CASE REPORT

Patellar tendon re-rupture management using reconstruction with allograft, proximal and distal bone blocks, and suture augmentation: a case report

Manejo de reruptura del tendón patelar mediante reconstrucción con aloinjerto, bloques óseos proximal y distal y suplementación con suturas: reporte de caso

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Abstract

Introduction: Patellar tendon rupture is a rare but highly disabling injury due to extensor mechanism involvement, and in most cases it requires surgical management. Ruptures following initial reconstruction (re-rupture) are even less frequent and the literature on their management is limited to case reports.

Case presentation: A 34-year-old man with a history of left patellar tendon rupture visited the emergency room of a quaternary care institution in Bogotá, Colombia, due to sudden pain, edema, and limitation of active extension of the left knee following a direct trauma sustained while practicing sports. An X-ray of the knee taken on admission revealed high patella and confirmed re-rupture of left patellar tendon. Patellar tendon reconstruction was performed using allograft, proximal and distal bone blocks, and augmentation with high-strength sutures, achieving full range of motion, successful return to sports activities, and satisfactory results from the patient’s perspective at one-year follow-up.

Conclusions: Based on the satisfactory results reported in this case, it may be stated that the patellar tendon reconstruction technique described here is an effective alternative for patellar tendon rupture management. However, studies with a larger number of patients and longer follow-up periods are required to establish the effectiveness and safety of this surgical technique.

Keywords: Patellar Ligament; Rupture; Tendon Injuries; Allograft (MeSH).

Resumen

Introducción. La ruptura del tendón patelar es una lesión poco frecuente y altamente incapacitante, ya que compromete el mecanismo extensor de la rodilla. Además, la mayoría de los casos requieren manejo quirúrgico. Las rupturas posteriores a una reconstrucción inicial (reruptura) son aún menos frecuentes y la literatura sobre su manejo se limita a reportes de caso.

Presentación del caso. Hombre de 34 años con antecedente de ruptura de tendón patelar izquierdo que consultó al Servicio de Urgencias de un hospital de cuarto nivel de atención en Bogotá (Colombia) por dolor súbito, edema y limitación para la extensión activa de la rodilla izquierda posterior a trauma directo durante una práctica deportiva. En la radiografía de rodilla al ingreso, se observó patela alta y se confirmó la presencia de reruptura del tendón patelar izquierdo. Se realizó reconstrucción del tendón patelar usando aloinjerto, bloques óseos proximal y distal, y aumentación con suturas de alta resistencia, logrando un rango de movilidad completo, retorno exitoso a actividades deportivas y resultados satisfactorios desde la perspectiva del paciente a un año de seguimiento.

Conclusiones. Con base en los resultados satisfactorios reportados en este caso, es posible afirmar que la técnica de reconstrucción de tendón patelar aquí presentada es una alternativa efectiva para el manejo de rerupturas del tendón patelar. Sin embargo, se requieren estudios con un mayor número de pacientes y en los que se realicen seguimientos más largos para determinar la efectividad y seguridad de esta técnica quirúrgica.

Palabras clave: Ligamento rotuliano; rotura; traumatismos de los tendones; aloinjerto (DeCS).
**Introduction**

Patellar tendon rupture accounts for 0.6% of all tendon injuries, with an incidence of 0.68 cases per 100 000 people every year,¹ being even more rare among athletes.² This lesion is usually seen in active young people under 40 years of age, with a male to female ratio of 8:1.³⁵ Moreover, this type of rupture can be caused by direct trauma or overuse in patients with patellar tendinopathy.³⁵ They may also occur as a complication of total knee replacement (TKR), with an incidence between 0.2% and 5%.³

Patellar tendon ruptures are highly disabling injuries because they affect the knee extensor mechanism, which is essential for walking. In most cases, timely surgical management is required. In this regard, various surgical techniques have been described, which aim to repair or reconstruct the tendon depending on the time of evolution of the rupture and its location. However, there is no consensus on their use.⁵

Ruptures following patellar tendon repairs (rerupture) are even less frequent, with an occurrence rate between 2% and 50%, and the literature on their treatment is limited to case reports describing multiple reconstruction techniques.⁶ In addition, reruptures pose a more demanding surgical challenge due to fibrosis formation and tendon degeneration, which impacts the chances of repair.⁶

The following is the case of a man with chronic patellar tendon rerupture who underwent surgery with a reconstruction technique consisting of the use of patellar tendon allograft with proximal and distal bone blocks, as well as supplementation with high-strength sutures in the remaining portions of the tendon.

