Advanced International Journal of Multidisciplinary Research
E-ISSN: 2584-0487 editor@aijmr.com
Volume 2, Issue 5, September-October 2024
CrossRef DOI: 10.62127/aijmr.2024.v02i05.1103

Patellar Tendon Reconstruction Using Hamstring Graft: A Case Report

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Abstract

Background: Patellar tendon ruptures presenting in a chronic setting are rare events that impose technical surgical challenges due to proximal retraction of the patella, quadriceps muscle atrophy and contracture, and peripatellar adhesions. Various reconstruction techniques have been described using different grafts and fixation methods; however, there is a paucity of reported out- comes and there is no consensus on standard of care.

Indications: The patient is a young female of 18yrs who presented with a history of trauma to right knee and was diagnosed with chronic patellar tendon tear. The patient was indicated for patellar tendon reconstruction with autologous hamstring tendon graft due to chronicity of the injury.

Method: Patellar tendon reconstruction using hamstrings graft and fixing with anchor suture and interference screw.

Result: Achieving normal patella tendon height and complete range of motion with restoration of extensor mechanism of knee.

Conclusion: Knee extensor mechanism disruptions necessitate prompt surgical correction. In patients with poor tendon quality and/or a history of knee arthroplasty, primary repair should be supplemented with autograft or allograft. Early repairs yield better results than late interventions, which necessitate intricate reconstructions to reestablish the extensor mechanism's continuity. Achieving early osteointegration of the graft is important in case of tendon reconstructive procedures such as in this case as it leads to better outcomes in terms of rehabilitation and early progress to daily activities.

Keywords: tendon injuries, patellar tendon reconstruction, chronic patellar tendon tear, hamstring graft, hamstring tendon autograft, interference screw

INTRODUCTION

Patellar tendon is a continuation of quadriceps muscle attaching to tibial tuberosity from inferior pole of patella. (1) Patellar tendon rupture involves a complete tear of the tendon that runs from the patella's inferior pole to the tibial tubercle. The patella, the patella tendon, the quadriceps tendon, and the tibial tubercle are the four parts of the knee's extensor mechanism.(2) The rate of patellar tendon rupture has been reported to be about 0.25%, while patellar fractures are seen at a rate of 1.3%.(3,4) Patellar tendon ruptures, while relatively uncommon, affect less than 0.5% of the population each year, with greater

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prevalence among patients in their 30s to 40s.[5] The extensor mechanism may be disrupted by damage to any one of these. When a tendon is subjected to strong tensile stresses and is generally weakened and rupture typically occurs. Being a component of the extensor mechanism, the patellar tendon requires an immediate diagnosis and surgical repair in case of this kind of injury as the knee's ability to extend, and resist flexion is entirely dependent on it. Whereas chronic ruptures frequently necessitate tendon reconstruction, acute ruptures can easily be repaired with primary care. [6] Hamstring tendon auto grafts have recently become more common as reinforcements for patellar tendon reconstruction in native tissue.[7,8,9] Hamstring tendon autografts have biomechanical properties close to those of the native extensor apparatus and are widely used to reconstruct the patellar tendon.[10]

Various approaches have been proposed for repairing chronic patellar tendon injuries, which include autografts, allografts or synthetic materials fixed using transosseous tunnels through patella and/or anchor sutures.

THE CASE

Here we present a case of an 18-year-old female who sustained a fall and came with pain and swelling over left knee and inability to extend the knee. The clinical examination revealed tenderness and palpable gap between inferior pole of patella and tibial tuberosity with extension lag on straight leg raise test. After clinical and radiographic investigations, she was diagnosed with complete patellar tendon tear with patella alta.

This case was approached with patellar tendon augmentation with ipsilateral semitendinosus autograft using anchor suture, biofiber and Interference screw followed by extensive post operative rehabilitation for 8 weeks to achieve complete knee extension without extension lag and improved over all range of motions by the end of 4 months.

Tendon length: 1.7 Patella length: 1.2
Fig 1: pre- op x-ray

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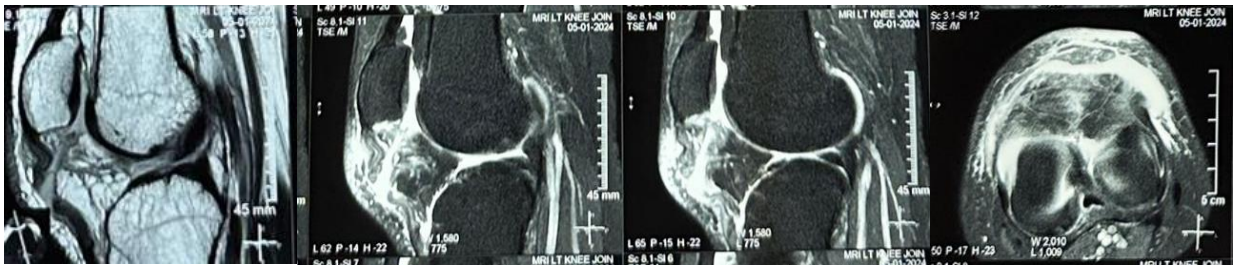

