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Reconstruction of ruptured patellar tendon using semitendinosus and gracilis tendon autograft: A modified technique

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Abstract
Background: Patellar tendon rupture is a relatively infrequent injury, resulting in severe morbidity if neglected or treated improperly. The treatment aims to preserve the extensor mechanism. Quite a few reconstruction techniques have been proposed. Still, most result in complications including contractures, adhesions & atrophy of the quadriceps tendon, fracture of the patella, damage to the patellar articular surface and patella Alta or Baja. We use a modified technique to reconstruct a ruptured patellar tendon using ipsilateral semitendinosus and gracilis autograft without making a trans-osseous patellar tunnel.
Surgical technique: The patellar tendon is sutured using an end to end technique. The procedure involves harvesting and suturing semitendinosus, and gracilis tendons end to end. A horizontal tunnel of 4.5-mm diameter is drilled at a point one centimetre posterior to the tibial tuberosity. One free end of the graft is passed through this tunnel in a medial to the lateral direction and then placed in front of the patella in a figure-of-eight fashion. Each end is then introduced transversely through the distal end of the quadriceps tendon along the proximal margin of the patella. The two ends are pulled distally and placed in a figure-of-eight fashion again. Finally, the ends were sutured in between where they overlapped after adjusting the tension and the position of the patella.
Conclusion: This modified technique reduces patella associated complications like fracture and patellofemoral cartilage damage. The figure of eight patterns allows the adjustment of graft tension as deemed required for keeping the patella in the ideal position. The load from the patella is directly transmitted to the tibial tubercle so that the repaired patellar tendon remains tension-free and can heal properly. Moreover, when the knee flexes, the patella is pulled downward and is prevented from anterior translation to stabilise the patella and maintain appropriate tracking. Most importantly, this technique avoids postoperative splinting and thereby facilitates early mobilisation and hence a better outcome.

Keywords: patellar tendon rupture, semitendinosus and gracilis autograft, trans-osseous patellar tunnel, patellar tendon augmentation

1. Introduction
Patellar tendon rupture is an uncommon injury. However, it can result in severe morbidity to the patient if neglected or not treated properly. The goal of the management of these injuries is to preserve the extensor mechanism of the knee joint. Medical practitioners have proposed several reconstruction techniques for the same, including 1) the end-to-end suturing of the ruptured tendon with non-absorbable sutures, 2) augmentation (using encircling wires or auto grafts using the semitendinosus alone or together with the gracilis tendon), 3) reconstruction using contralateral patellar tendon 4) turn down of the quadriceps tendon 5) or using allograft such as the Achilles tendon. But most techniques remain difficult to perform along with multiple complications, including contracture, adhesion and atrophy of quadriceps tendon, fracture of the patella, damage to the patellar articular surface and patella Alta or Baja. Most surgical techniques demand a period of immo bilisation, which can effectively weaken the quadriceps mechanism or lead to a stiff knee. We use an ipsilateral semitendinosus, and garcilis autograft placed anterior to the patella in this case under discussion. It is set in a figure of eight patterns without drilling the patella or using any synthetic materials. The load is transmitted directly from the patella to the tibial tubercle.

2. Surgical technique

Pre-operative radiological imaging of bilateral knee joints, as well as an MRI evaluation of the affected limb, must be taken to assess the patellar height, position, tendon length and tendon integrity. The patient is positioned supine, and the surgery is performed using an anterior midline approach extending from the proximal pole of the patella to four centimetres distal to the tibial tubercle. After careful surgical dissection, the ruptured ends of the patellar tendon is exposed and freshened. Then, the remaining fibres were aligned in an anatomical position and did primary repair as far as possible. The optimum level of the patella is determined by comparing it with the contralateral knee's lateral view intra-operatively.

