Ligament augmentation reconstruction system artificial ligaments in patellar tendon reconstruction - a chronic patellar tendon rupture after multiple operations: A case report

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Abstract

BACKGROUND
Patellar tendon rupture is a rare disease, and reports regarding patellar tendon reconstruction with ligament augmentation reconstruction system (LARS) ligaments are limited, with only three reports available in the literature. LARS ligaments are made of polyethylene terephthalate and have been certified as a more favorable option than other tendon transplants. To our knowledge, this is the first report of patellar tendon reconstruction with LARS for suture fixation due to poor quality of the tendon after multiple operations to enable early mobilization and quick rehabilitation.

CASE SUMMARY
A 65-year-old woman had limited ability in extending her leg and an inability to perform a straight leg raise after multiple operations due to patella fracture. The patient underwent patellar tendon reconstruction with LARS artificial ligaments. After 12 mo of follow-up, the patient was able to perform a straight leg raise, and the incision healed well without complications. The Lysholm score was 95 and the range of motion of the knee was 0-130°.

CONCLUSION
This study revealed that patellar tendon reconstruction with LARS artificial ligaments is possible in a patient with a patellar tendon rupture who required rapid postoperative recovery.

Key words: Ligament augmentation reconstruction system artificial ligaments; Patellar tendon; Reconstruction; Rupture; Case report

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Core tip: Patellar tendon rupture is a rare disease and leads to a loss of involvement in sports activities and hinders daily life activities due to loss of function of the knee extensor mechanism. We present a case of chronic patellar tendon rupture in a 65-year-old woman who underwent multiple operations, after 12 mo of follow-up, the patient had good clinical and functional outcomes.

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INTRODUCTION

The patellar tendon, a part of the knee extensor mechanism, can be predisposed to ruptures due to direct or indirect injury. Ruptures are rare, but serious injuries at the joint will lead to a loss of involvement in sports activities or hinder daily life activities owing to the loss of function of the knee extensor mechanism. Ruptures typically tend to occur in males aged 30 to 40 years and involve a complete tear of the tendon that runs from the tibial tubercle to the patella inferior pole\[1,2\]. In chronic cases, reconstruction surgery is the gold standard if a primary repair is not possible and aims to restore the ability to extend the knee\[3\]. Although surgical repair has been recommended for acute patellar tendon rupture, the efficacy and prognosis of reconstruction surgery for chronic patellar tendon rupture are still controversial. There is currently no gold standard for the treatment of tendon ligament ruptures, but some surgical techniques have been previously reported; for instance, one- or two-stage reconstructions\[4\], contralateral bone-tendon-bone grafts\[5\], ipsilateral semitendinosus tendon grafts\[6,7\], and artificial ligament grafts have been used to reconstruct the patellar tendon\[8,9\]. All of the previous reports included small samples, and the efficacy and prognosis of surgery were unclear. Postoperative complications are critical to the success of the reconstruction and include wound infections, septicemia, fractures, wire breaks, and quadriceps weakness\[3\].

Herein, we present a case of chronic patellar tendon rupture in a 65-year-old woman who underwent multiple operations; we repaired the rupture with the ligament augmentation reconstruction system (LARS) due to poor-quality soft tissues and a vascular injury. This is a rare condition that was treated with good clinical and functional outcomes at the 12 mo follow-up. To the best of our knowledge, this is the first case of the use of LARS in a patellar tendon reconstruction due to chronic tendon rupture after multiple operations for patellar fractures.

CASE PRESENTATION

Chief complaints
A 65-year-old retiree with no previous history of other diseases presented to hospital due to a left patellar tendon rupture after three operations. She experienced knee pain and feared going up and down stairs.

History of present illness
The woman underwent open reduction and internal fixation after a fracture of the left patella in another hospital 3 years ago, and was treated again for the fracture 1 mo later. The internal fixation was removed 17 mo ago, and the patient was immobilized postoperatively for 4 wk.

History of past illness
The patient has no previous history of other diseases.

