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Semitendinosus and Gracilis Autograft for Neglected Patellar Tendon Rupture: A Surgical Reconstruction

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Abstract

BACKGROUND: Neglected patellar tendon rupture is an extremely rare case among orthopedic injuries that severely compromises the function of the extensor mechanism of the knee. Therefore, a prompt and accurate diagnosis of a ruptured patellar tendon are a key to efficacious management, because a treatment delay is often associated with unsatisfactory functional outcomes.

CASE PRESENTATION: We report the case of an adult male patient with traumatic patellar tendon rupture after 9 months of a motorcycle accident. The patient underwent reconstruction surgery using semitendinosus and gracilis tendon augmentation. This procedure restores the anatomical position of the patella and prevents extensor lag. At a 3-month follow-up, a full recovery of the structure and function of the extensor mechanism was perceived. The patient could return to normal daily activities following rehabilitation protocol.

CONCLUSION: Semitendinosus and gracilis tendon autograft is the technique of choice to be applied in the surgical reconstruction of neglected patellar tendon rupture.

Introduction

The rupture of the patellar tendon is a rare case of orthopedic injuries, in which mechanism is due to forceful eccentric quadriceps contraction along with a forced flexion of the knee, commonly as a person lands after a jump [1]. Patellar tendon rupture may occur as acute (less than 14 days), chronic (over 14 days), or neglected (over 6 weeks) injuries [2], [3]. Sometimes, a chronic or neglected patellar tendon rupture is highly disabling, requiring prompt and adequate surgical management techniques to overcome potential disability. In a complex case, where a direct repair of the tendon is not possible, the tendon is augmented using either autograft or allograft to preserve stability and restore normal knee function [4].

Here, we present a case of surgical technique for neglected patellar tendon rupture using an ipsilateral semitendinosus and gracilis (STG) tendons autograft. Informed consent was obtained from the patient, and all the clinical pictures were permitted by the patient to be used for medical publication purposes.

Patient information

A 38-year-old Balinese male presented with the right knee pain and an inability to perform a straight leg raise. The patient could not run and had difficulty climbing up and downstairs. He had a history of motorcycle accidents 9 months before. He also experienced dislocation but was spontaneously reduced. Other significant medical history was absent.

Clinical findings

The physical examination revealed a palpable hollow in the patellar tendon groove. In addition, there was a limitation of the right knee active extension, with an extensor lag ranging from 10 to 100° (Figure 1). The lateral knee view radiographs showed an image of the patella alta, which is a displacement of the patellar bone superior to the knee (Figure 2).

Surgical approach

The patient consented to surgical reconstruction of the patellar tendon. He was subsequently placed in a supine position with a high-thigh tourniquet inflated to

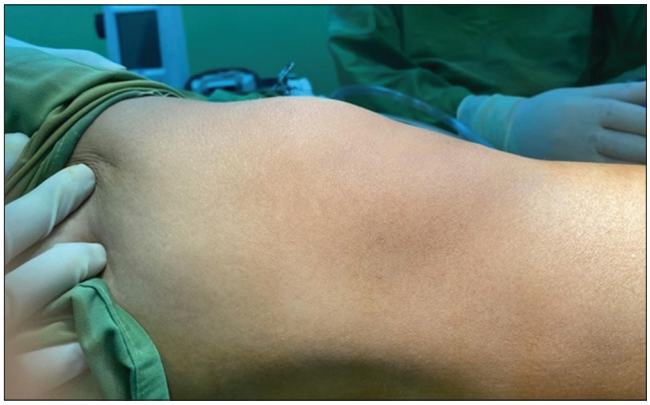

Figure 1: A hollow groove of the patellar tendon was seen on the inspection of the affected knee

250 mmHg to exsanguinate the lower limb. The knee is scrubbed and draped using a standardized sterile manner and then flexed to 90°. Next, we carried out the incision using the anterior mid-line longitudinal technique beginning from the superior pole of the patella approaching 3-cm distal to the tibial tubercle. Skin and subcutaneous tissue were excised to visualize the tendon and later be freed from the adjacent fibrotic adhesions and scar tissue, providing sufficient support for an active extension.

Figure 2: Lateral X-ray view revealed patella alta with Caton-Deschamps index value of 1.5

Patellar visualization revealed that the tendon was not intact on the inferior pole of the patella. All the nonviable portion of the tendon was debrided, followed by the freshening of the patellar pole. The patella was mobilized distally to its native anatomical position and was fixated using Suture Wire through a horizontal tunnel drilled with a 4.5-mm bit in the lower half patella. These Suture Wire were used to provide a temporary fixation that shortens the distance between the patella to the subsequent patellar tendon graft (Figure 3).

Figure 3: A well-positioned patellar bone was fixated to the patellar tendon using wire

Graft harvest and preparation

We harvested the ipsilateral semitendinosus and gracilis tendons through a small skin incision over the pesanserinus using a tendon stripper, which was pulled through the main incision. The semitendinosus and gracilis tendons were cleaned out of the excess muscle and soft tissue and measured at least 25 cm in length (Figure 4). Both tendon grafts were combined for the final preparation, and a stitch was tied at both ends of the autograft using VICRYL no.1. The autograft bundle was sized for a diameter of 6.5 mm.

