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Case Report

### Reconstruction of Neglected Ruptured Patellar Tendon Using Ipsilateral Semitendinosus Tendon and a Turndown Quadriceps Tendon Flap

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#### Abstract

Neglected rupture of the patellar tendon is a rare, can be easily missed in a group of patients. The most common rupture sites are the inferior pole of patella and distal insertion; ruptures at the midsubstance are very rare. Extensor mechanism adhesions and scar tissue formation makes the treatment more difficult than acute tendon rupture. Different techniques have been described for reconstruction of this uncommon problem that includes use of autografts, allografts and synthetic materials. We report the case of patient with neglected patellar tendon rupture treated by primary repair augmented by semitendinosus tendon graft, we used a turndown quadriceps tendon flap as a protective technique which allowed for early rehabilitation and did not require a second intervention to remove implanted material. The patient reacquired near normal strength and stability of the patellar tendon and restoration of function after operation and rehabilitation.

**Keywords:** Knee; Patellar Tendon; Rupture; Semitendinosus; Quadriceps Tendon

#### Introduction

Patellar tendon ruptures usually caused by an indirect mechanism are infrequent injuries that severely disable the extensor mechanism of the knee [1]. The true incidence of patellar tendon rupture is not known. It usually occurs near the inferior pole of patella in individuals younger than 40 years due to sporting activities [2-5]. Patients present late either due to neglect, native treatment or missed diagnosis. Neglected ruptures of the patellar tendon (defined as ruptures presenting after four weeks) are often difficult to repair [3,6] because of contracture, adhesion, atrophy, of the quadriceps muscle and proximal patellar migration [3,7,8]. Treatment goals include restoration of the extensor mechanism, both structurally and functionally, to allow

active knee extension [9]. Several methods of treatment for this difficult problem have been described, including primary repair with wires [10], sutures [11], as well as augmentations with autogenous tissue, such as a free fascia lata grafts [12,13], gracilis tendons [14], semitendinosus tendons [7] or gastrocnemius muscle flaps [15]. Multiple authors combine the reconstruction with wire cerclage or metalwork to reduce the load on the reconstructed tendon. This device allows for early rehabilitation, but requires a second intervention to remove the implanted material.

In this article we describe an improved surgical technique for reconstruction of the patellar tendon using primary repair augmented by semitendinosus tendon graft. We used a turndown quadriceps tendon flap as a protective technique.

## Case Report

The patient was a 24-year-old male carpenter, who routinely works on his knees and averages 3h/week of sports participation while playing soccer, he felt a buckling of his right leg when landing from a jump, followed by pain in the anterior aspect and functional disability, soon he noticed that his knee was swollen immensely. At the emergency ward, a total of 100 ml of sero-sanguinous fluid was aspirated, the knee X-ray was made and the patient was told that he had sustained a knee distorsion. The patient's knee was put in a cast immobilization for a month. Afterward, he started his physical therapy. Five weeks after the injury, the patient described experiencing weakness and being unable to lock his knee when going down stairs and had the impression that the patella was moving upward, especially when seated. Clinical evaluation confirmed this proximal migration along with an infrapatellar void. The passive range of motion of his right knee was normal; however, there was no active knee extension. Radiographs revealed high location of patella (figure 1). With all these clinical and radiographic findings, we diagnosed neglected patellar tendon rupture.



**Figure 1.** Photograph X ray showing Patella Alta

## Operative Technique

The patient is placed under spinal anesthesia and intravenous antibiotic prophylaxis is administered. He is positioned on the operating table in a supine position. After exsanguinating the limb and applying tourniquet ischemia, the knee is prepped and draped in the usual sterile fashion. An anterior midline skin incision was made from the proximal pole of the patella to approximately 6cm distal to the tuberosity. Full exposure of the patellar tendon revealed midsubstance rupture (figure 2). Owing to clear pattern of rupture ends without macroscopic signs of tendinopathy, gross inspection of patellar articular surface did not suggest any chondral lesion. A primary repair of the patellar tendon could be performed; after raising the flaps and debridement, the scar between the two tendon endings was removed until healthy tissue was encountered. The patellar tendon ends were then repaired at the correct length:



**Figure 2.** Intraoperative photograph showing rupture of the patellar tendon at the midsubstance with scar tissue

No.2 vicryl sutures were used to tie up the patellar tendon with the technique described by Krakow et al. [16], multiple end to end sutures were then put to further strengthen this repair (figure 3). Adjustment of tension within stitches was carefully monitored to avoid excessive tendon tension and shortening of infrapatellar length while still keeping the continuity of repair site. To ensure strong protection of the suture we used as a lateral reinforcement a semitendinosus autograft and as central reinforcement a turn-over flap of the quadriceps extension.