Fig 2 : pre-op MRI

MATERIALS AND METHODS:

Plain radiographs may depict avulsion fractures from the inferior pole of the patella or rarely the tibial tuberosity. Unilateral patella alta compared to the uninjured knee may be observed in complete tears. An Insall–Salvati index over 1.2 is indicative of a patellar tendon tear. The gold standard in imaging of patellar tendon tears is MRI. Undulating appearance of the tendon with discontinuity at the tear site is typical for complete tears. Partial tears may appear as increased signal intensity at the patella-tendon interface and thickening of the tendon. The radiological diagnosis was made with X-rays and MRI through which we calculated Insall-Salvati index which revealed a value of 1.4 . Clinically the patient had an extensor lag on straight leg raise test and a palpable gap at inferior pole of patella along with tenderness, unable to extend the knee.

Surgical Technique:

Under spinal anaesthesia, through an anterior midline incision patella, completely ruptured patellar tendon and tibial tuberosity are exposed. The patella is lowered and the patellar tendon is approximated end to end. But after careful examination of the torn tendon it was found that the tendon was poor in quality, fragile and any repair technique to approximate the torn ends would have had poor and questionable outcome and hence a decision of reconstruction of the tendon was made intraoperatively and through the same approach the semitendinosus and gracilis are harvested as free graft . The graft is prepared using vicryl and biofibre by taking suture that enters the tendon at its tip and leaves the tendon through the side in close proximity. The suture is then passed circumferentially around the tendon, creating a 360° loop, after passing through the tendon's edge. The tendon's edge is once more penetrated by the needle from the proximal end this pattern moves distally in the same circumferential manner. The proximal and distal ends of the suture are left long to be dragged through the hole drilled in patella proximally and holding the distal end. This suture method gives the tendon both traction and constriction. A Tunnel is drilled through the patella at the centre leaving a 2-3mm distance from superior patellar pole under c-arm fluoroscopic guidance using a guidewire and a drill bit. The prepared graft is pulled through the prepared tunnel to approximate the graft up to inferior pole of patella and the pulled sutures are tied with multiple knots at the superior pole of patella. The graft is then fixed to the patella with a 10 x 35mm Interference screw to achieve osseoligamentous integration and c-arm fluoroscopy vison to confirm the position. The other end is fixed to the free end of torn patellar tendon at a length of 6cms from inferior pole of patella using 5mm anchor suture fixed at the tibial tuberosity. The remnant graft is folded proximally and sutured at the inferior pole of patella to the already fixed graft. The reconstructed tendon is reinforced by suturing any remnants of the patellar tendon to the graft using the free ends of the sutures. The distal end of the fixed graft is then sutured to the patella retinaculum both

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medially and laterally and repaired to give the strength and stability. The strength of the tendon reconstruction and patella tracking was tested by performing a range of knee movements intraoperatively.