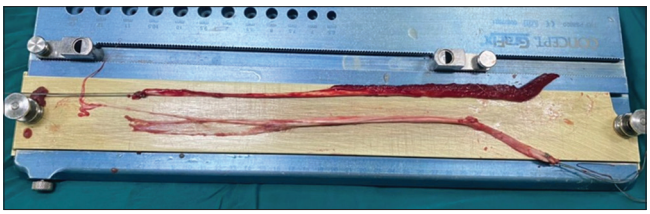

Figure 4: Preparation of the harvested semitendinosus and gracilis autograft, measured at least 25 cm in length

Patellar tendon fixation

Horizontal bone tunnels were created using a cannulated reamer, proximally at the superior pole of the patella (patellar tunnel), followed by 3-cm distal to

the tibial tubercle and 2-cm posterior from the anterior tibial crest (tibial tunnel). The approximate diameter size of the tunnels should match the autograft bundle size (6.5 mm). The harvested tendon grafts were augmented on the knee positioned at 30° flexion, passing through the patellar tunnel from the lateral to the medial aspect of the tunnel. In contrast, the other end of the graft passed through the tibial tunnel from the medial to the lateral aspect of the tunnel. The two ends of the graft are joined crosswise in front of the patella and stitched on both sides to the remnant patellar tendon, forming a Figure-of-Eight pattern.

The autograft tension was maintained by matching the patellar tendon length to be approximately equal to the height of the patella, by the Insall-Salvati index (Figure 5). Furthermore, to ensure an optimal continuity and assembly between the newly-reconstructed patellar grafts, the quadricep expansion was folded 1.5-cm wide and sutured on the patellar tendon. An intraoperative motion test of 90° flexion position was gained perfectly, without any tension. Finally, the Suture Wire was removed, and the wound was dressed. A post-operative radiograph was performed, showing an excellent reduction of the patellar bone, with Caton-Deschamps patella height index of 1 (Figure 6).

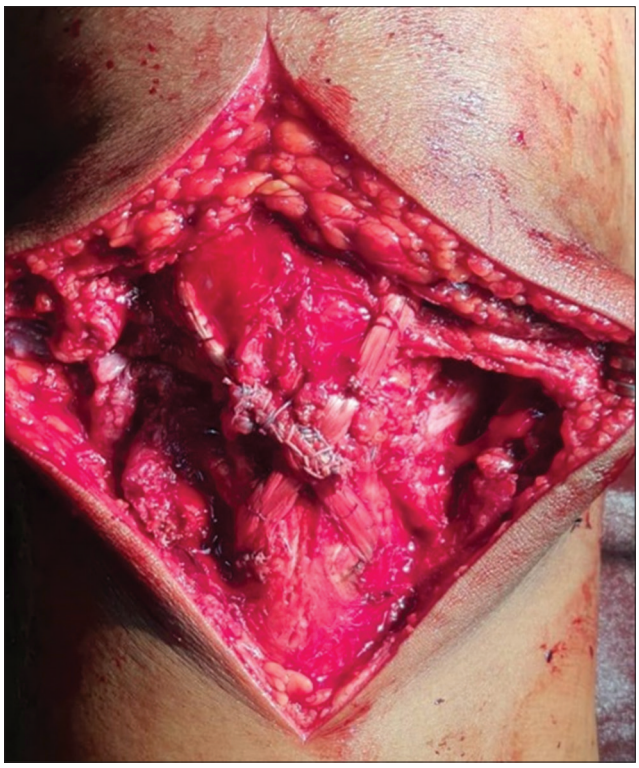

Figure 5: The final Figure-of-Eight appearance of autograft semitendinosus and gracilis tendons weaved in with the remnant patellar tendon during surgery

Post-operative rehabilitation

The patient underwent immobilization in a full-extended position using a cylinder cast. A partial weight-bearing with axillary crutches began on day 14,

Figure 6: Post-operative radiograph showing a normal patellar height

along with physiotherapy sessions. The focus of initial rehabilitation is to regain the passive range of motion of the knee up to 90° of flexion during the first 30-days, while active knee extension is not allowed. In the 6th week, the range of motion was gradually improved with quadriceps strengthening exercises. At 3-month follow-up, a full active extension and 90° flexion were achieved and were comparable to the contralateral side (Figure 7a and b). The patient was able to carry out normal daily activities without any significant complaints in his knee.

Figure 7: (a) Full active extension and (b) flexion after reconstruction presented at 3-month follow-up

Discussion

The patellar tendon rupture is an infrequent orthopedic injury, accounting for 0.6% of cases in the general population. The estimated mean age of the patient is 40 years old, with a gender predominance in the male population (78%) [5]. A prompt and precise diagnostic approach is key to efficacious management, because a delay of treatment is often associated with

unsatisfactory functional outcomes [6]. Diagnosis is made upon clinical examinations, with a hallmark finding of a palpable hollow defect on the patellar groove, resulting in a symptom of pain and a failure to extend the knee.