Physical examination
A physical examination revealed that the left knee was limited in active extension, she was unable to perform a straight leg raise, and there was palpable concavity on the patellar tendon (Figure 1A). Her body mass index was 24.4 and the Lysholm score
was 38 (Table 1).

**Imaging examinations**
The lateral knee radiograph showed that the patella moved superiorly, which revealed a high-riding patella and the Insall-Salvati ratio was 1.53 (Figure 2A). Magnetic resonance imaging (MRI) revealed rupture of the patellar tendon (Figure 2B).

**FINAL DIAGNOSIS**
Chronic patellar tendon rupture.

**TREATMENT**
The patient consented to LARS artificial ligaments instead of autograft or allograft reconstruction as she had already undergone repeated operations previously that resulted in poor-quality tendons with a poor blood supply. As autograft reconstruction requires long-term recovery and immobilization, the patient was informed of the advantages and risks of LARS artificial ligament reconstruction and signed an informed consent form before surgery. The operation was performed by the deputy chief physician. The surgeon tied a tourniquet at the proximal part of the thigh, and the surgical incision was along the longitudinal midline of the left knee. The surgical field revealed that the patellar tendon was completely ruptured, and granulation tissue was hyperplastic and adherent. We loosened the stump of the patellar ligament, braided the ligament, and made three longitudinal medial-sided and lateral-sided bone tunnels through the patella with Kirschner wires. The braided ligament was fixed through the bone tunnels at a flexed knee position of 90°. The reconstruction was performed using a “figure 8” pattern through the patellar tunnel with screw fixations to the tibia (Figure 1B). The wound was washed with sterile normal saline and sutured in layers.

Weight bearing was not allowed for 4 wk. Particular attention was paid to postoperative rehabilitation exercises. The day after surgery, the patient was able to get out of bed, and could use a brace for external immobilization. We first educated the patient on ankle pump exercises and focused on passive range of motion (ROM) exercises, then we concentrated on extensor and quadriceps strength. The patient was discharged after three days, and the ROM was 0-90°.

**OUTCOME AND FOLLOW-UP**
At the 1-mo postoperative follow-up, the wound had healed well and had no signs of infection, and the patient walked without the aid of crutches. The patient was able to complete a straight leg raise but still felt a little discomfort and dreaded descending stairs. The ROM improved to 0-120°, and the radiographs showed that the patella had moved distally (Figure 3). At the 12 mo postoperative follow-up, the affected limb was the same as the uninjured side, and the Lysholm score was 95 (Table 1). The ROM of the knee was 0-130°.

**DISCUSSION**
Disruption of the knee extensor mechanism can occur as a result of injuries to the quadriceps muscle, quadriceps tendon, medial and lateral patellar retinaculum, patella, patellar tendon, and the tibial tubercle. Patellar tendon rupture is a rare injury that occurs in 0.6% of the general population. The estimated mean age of the patient population is 49 years, 78% are male, the most prevalent risk factors are previous knee surgery and patients who had recently undergone total knee arthroplasty. Spontaneous rupture may occur in degenerated tendons, and spontaneous ruptures have been reported to be associated with local steroid injection, systemic lupus erythematosus, rheumatoid arthritis, chronic renal failure, hyperparathyroidism, infections, iatrogenic causes, and diabetes mellitus.

Although patellar tendon ruptures are rare, they should be diagnosed early and treated with surgery due to functional disability of the knee extensor mechanism. The diagnosis of patellar tendon rupture relies heavily on medical history, symptoms, signs, and imaging examinations, such as radiographs, arthrography, ultrasound, and...
Table 1  The preoperative and postoperative Lysholm score after 12 mo

|                        | Preoperative | Postoperative |
|------------------------|--------------|---------------|
| Pain                   | 10           | 25            |
| Instability            | 5            | 25            |
| Locking                | 15           | 15            |
| Stair climbing         | 0            | 6             |
| Limp                   | 0            | 5             |
| Support                | 2            | 5             |
| Swelling               | 6            | 10            |
| Squatting              | 0            | 4             |
| Overall                | 38           | 95            |

MRI; radiographs are the most cost-effective method as the symbolic diagnostic sign is a high-riding patella. MRI can further diagnose patellar tendon rupture and provides detailed information about the injury, which contributes to the formulation of a surgical plan.