**Case presentation**

A 34-year-old man was admitted to the emergency room of a quaternary care hospital in Bogotá (Colombia) with sudden pain, edema, and limitation of active extension of the left knee following trauma during a sports practice. Nine months prior to admission, he suffered an acute rupture of the left patellar tendon with avulsion fracture from the inferior pole of the patella, which required repair with two bone anchors and Krakow suture. Ten years earlier, the patient had suffered a rupture of the right patellar tendon due to trauma, which was repaired at another institution. It should be noted that the patient reported that he played soccer for recreation.

A knee X-ray on admission showed a patella alta (Insall-Salvati ratio: 0.46) and confirmed the presence of rerupture of the left patellar tendon (Figures 1A and 1B). During the emergency department visit, the patient was evaluated by professionals from the internal medicine department, who, in view of his history of bilateral patellar tendon rupture, performed the following laboratory tests: comprehensive metabolic panel (results within normal limits), renal function tests (no abnormal findings), and complete blood count (no evidence of alterations in cell lines). When interviewed, no signs or symptoms suggesting the presence of autoimmune diseases or genetic alterations were found. Based on these findings, the patient was discharged; however, 2 weeks later he attended the emergency department again, so he was admitted to the hospitalization department for surgery (reconstruction of the patellar tendon).
Figure 1. X-rays of the left knee showing patellar tendon rupture (patella alta). A. Anteroposterior plane B. Lateral plane.
Source: Image obtained while conducting the study.

Surgical technique

Patient preparation

With the patient in the supine decubitus position on the surgical table, spinal and regional anesthesia was used and the extremity to be operated on was prepared. A pneumatic tourniquet was used during the entire procedure.

Incision

A midline incision of approximately 15cm was made from the proximal pole of the patella toward the tibial tuberosity. Debridement of fibrous and scar tissue was then performed at the proximal end of the patellar tendon, where the rerupture and gap from the distal pole of the patella was observed. Subsequently, a longitudinal incision was made in the middle of the patellar tendon towards the anterior tuberosity of the tibia.

Preparation of bone tunnels in the tibia and patella

Using an oscillating saw and an osteotome, cuts of approximately 1.5cm were made in the distal patella, forming a trapezoid in which the allograft bone block was placed. During this process, precautions were taken not to make deep cuts that could compromise the articular surface. This procedure was also repeated on the anterior tuberosity of the tibia (Figure 2).

Figure 2. Bone tunnels in the tibia (tibial tuberosity) and patella, performed for placing allograft bone blocks. The medial and lateral portions of the patellar tendon were preserved through an incision in its middle third.
Source: Image obtained while conducting the study.
### Preparation and positioning of the graft and augmentation

An extensor mechanism allograft was prepared with two bone ends molded to fit into the previously described tunnels. The allograft was then implanted (press-fit implantation), securing fixation with partially threaded cannulated screws horizontally (lateral to medial) in the patella and two cortical screws with washer (anterior-posterior) in the tibia (Figure 3). Subsequently, the patellar tendon reconstruction was complemented with high-strength sutures from the medial and lateral portions to the remnant portions of the native patellar tendon.

![Figure 3](image.jpg)

**Figure 3.** Graft fixation. A. Graft fixation with cortical screws with washer in the tibial tuberosity. B. Transverse fixation of the graft with partially threaded screws in the patella.
Source: Image obtained while conducting the study.

### Wound closure and initial immobilization

The tourniquet was deflated, without removing it until the end of surgery, and hemostasis was assessed. The wound was then closed by anatomical planes and the limb was initially immobilized with an ischiomalleolar splint for 2 weeks, allowing it to be placed on the floor. Additionally, X-rays were taken in the immediate postoperative period (figure 4).

![Figure 4](image.jpg)

**Figure 4.** Postoperative X-rays of the knee. A. Anteroposterior plane. B. Lateral plane.
Source: Image obtained while conducting the study.
Postoperative management

Between weeks 0 and 3, the knee was immobilized in extension with a knee brace. From week 3 to 5, knee mobility was allowed in a range of 0° to 30°, and emphasis was placed on passive manipulative rehabilitation during physical therapy sessions to prevent the development of adhesions. Then, the allowable range of motion was increased to 60° at week 6 and to 90° at weeks 7 and 8. Finally, starting at week 9, full knee mobility with a knee brace was allowed.

Outcomes and follow-up

Three weeks after the surgical procedure, there was complete wound healing and quadriceps hypertrophy, as expected. Moreover, the knee range of motion was gradually recovered in accordance with the postoperative management described above. At the last follow-up appointment, one year after the surgery, the patient had a full range of motion (0° extension, 150° flexion) and was performing activities of daily living and low-impact sports, such as cycling, without difficulty. Regarding the patient’s perception of the outcomes of the treatment received, the Spanish validated versions of the Lysholm and Kujala scales were used, obtaining scores of 85 and 91, respectively, so it is possible to state that the outcome was satisfactory. However, it is worth mentioning that a slight quadriceps hypotrophy still persisted in the last follow-up.