Radiographic X-ray imaging shows the patella alta, which effectively distinguishes the patellar tendon ruptures apart from patellar fractures [7]. In neglected cases, additional examinations, that is, ultrasonography or magnetic resonance imaging (MRI), may be performed to assess the degree of tendon degeneration and other pathological conditions of adjacent soft-tissue resulting from a long-standing neglected condition [8]. However, we did not perform both imaging modalities due to the limitation of cost from the patient.

Neglected patellar tendon ruptures often result in a permanent extension deficit. Thus, surgical reconstruction is mandatory and the first option to relieve symptoms and reestablish normal knee function. In addition, as the tendon is detached from the bone attachment, it eventually causes the retraction and scarring of the tendon and muscle atrophy. Therefore, in neglected cases, primary repair with end-to-end sutures can be challenging and lead to poor outcomes and increased risk for retear [9]. The primary aim of surgery in patellar tendon rupture cases is to restore the extensor mechanism, both functionally and structurally, allowing active knee joint extension and return to pre-injury level activities [10].

Numerous graft procedures have been demonstrated, such as using synthetic materials, allograft, fascia lata, Achilles tendon, autograft, and the single-use of semitendinosus tendon or combined with gracilis tendon [11]. Labib *et al.* stated that the reconstruction using the contralateral patellar tendon caused an additional defect on the uninjured knee. The use of synthetic materials and allografts may escalate the risk of pathogenic infection and neoplasia [12]. Naim *et al.* preferred synthetic ligaments to prevent morbidity in the donor site, allowing early mobilization and avoiding additional procedures to remove the neutralization cerclage wire [13]. However, its usage is limited by the high cost and availability. The use of Achilles tendon grafts often causes complications, such as infection, residual donor site rupture, and the functional loss of plantar flexion. These factors discourage the routine use of these graft techniques [14].

In our case, we performed reconstruction and restoration of the patellar tendon using a semitendinosus and gracilis (STG) tendons autograft without using any synthetic materials. We believe that this technique provides an excellent outcome as described by previous studies, stating that STG tendons contain a large number of fibers comprising a solid graft [9], [15]. Furthermore, the ultimate tensile load of doubled semitendinosus tendon grafts is estimated to reach 2330 N [15]. The advantages of STG autograft include the low risk of developing disease transmission and rejection of immunogenic reactions, avoiding potential patellar fracture due associated with vertical blind tunneling, ipsilateral distally based graft, no requirement of additional implants, inexpensive, with great availability, because STG is easy to harvest [16].

Jarvela *et al.* reported using STG tendons without preserving the distal insertions, which resulted in excellent functionality without any complications [17]. Gilmore *et al.* stated that STG graft becomes the most popular graft choice and is used in 41% of patients with neglected patellar tendon rupture [18]. Several studies have demonstrated the outcome superiority of STG graft in terms of repair strength, range of motion after reconstruction, and restoring normal daily activities [18], [19]. Chen *et al.* used the STG tendon to reconstruct a neglected patellar tendon rupture with preserved distal insertions. Though, a combined fixation with wire was applied [11]. In our technique, the insertion of wires was only to provide a temporary fixation when reducing the patella in a normal anatomical location. In the final stage of reconstruction, the wires were eventually removed.

The normal position of the patella is essential in establishing an ideal knee motion and stability. Anatomical alterations of the knee joint cause instability and further influence the patient's daily activity and quality of life [20]. A satisfactory functional outcome is obtained by maintaining proper intraoperative techniques, including ensuring an accurate determination of patellar height. Standard measurements were performed at the reduced knee in a 30° position to confirm the appropriate placement of patellar bone without patella alta or patella Baja. Post-operative X-ray examination is an additional method that can be performed.

Our patient successfully returns to normal daily activities within 3 months after surgery. This finding highlights that STG autograft had an excellent outcome of restoring function. In contrast, Sanaboyina *et al.* reported a neglected patellar tendon rupture with reconstruction using STG autograft, which regained a full active knee range of motion after 1 year [21]. Moretti *et al.* suggested that post-operative rehabilitation is an important factor that should not be overlooked in achieving an optimal therapeutic goal. Rehabilitation in the first 3 months after reconstruction is a golden period that influences the overall outcomes of functional restoration of the knee extension movement [22].

Conclusion

Semitendinosus and gracilis (STG) tendon autograft is the technique of choice to be applied in the surgical reconstruction of neglected patellar tendon rupture cases. Our case provides an excellent demonstration of the use of STG autograft, which resulted in satisfactory functional clinical outcomes.

Furthermore, when combined with an appropriate rehabilitation approach, this technique offers much greater benefits to regain a full range of motion of the knee and optimal recovery time.

Authors' Contributions

Surya Adisthanaya: Conception, literature review, analysis, data collection, writing review, and editing. Putu Astawa: Conception, literature review, and supervision. I Gusti Ngurah Wien Aryana: conception, methodology, and supervision. Febyan: literature review, data collection, and editing.

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