It is rare for acute tendon ruptures to develop into a chronic condition, and acute ruptures require direct primary repair as these are associated with functional disability of the knee extensor mechanism. The ideal transplants for ligament reconstruction remain controversial, and the main types of tendon transplants are as follows: Autologous, allogeneic, and artificial tendons[3]. Autografts are the most common graft material which can enhance suture repair of the patellar tendon, especially the hamstring tendon, however, the quality of the soft tissues and the prolonged rehabilitation period required are unsuitable for elderly patients, and autografts result in more postoperative complications, including infection and irritation, than other tendon transplants[13,17]. The main advantage of allografts is that they can avoid the autologous harvesting process, which reduces the morbidity of the surgical procedure, but allografts can expose patients to the risk of infectious disease and graft rejection[18]. Over the last decade, LARS artificial ligaments have been used as an advantageous option for suture fixation in ligamentous reconstruction of the knee, especially in cruciate and collateral ligament reconstructions. The use of LARS for patellar tendon reconstruction is infrequent. Talia and Tran reported the use of LARS for bilateral tendon reconstruction in a young gymnast[8]. Naim et al[9] reported a 79-year-old woman who fell and landed on her left knee, and they reconstructed her tendon using LARS ligaments 1 year later. Bouguennec and Colombet reported a 29-year-old handball player who presented with an iterative rupture and a fracture of the patellar tunnel after semitendinosus graft reconstruction was performed and revision reconstruction surgery used LARS[19]. All patients achieved rapid postoperative recovery without re-rupture or synovitis.

LARS ligaments are made of polyethylene terephthalate, which has the following advantages: (1) Avoids the need to obtain autologous tendons and donor site morbidity; (2) Accelerated rehabilitation and early return to sport activities; (3) Does not demonstrate evidence of graft rejection; (4) Encourages collagen ingrowth due to the porosity of the material; and (5) Provides the possibility of repeating the reconstruction in case of failure[9,20,21]. The disadvantages of reconstruction of the patellar ligament are the lack of long-term follow-up, large population-based studies and quality randomized trials. However, LARS ligaments have been certified as a more favorable option than other tendon transplants for anterior cruciate ligament reconstruction in which twenty-six patients were reviewed at an average follow-up of 11.6 years, especially in elderly patients requiring rapid postoperative recovery[22].

In the present case, LARS ligaments were used in an elderly woman. Although the LARS ligament has mostly been used in cruciate and collateral ligament reconstructions, especially in athletes, it can be used in elderly patients who require high-quality postoperative function and early mobilization. The application of the LARS ligament in the reconstruction of chronic patellar ligament rupture is rare, but the outcomes in these cases are good. A limitation of this case is the relatively short follow-up (12 mo), but postoperative complications were rare, as in other previously reported tendon reconstructions, such as knee synovitis, graft ruptures, surgical site infection, and residual knee instability[23]. To the best of our knowledge, this is the first study to report reconstruction with LARS ligaments in an elderly woman who underwent multiple patella operations. We suggest the use of the LARS in elderly patients who require rapid postoperative recovery.
Figure 1 The physical examination and surgical technique. A: The underlined showing the patella inferior pole of the uninjured knee, the overline showing the patella inferior pole of the injured knee; B: The image demonstrates the way in which the “figure 8” reconstruction was performed.

**CONCLUSION**

Patellar tendon ruptures are rare but serious injuries. We report a case in which LARS artificial ligaments were chosen for suture fixation due to the poor quality of the tendons after multiple operations to enable early mobilization and quick rehabilitation. At 12 mo follow-up, the patient achieved rapid postoperative recovery, and was able to complete a straight leg raise and did not fear going up and down stairs.
Figure 2 X-ray and magnetic resonance imaging. A: The X-ray showing a high riding patella; B: Magnetic resonance imaging showing a rupture of the patellar tendon. Patellar tendon height (H) and patellar length (L) were used to calculate the Insall-Salvati ratio.

Figure 3 Post-operative X-ray showing that the patella had moved distally.

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