**Figure 3.** a primary repair of the patellar tendon could be performed after raising the flaps and debridement. No.2 vicryl sutures were used to tie up the patellar tendon with the technique described by Krakow et al [16].

First, the end of the semitendinosus tendon was exposed through a small incision over the surface of the pes anserinus. A tendon stripper was used to harvest the tendon without preservation of the tibial insertion, thereby obtaining a free graft of about 25 to 30 cm long. A horizontal tunnel with 4.5mm diameter, was drilled in a medial to lateral direction at the level of the tibial tubercle, the graft was passed through this tunnel in a medial to lateral direction equal length (figure 4). Both strands of the graft are tensioned proximally and sutured to both sides of the patellar tendon, each strand was then introduced, transversely, through the distal end of the quadriceps tendon along the proximal margin of the patella and sutured to them even in 30° of flexion.



**Figure 4.** a horizontal tunnel was drilled in a medial to lateral direction at the level of the tibial tubercle and the graft was passed through this tunnel

To obtain good patellar tendon continuity and solidify the assembly, the central portion of the suture was enhanced by a turning of the flap quadriceps tendon; the quadriceps expansion was folded over to a 1.5cm width 7cm long and sutured to the patellar tendon (figures 5,6). An intraoperative flexion of 90° could be attained easily, without tension. Standard post operative radiographs showed good restoration of the patellar height with a Caton Deschamps index of a 1.



**Figure 5.** The central portion of the suture was enhanced by a turning of the flap quadriceps tendon.



**Figure 6.** intraoperative photograph after repair of the patellar tendon and augmentation with a semitendinosus tendon and turndown quadriceps

Full weight bearing was allowed at day 1 and protected with an extension splint between physiotherapy sessions. The initial rehabilitation aimed at restoring passive range of motion up to 90° of flexion during the first 40 days; no active extension was allowed. Starting in week 6, the range of motion was gradually increased and quadriceps strengthening initiated (figure 7).



**Figure 7.** clinical photograph of the patient at 5month follow-up

At 5month follow-up, full flexion could be achieved and was comparable to the contra lateral side. Jogging was encouraged after 3 months. Sprinting and various competitive exercises were permitted 6 months after the operation and the patient was allowed to return to full sports activities, in a step- by- step manner, starting 8 months after the surgery.

## Discussion

Patellar tendon disruptions are relatively uncommon knee injuries compared to fractures, ligament sprains or meniscal tears [17], the true incidence of patellar tendon rupture is unknown, but it is the third common injury to the extensor mechanism, after patella fracture and quadriceps tendon rupture [18,19].The mechanism of injury is an eccentric overload to the extensor mechanism, with a planted foot and flexed

knee. Micro trauma from repetitive activity and degenerative tendinopathy have been proposed as pathophysiological factors behind patellar tendon rupture [20]. Then, many risk factors have been cited in the literature: steroid injections [21], jumper's knee [22,23], previous major knee surgery (e.g. anterior cruciate ligament reconstruction with central one-third patellar tendon autograft or total knee arthroplasty [24,25] and medical conditions resulting in weak collagen (e.g. rheumatoid arthritis, chronic renal failure) [26].

The diagnosis is not always made during the initial post injury phase. Even if the proper physical examination is performed, the acute tear is accompanied by substantial swelling and hematoma formation, which may make palpation of the tendon defect difficult, in addition intact medial and lateral retinaculae can make the patient able to extend knee actively, leading to neglected patellar tendon rupture [17]. Additional information from X-ray examination can show a patella alta, knee MRI can also be a useful, non-invasive and accurate tool for providing additional information such as the location of the rupture, the condition of tendon, and the appearance of the surrounding tissues [27], misdiagnosis of patellar tendon rupture can occur quite frequently, a series reviewed by Siwek and Rao [18], had a misdiagnosis rate of 28% and Rose and Frassica [28] reported that one eight ruptures cases had a delay in diagnosis.

Patellar tendon ruptures are also classified according to the site of damage [29,30]:

1. the insertions (the inferior patella pole, the tibial tubercle)
2. the substance of the tendon.

