cm side by side was done. Followed by closing the medial and lateral paratenon defects with Vicryl 0. Both knees were protected with long leg casting for 4 weeks with total bed rest. Gradual weight-bearing using a walker was advised after 4 weeks with both legs protected in a post-op knee extension brace. Physiotherapy was prescribed with specific instruction in keeping the knee extended.

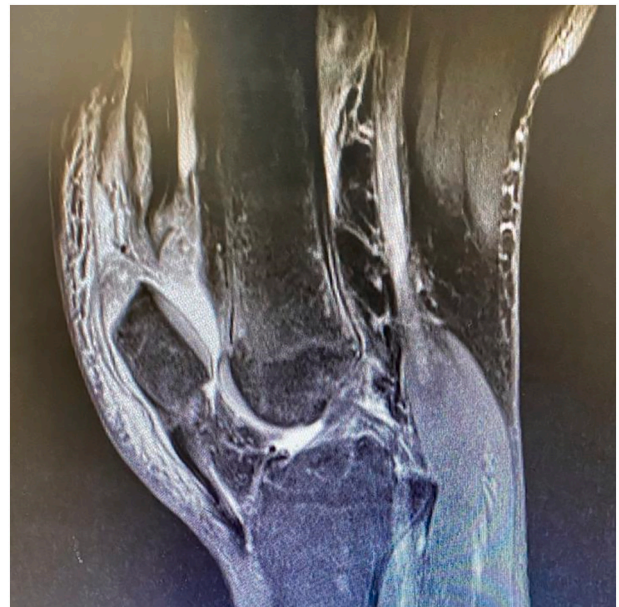
Routine follow-up was advised for the patient, but the patient failed to comply for routine check-ups. Two months after surgery, after the post-op knee extension brace was taken off she complained of painless "clicking" in the right knee while walking. The left knee was perfect. The range of motion in both knees was good with full extension and 135-degree flexion. Six months after the first onset of "clicking", the quadriceps patellar gap was noted with an extension lag in the right knee which suggests re-rupture of the quadriceps tendon. The patient was still able to walk using a knee brace in the right knee. The patient refused to re-repair the right quadriceps tendon and decided to accept the condition.

The patient was managed by our internal medicine department for therapy of ESRD. Due to the end-stage of the disease, the patient died 2 years after the surgery.

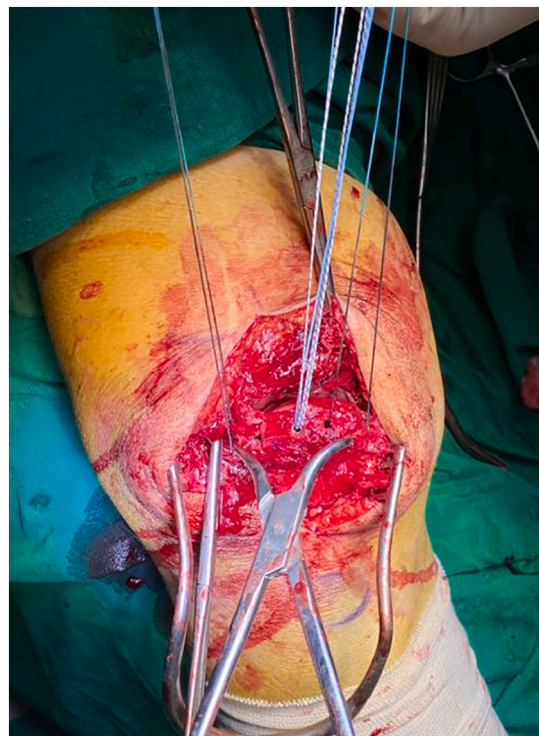
3. Case 2

A 26-year-old male with ESRD due to autoimmune glomerulonephritis on continuous ambulatory peritoneal dialysis (CAPD) for 7 years came to our hospital after a scooter accident. Physical examination showed hematoma and a positive ballottement test of the right knee. Laboratory examination showed increase levels of iPTH, urea (133 mg/dl), creatinine (15,79 mg/dl), phosphate (7,40 mg/dl), and calcium (7,5 mg/dl). His x-ray showed a displaced right patella with suspicion of an avulsion rupture of the quadriceps tendon. MRI of the right knee confirmed a sub-total rupture of the quadriceps tendon with subluxation of the patella (Picture 1). Laboratory parameters and ESRD were controlled by the internal medicine department.

Complete rupture at the insertion site of the tendon on the superior pole of the patella was repaired transosseous using a modified Bunnel technique. Triple Loaded Fiber Suture 5.5 mm PEEK Anchor was used as an internal augment, placed in the middle of the top of the patella. Two vertical holes were drilled with a 2,5 mm drill bit from the superior to the inferior direction in the medial and lateral part of the patella. Connecting bone surfaces were scraped to produce a rough surface. The central fiber suture is used to directly tie the middle third of the tendon stump, while the two other sutures fixed the medial and lateral third of the stump after re-routing one limb of the sutures through the vertical tunnel on each side. Complete fixation of the quadriceps was finished in 3 sutures using a modified Bunnel technique. The suture was supplemented with overriding stitches. The right knee was immobilized with above-knee long leg casting for 6 weeks, followed by a post-op knee extension brace for another 4 weeks (Picture 2, Diagrams 1 and 2).



Picture 1. MRI of the right knee.



Picture 2. Single anchor technique.