The semitendinosus and gracilis tendons are surgically exposed through a 4-cm incision over the surface of the pes anserinus muscles. Each tendon was identified, isolated at its insertion, and harvested using a stripper. Both tendons were sutured end to end after preparing the tendons adequately by clearing the remaining muscles and fat tissue attached to them. A horizontal tunnel of 4.5-mm diameter is drilled in a medial to the lateral direction on a point that is at least one centimetre posterior to the tibial tuberosity. One free end of the graft is passed through this tunnel in medial to the lateral direction and then placed in front of the patella in a figure-of-eight pattern. It is then introduced through the quadriceps tendon. The two ends are pulled distally and placed in a figure-of-eight pattern again (Fig 1). Finally, the ends were sutured in between where they overlapped after adjusting the tension and the position of the patella. The tension is set such that the lengths of the reconstructed tendons are approximately equal to the height of the patella.

After the surgery, there is no splinting of the knee joint. The patient can start Passive motion exercises and isometric quadriceps strengthening exercises on Day 1 with knee flexion limited to 90 degrees. Non-weight-bearing ambulation using a quadrangular walker can be initiated on Day 2, followed by partial weight-bearing with an extension brace by four weeks. The patient can remove the braces and start closed kinetic chain exercises by six weeks. Open chain exercises are allowed by four months, and complete sports activities by eight months after surgery.

3. Case report

A 40-year-old female without any known co-morbidities came to our emergency department with complaints of pain and swelling over her right knee following an RTA. She also had difficulty actively extending her leg and giving way to feel while trying to walk. On examination, the posterior sag sign and Lachmann test were positive, and she had lost her patellar tendon integrity. Her right patella had migrated proximally as compared to her left. Radiographs showed patella Alta and the Insall-Salvatti index was 1.6. MRI evaluation showed rupture of the patellar tendon and complete rupture of ACL and PCL (Fig 2). As it's a complex injury, she was planned for a staged procedure and underwent patellar tendon repair in the first phase. During the surgery, the remnants of the patellar tendons were found to be thin and fragile. We did a primary repair as much as possible; however, the tissue quality was poor, and we planned for an augmentation (Fig 3). Patellar tendon augmentation is done using ipsilateral semitendinosus and gracilis graft as per the surgical technique previously described (Fig 4). We also conducted postoperative radiological evaluations to confirm Patellar heigh (Fig 5). The postoperative period was uneventful and started on rehabilitation as described. By six weeks, she walked using an extension brace and had a range of movement comparable to the opposite knee. On the eighth week after the initial surgery, she underwent arthroscopic ACL and PCL reconstruction using contralateral semitendinosus and gracilis graft. This procedure was done along with an ipsilateral peroneus tendon graft. Rehabilitation started as per the standard protocol. After a year of follow-up visits, we observed that our patient had a full range of movements with a quadriceps power of grade 5.

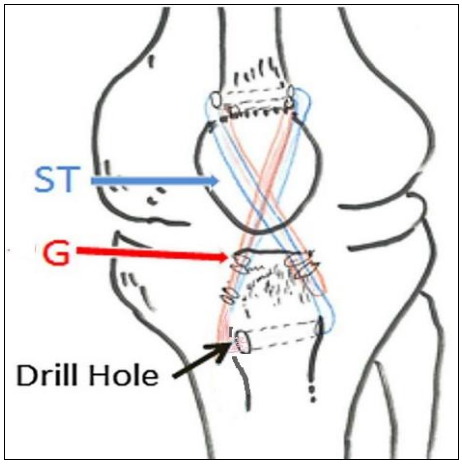

Fig 1: Graphical representation of the figure of eight patterns of tendon grafting.

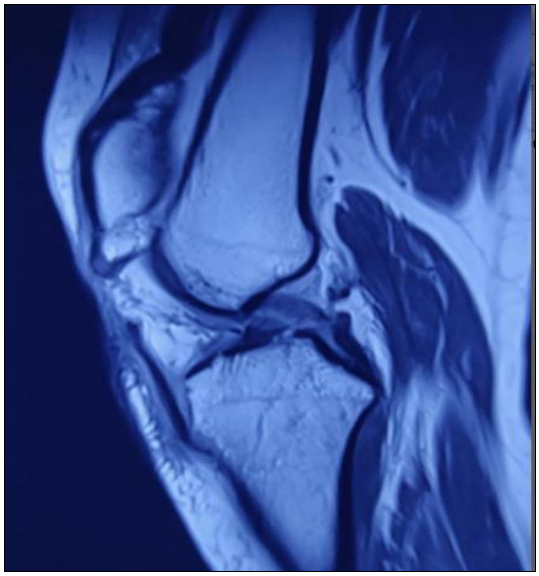

Fig 2: MRI showing rupture of the infra-patellar tendon along with ACL and PCL.