The first location is often termed the 'osteotendinous junction' [31], ruptures affecting this site are thought to be associated with the repetitive micro traumas found in patients with 'jumper's knee' [29,32]. It has also been suggested that ruptures of the midsubstance are associated with concomitant systemic disorders or steroid use [29]. However, since only 32% of patients with systemic disease had ruptures of the substance compared with 39% of patients (including our own) without systemic disease, our review of the literature could not confirm this association, although some reports do not specify the localization of the injury, the majority of patellar tendon ruptures occurred at the inferior patella pole, a literature review did not reveal any publications about midpart patellar tendon rupture as a closed injury (only in case with TKA) [33].

The treatment goals for ruptured patellar tendons include restoration of the quadriceps mechanism, restoration of the anatomic congruity of the patello femoral joint to avoid chondral lesions, improved range of motion and splinting of the patellar tendon to allow early mobilization. The neglected rupture of the patellar tendon is a rare occurrence, the treatment of which is a difficult challenge for orthopedic surgeons. Many reconstruction techniques have been proposed: synthetic materials [34,35], autograft using the

semitendinosus alone [36] or together with the gracilis [37] and the contra lateral patellar tendon [19,38] or allograft using the Achilles tendon [39, 40]. Use of a contralateral patellar tendon may result in additional damage to the injured leg, this technique is most useful when the remaining tendon stump is not adequate or in cases of surgical revision, whereas the use of synthetic materials and allografts increases the risk of bacterial or viral infection and neoplasia.

The results of direct suture repair of the neglected ruptured patellar tendon were discouraging, in a series of complications reported par Lynch et al [41], results in 04 cases of direct suture repair were re-ruptured tendon in two, deep infection in one, and extension lags of 18° and 22° in one. We performed reconstruction and restoration of ruptured patellar tendon using primary repair combined with autogenous graft augmentation using semitendinosus tendon and a turndown quadriceps tendon flap. We suggest that this modified technique has several advantages: first, semitendinosus tendon is rich in tendon fibers, which are stronger than those of the distal iliotibial tract or fascia lata, this robust autograft can restore the strength and stability of the extensor mechanism with minimal donor site morbidity [36,42]. As our case, Timo Jarvella et al. [9] used a semitendinosus graft for reconstruction of the patellar tendon, but the graft was free. They did not keep semitendinosus insertions and not make full use of the role provided by insertions. Second, by pulling tendon through tibial tunnel, the integration between tendon and bone is strengthened and stability is maximized after construction. Nyemb et al. [5] also described a reconstruction technique with a semitendinosus autograft that maintained its original. However, their technique required the formation of a horizontal tunnel in the patella; such a hole in the small patella promotes a risk of fracture [43]. The presently described technique does not require the formation of hole in the patella as each strand of the graft was introduced transversely through the distal end of the quadriceps tendon along the proximal margin of the patella and sutured to them. Even for additional stabilization, this technique is able to transmit the tension load from the patella directly to the tubercle tibia. Third, when the semitendinosus tendon was passed through the tunnel in the tibia tubercle medial to lateral, force is distributed on both sides of original patellar tendon, which allows for even transmission of tension.

Direct repair with augmentation with an autogenous semitendinosus tendon grafts has gained a higher successful result but with poor knee flexion because of prolonged immobilization [7], multiple authors combine the reconstruction with wire cerclage or metalwork to reduce the load on the reconstructed tendon. This device allows for early rehabilitation but requires a second intervention of remove the implanted material, we used a turn. over flap of the quadriceps extension as a protective technique recommended by Dejour et al [38] which allowed for 90° of flexion without tension and did not require a second intervention to remove implanted material. Our surgi-

cal technique of reconstruction of the ruptured patellar tendon using a turndown quadriceps tendon flap was derived from Scuderi who used a triangular turndown flap of the quadriceps tendon to reinforce and lengthen the rupture of the quadriceps tendon [44]. Because our case was ruptured patellar tendon, we created a longer quadriceps flap (7x1.5cm) rather than a triangular flap to cover the repaired tendon. In the current report, the patient started early rehabilitation, based on strong augmentation of the repaired tendon and protection of the repair by a turndown quadriceps tendon flap, which resulted in the quick recovery of the quadriceps power (06 weeks post operatively) because of strong reinforcement of the living tissue at the repaired tendon.

## Conclusion

Untreated patellar tendon ruptures result in severe disability in an active individual. Apparent advantages of our technique over other published techniques are reduced morbidity due to use of semitendinosus autograft, and no need of second surgery to remove materials used to protect the reconstructed tendon. The technique accomplished the preoperative goals for restoring quadriceps function and allowing early mobilization after surgery. Patient returned to playing soccer in his spare time without having any limitation.

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