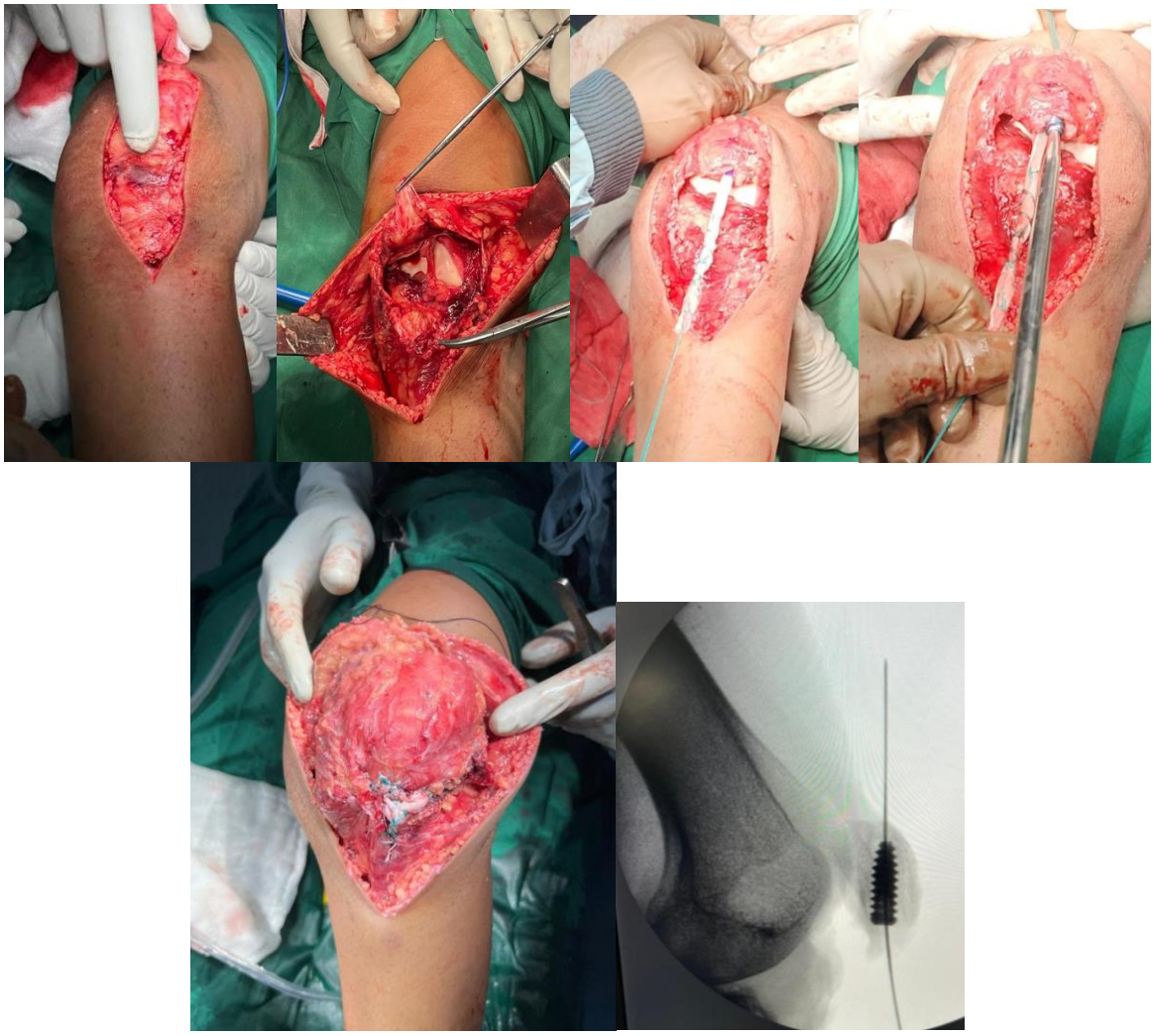

Fig 3: Intraoperative clinical and c-arm images

OUTCOME AND RESULT:

Postoperatively, the knee was immobilised in a hinged knee brace locked in extension and allowed partial weight bearing. Continuous passive knee motion was initiated from day 2. There is no standardized postoperative protocol for patients undergoing reconstruction of a patellar tendon rupture, nor is there strong evidence on best practices. However, certain steps can be taken to aid in rehabilitation and appear to lead to successful outcomes. According to Massachusetts general hospital, Brigham rehabilitation protocol for patellar tendon repairs the patient was allowed partial weight bearing with the help of crutches and a knee brace and after 6 weeks, full weight bearing and active assisted knee After 6 weeks, full weight bearing and active assisted knee mobilization was allowed. Active knee extension was allowed only after 10 weeks. Straight leg raise (SLR) was allowed after 2 weeks and quadriceps strengthening exercises were allowed after 6 weeks with gradually increasing resistance. To avoid knee stiffness and quadriceps atrophy, compliance with postoperative rehabilitation is vital to restore ROM

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and quadriceps strength. Postoperatively patient was able to actively extend the knee and 110-degree flexion was achieved at the end of 4 months.

Fig 4: Post-op x-ray

Fig 5: 4 months post op range of motion and x-ray

DISCUSSION

Patellar tendon ruptures are relatively uncommon, and reconstruction of the ruptured tendon is a must to achieve normal extensor mechanism of the knee. Direct tendon to tendon repair with suture anchors or trans-osseous sutures can be tough in a case where there is tissue retraction, and the quality of the tendon is poor as in this case. Reconstruction with semitendinosus autograft is still the most widely used method. The grafts are passed through a transverse tunnel on the patella and an oblique tunnel in the tibial tuberosity. The length of the patella and the distance between it and the tibial tuberosity must match in order to duplicate a normal patellar height.[11] But using an interference screw to fix the graft in the patella is the novel method we tried as interference screws have become one of the most commonly utilized methods of securing ACL grafts such as BPTB autografts, which are considered by many to represent the gold standard in graft fixation.[12] Bone can incorporate directly, or primarily, when fragments are compressed together without the generation of any callus. Alternatively, bone heals indirectly, or secondarily, with intermediate callus formation as a result of the local strain environment.[13] Studies have shown that graft tissue healed within the tunnels in the bone and callus growth has been noted adjacent to the graft when a graft is fixed to the bone using interference screw.[14]