Discussion

Patellar tendon rupture is a rare injury that usually occurs in young active men due to direct trauma, tendinopathy, or following TKR. The use of systemic or local steroids, a history of rheumatic or connective tissue diseases, metabolic disorders, chronic kidney disease, and the administration of fluoroquinolones have been described as risk factors associated with a high incidence of this rupture. In the case of bilateral ruptures, the most frequently found risk factors are chronic kidney disease, diabetes, and obesity.

Patellar tendon ruptures can be classified based on the time elapsed since the occurrence of the injury as acute (<2 weeks) or chronic (>2 weeks), and depending on the location of the rupture as lesions of the mid-substance, the tibial tuberosity, or the distal pole of the patella, the latter being the most common.

In patients with acute and incomplete patellar tendon ruptures and normal function, conservative management with 2 to 3 weeks of immobilization of the knee in full extension is indicated. On the other hand, in cases with acute and incomplete ruptures and functional deficit or complete ruptures, early surgical management should be implemented. Surgical management options include single repair with end-to-end suturing, which is rarely used because of its high failure rate, and repair with Krackow suture (locking-loop) weave technique or other similar suturing techniques through bone tunnels in the patella or tibia, with or without augmentation. Repairs with bone anchors have also been described, and they seem to have a lower rerupture rate compared to the transosseous suture technique (7.5% vs. 0%; p=0.034).

In patients with chronic ruptures, tendon reconstruction is preferred, since tendon retraction and adhesion formation make primary repair difficult; however, some authors have described primary repairs with augmentation of the tensor fascia latae or hamstrings. In these cases, hamstring autograft with bone tunnels in the tibia or patella is usually used for reconstruction, depending on the location of the rupture. Good outcomes have also been reported with the use of autografting of the central third of the contralateral...
patellar tendon with proximal and distal bone blocks, Y-shaped flap from the vastus lateralis fascia, Achilles tendon allografts, as well as synthetic grafts, which should only be used in patients with low functional demand.\textsuperscript{5,8}

In a systematic review including studies published between 1947 and 2013, Gilmore et al.\textsuperscript{6} evaluated the postoperative outcomes of different surgical techniques for the management of acute patellar tendon ruptures (n=8), chronic ruptures (n=8), and ruptures following TKR (n=9) in terms of complications, failure rate, and functional outcomes measured with scales and according to the range of motion.\textsuperscript{6} The best postoperative outcomes were observed in augmentation repairs for patients with acute ruptures and in autograft reconstructions for patients with chronic ruptures and post-TKR ruptures.

Although good outcomes have been achieved in the surgical management of the patellar tendon with several of these techniques, there is no universal consensus on their use and the rupture rate ranges from 2% to 50% depending on the surgical technique used.\textsuperscript{6,11} In fact, it has been reported that rerupture is the second most common complication after surgical repair of patellar tendon rupture following TKR (25.33%).\textsuperscript{12}

Literature on indicated surgical procedures following patellar tendon rupture comprises only technical notes\textsuperscript{13-16} and case reports.\textsuperscript{17-23} On the other hand, the challenges of performing a revision patellar tendon repair, including quadriceps atrophy, contracture, tissue loss, excessive scarring, and improper patella height, must be considered.\textsuperscript{15}

Different procedures have been proposed for the surgical management of patellar tendon ruptures. For example, Maffulli et al.\textsuperscript{13} described a reconstruction with ipsilateral hamstring autograft and bone tunnels in the patella. Similarly, Moretti et al.\textsuperscript{14} performed reconstruction with semitendinosus autograft, gracilis augmentation, neutralization cerclage with wires, and local injection of platelet-rich plasma. In turn, Haber et al.\textsuperscript{15} used suture anchors, allograft augmentation, and suspensory fixation. Finally, Sutton et al.\textsuperscript{16} used suture anchors augmented with an extensor reconstruction using acellular human dermal allograft.

**Conclusions**

Based on the satisfactory outcomes reported in the present paper, it can be stated that the patellar tendon reconstruction technique described here is an effective alternative for the treatment of recurrent ruptures, considering that, upon completion of the physical rehabilitation program, the patient recovered full mobility of the knee without joint stiffness and was able to perform activities of daily living in an adequate manner, as well as resume sports activities progressively. Moreover, the patient reported feeling satisfied with the outcomes of the procedure. However, studies with a larger number of patients and longer follow-ups are required to determine the effectiveness and safety of this surgical technique.

**Informed consent**

The patient signed an informed consent form authorizing the use of his clinical data for the preparation and publication of this case report.

**Conflicts of interest**

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