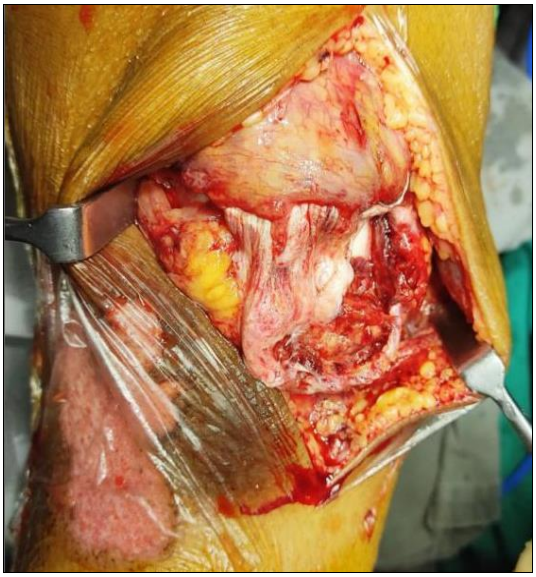

Fig 3: Intraoperative image showing the poor quality of the ruptured tendon.

Fig 4: Intraoperative image showing augmentation of the patellar tendon.

Fig 5: Postoperative radiograph to assess the position of the patella

4. Discussion

Patellar tendon ruptures may result from various causes ranging from trauma to a spontaneous rupture due to patellar tendon degeneration secondary to systemic inflammatory illnesses [1]. A traumatic rupture is quite common among young sportspeople due to the unconventional overloading of the quadricep muscles when their foot is on the ground, and the knee is in the flexion. Avulsion of the tendon from tibial tuberosity is the most common type, followed by mid substance tear and avulsion from the distal pole of the patella, which is rare. In almost all cases, surgical repair is needed to restore the quadriceps mechanism. The main aim of the surgery is to restore the extensor mechanism, anatomical congruity of the patellofemoral joint and early mobilisation. Experts have suggested many surgical procedures, but none of them is widely accepted. Blunt end to end repair requires a prolonged immobilisation and may go for failure due to inadequate splinting, weakened quadriceps mechanism or stiff knee [3]. Hence, augmentation is needed, mainly in cases involving poor tissue quality for early mobilisation and protection of the repaired patellar tendon. Use of a contralateral patellar tendon [4] may result in additional damage to the uninjured leg, whereas synthetic materials [5] and allografts [6] increase the risk of infection and neoplasia. Although practitioners have prescribed various grafts, the STG tendon is the optimal solution. It is a local tissue that is easy to harvest, has many tendon fibres, and has an excellent tensile loading capacity [7] with minimal donor site morbidity. Previously described techniques using semitendinosus graft demand a transverse tunnel drilling through the patella to anchor the tendon graft. Such tunnelling can lead to fracture of the patella and injury to the articular cartilage. In our technique, we avoid the hole in the patella as the tendon is taken transversely through the quadriceps tendon. Then it is placed in front of the patella in a figure-of-eight fashion for additional stabilisation. This pattern allows different graft tension to place the patella in the ideal position. In this technique, the load from the patella is directly transmitted to the tibial tubercle so that the repaired patellar tendon remains tension-free and can heal properly. When the knee flexes, the patella is pulled downward and prevented from anterior translation to stabilise the patella and maintain appropriate tracking. A salient feature of this technique is that it avoids postoperative splinting and thereby facilitates early mobilisation and a better outcome.

5. References

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