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Reconstruction after a rupture presents several challenges: (1) Which kind of tendon graft should be used? (2) Where are the tunnels most advantageous to be located? (3) How can the graft be fixed? and(4) the process of regaining patella height. The graft used in this case was a hamstring graft as it is considered the most as it has biomechanical properties close to those of the native extensor apparatus.[10] The use of single longitudinal tunnel rather than horizontal tunnels have a superior hand as it mimics the anatomic footprint of the patellar tendon insertion at inferior pole of patella and optimize the patellar tracking. The use of interference screw to fix the graft has its own drawbacks of graft laceration while tightening the screw and the diameter of the screw used which is interrelated to the drilled tunnel. And the anchor suture used to fix the graft at the distal point has a disadvantage of having a single point fixation principle of the graft. These drawbacks were overcome by selecting an appropriate. screw diameter that corresponds to the tunnel diameter and suturing the distal end of the graft with the patellar retinaculum so that the graft is firmly fixed even at distal end. The other drawback of using interference screw is that the chance of graft migration proximally which was avoided by controlled drilling of the tunnel through patella and giving equal tension on both ends of the graft and holding it in place until the screw was fixed giving it a proper position. The combined use of longitudinal tunnels, appropriate graft and interference screw along with a planned rehabilitation protocol made it possible in achieving desired range of motion at an earlier stage. A good result depends on attention to detail and is a matter of millimetres. Even though interference screw fixation offers several benefits, like enabling more aggressive and early rehabilitation and early range of motion, it is an extremely harsh construction. For a successful result, meticulous attention to detail is essential. The graft harvest and preparation needs to be done cautiously so as not to fracture the patella or mismatching the tunnel drilled and the prepared graft. Good outcomes require careful consideration of the graft's location in the tunnel and caution when inserting the screws to prevent graft laceration or migration. Inadequate graft, incorrect tunnel positioning, or other technical errors cannot be made up for by fixation with any kind of hardware.

CONCLUSION

While further studies are needed to evaluate long-term outcomes and compare different surgical options, the method we used underscores the potential use of interference screw and a longitudinal tunnel in this type of reconstruction procedure. This procedure highlights the feasibility and effectiveness of fixing the ruptured patellar tendon with interference screw and using a longitudinal tunnel to position the tendon in an anatomical orientation hence regaining the patellar tendon it's natural mechanism. The use of this new technique has given it a rigid fixation and hastening the process of osteointegration of the tendon and the longitudinal tunnel offers several advantages, including sufficient strength, and favourable biomechanical properties that closely resemble the native tendon. Following surgery, the patient showed a notable improvement in knee function and stability, demonstrating the effectiveness of this surgical strategy. Our experience reaffirms the efficacy of this surgical approach and emphasizes the importance of a multidisciplinary approach involving orthopaedic surgeons and physical therapists, to achieve optimal outcomes in patients with patellar tendon injuries. It also emphasizes how crucial and careful must be the patient selection, exacting surgical skill, and thorough rehabilitation are needed to attaining successful results. Although more investigations and follow up is necessary to evaluate long-term durability and compare results with other graft alternatives, this case adds to the increasing amount of

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data that supports the use of hamstring grafts in patellar tendon reconstruction. Through disseminating our surgical approach, we aim to improve knowledge in treating this kind of injury, which will ultimately benefit patients having patellar tendon replacement surgery.

TAKE AWAY LESSON

This approach to patellar tendon reconstruction has its own set of merits which starts with the fixation of the graft to the patella in the anatomical orientation and use of interference screw to anchor the graft which had a hold in the tunnel drilled and helped in early osteointegration like in the cases of ACL reconstruction. The use of suture anchor had a single point fixation at the tuberosity end rather than a wide spread hold which has a chance of fraying and dislodging of the graft.

Though the number of follow ups being less makes it difficult to understand the integrity of the graft and long term durability along with the adverse effects of this procedure the patient had a good or to say an excellent clinical outcome in short term as compared to other techniques. Our intention of this report is to perform this technique more times and to be tested in order to compare with the older techniques for the strength and time taken to get back to the previous activities as earlier as possible without any adverse effects of the surgery performed.

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