4. Discussion

Spontaneous quadriceps tendon rupture is usually underlined by degenerative changes of the tendons. The pathologies vary, but especially for patients with chronic renal failure as in ESRD; there are five main factors: (1) elastin deposition in the tendon due to chronic acidosis; (2) chronic uremic toxin exposure; (3) beta-2 microglobulin amyloidosis; (4) secondary hyperparathyroidism causing increased osteoclastic cortical bone resorption; (5) calcium deposition in tendon elicited by the increase in circulating calcium level. Most of the recent reports point out that secondary hyperparathyroidism was the leading cause of

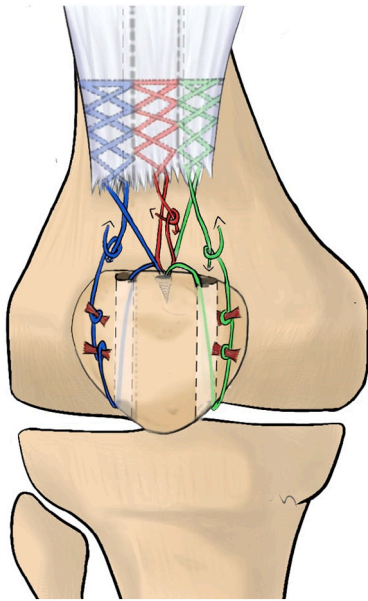


Diagram 1. Operation technique.

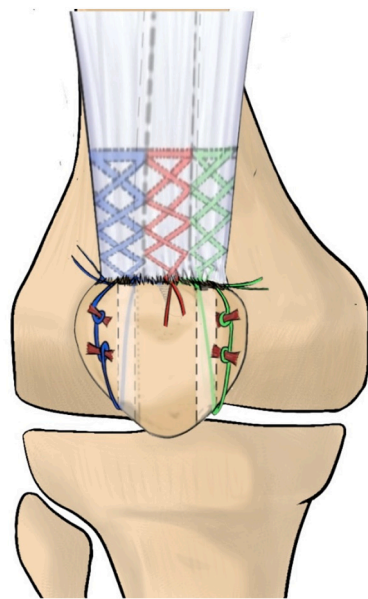


Diagram 2. Operation technique.

spontaneous bilateral quadriceps tendon rupture [1–6].

High calcium levels, uncontrolled iPTH, urea, and beta-amyloid are the main contributing factors for the brittle tendons needing dialysis [1,2,6]. Insufficient dialysis may lead to SQTR and other complications, which is why proper dialysis therapy must be prescribed by the internal medicine department. It is also worth noting that a new hemodialysis machine can filter out beta-2 micro-globulin to avoid amyloid degenerations [7]. The difference in the type of dialysis may also be a factor that can predispose to tendon frailty [8].

The surgery for a ruptured quadriceps tendon must include mechanical considerations such as using a secure and durable suturing technique combined with an internal augmentation of the repair if needed. The added internal augmentation is meant to reduce the tension in the brittle repair side of pathologic tendons. Internal augmentation can be done through various methods such as nylon-suture, tendon graft, tendon flap, or synthetic material such as dacron graft [10].

In our second case, the repair was done with a modified bunnel suture with a Triple loaded Fiber Suture 5.5 mm PEEK Anchor suture on a pre-scraped bone surface was used to add strength and stability to the repair [7–9]. Single anchor usage was done with regards to efficiency in the limited resources that are available. Additionally, the paratenon was re-sutured to enhanced blood flow and promote healing of the tendons.

We apply a post-operative long leg knee extension casting followed by a knee brace as a part of the rehabilitation procedure for both patients. Although some authors promote early functional rehabilitation with early passive flexion and weight-bearing, there is still no sufficient evidence for SQTR cases in ESRD [11].

We have yet to find a literature source that presents statistical data which shows the most appropriate surgical approach for SQTR in ESRD patients. But Neubauer, et al reported an end-to-end repair of tendon in 3 cases of SQTR in obese patients without underlying ESRD with good results [11]. While Hasan, et al. reported a repair technique with 3 metallic anchor and an internal cerclage wiring for a case of SQTR in an ESRD patient [12].

Additionally, biological enhancements for tendon healing with stem cells, platelet-rich plasma, or local recombinant PTH injection might be worth looking into [13–15]. We did not add any biological enhancement due to the limited resources available in our facility.

5. Conclusion

Spontaneous quadriceps tendon rupture is generally underlined by degenerative processes of tendons and so, a multi-disciplinary approach, and a proper surgical approach and post-operative care is crucial for good functional outcomes of the extensor mechanism. More researches are still needed to determine the best approach for SQTR in patients with ESRD.

Provenance and peer review

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Ethical approval

Approval to publish case report is waived by the institution.

Consent

Written consent was obtained from the patient for publication of this case report and accompanying images.

A copy of written consent is available for review by Editor-in-Chief of this journal on request.

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Franky Hartono, Orthopaedic surgeon: Manuscript design and writing, literature review and data collection.

Daniel Petrus Marpaung, Orthopaedic surgeon: the literature review.

Karina Besinga, Orthopaedic surgeon: the literature review.

Tessi Ananditya: Manuscript writing.

Nicholas Gabriel H.R: Manuscript design, writing and data collection.

Guarantor

Franky Hartono, Orthopaedic surgeon.

Registration of research studies

This is not a “First in Man” study.

Declaration of competing interest

No conflict of interest.

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