Novel Technique to Repair Bilateral Inveterate Quadriceps Tendon Rupture

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Abstract

Quadriceps tendon rupture is quite common in adult active population. Bilateral lesion is little bit rare, and all above, is more common if related at others pathology.

A lot of technique is described in literature, anyway treatment every time is a challenge. In this case we want show a new technique to repair a bilateral inveterate quadriceps tendon rupture, in a patient with renal failure.

The technique used, described in the article, is a mix of different technique using at the same time autograft and allograft.

Power of this technique is versatility of use with different grade of lesion, with patients very compromise and also a strong construction that permit a rapid recovery.

Keywords: Novel Technique; Quadriceps; Tendon Rupture

Introduction

Statistically bilateral tendon rupture is more common in patient general compromised.

Some report advocates renal failure as first cause of bilateral rupture [1,2].

In the past different techniques were described to repair quadriceps tendon rupture. One of the important issues is to cover a gap in the tendon; all above when the lesion is not fresh and when comorbidity is present.

Some technique describes use of autograft, others allograft, there are many kinds of suture (adsorbable, non adsorbable or metallic) [5,6]. Anyway achieve a good result when you have two tendons with huge gap to repair is not easy. It could be necessary a large harvest of tendon structures or a huge allograft.

Case Report

A patient 60 years old, with renal failure is presented at our Hospital after 3 months after fallen down. Patient was in dialysis for many years, is presented in wheelchair. Visual and clinical check showed a totally rupture of bilateral quadriceps tendon with a gap valuable using 4 fingers. Patients before to fall was able walking without any help.
Technique

We put the patient in supine position using a long longitudinal approach from the upper part of patella until the lower tip of patella.

Intra-operative, we found a tendon loss of 8 cm in the left side and 5 cm in the right side (Figure 3 and 4).

Remaining tendon was attached by strongly scar to the surrounding soft tissue.

We removed scar tissue.

In the left side, semitendinosus tendon was harvested. in the middle of patella, we prepare a transverse tunnel of 6 mm of diameter. We passed the semitendinosus through the tunnel as cerclage and we fixed it on the quadriceps in the Pulverstaft manner reinforced with fiber wire stitches.

To cover remaining gap, we used a patellar tendon allograft included a part of bone.

We prepared superior pole of patella broaching 1 cm of bone in the middle. In the lateral superior part of patella, we put 2 anchors with 2 sutures (Conmed Super Revo).

*Figure 1-4: Clinical images (Figure 1 and 2) ed intra-operative images (Figure 3 and 4) of respectively right and left knee. On the left totally quadriceps tendon lesion is shown (Figure 3); on the right (Figure 4) 5 cm of tendon loss.*

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Allograft was secured fixing bony part with an Asnis 4.0 Stryker screw and using one anchor's suture for any side of the tendon. Remaining anchor suture were used to fix quadriceps tendon and allograft together. Proximally allograft was fixed with fiber wire stitches (Figure 5 and 6). We obtained a strong construct in two layers. The deep layer is autologous layer and the superficial layer is homologous. The allograft works biomechanically but also biologically as scaffold. Fixation with a bony part in the patella helps to create a sort of imbrication between bone cell and homologous scaffold.

Figure 5: Yellow: semitendinosus graft fixed in Pulverstaft manner on the quadriceps and by transverse tunnel in the patella. Orange: patellar tendon allograft above the semitendinosus autograft fixed on the quadriceps by fiber-wires stitches. Orange square: bone part of allograft wedged in the patella. Blue: Anchors to fix allograft.

Figure 6: Left side surgery completed.
On the right side considering a gap smaller than right side allograft was not used. We harvest semitendinosus and also the gracilis tendon and we repeat the same procedure passing in the transverse tunnel both tendons (Figure 7-9).

*Figure 7:* Yellow: semitendinosus and gracilis tendons graft fixed in Pulverstaft manner on the quadriceps and by tunnel in the patella. Blue: anchors sutures support.

*Figure 8:* Autograft passed in the patella tunnel.

*Figure 9:* Right side surgery completed.
Results

After surgery we put both legs in brace with fully extension for four weeks. Patient starts walking at the fifth week, increasing knee flexion every week of 30°. At the same time, he started isometric exercises.

At eighth week we removed braces and at tenth week he was able manage staircase.

Now is able walk without crutches.

Figure 10-12: Postoperative X-rays. MRI at 6 weeks after surgery. You can see new tendon reconstruct.

Figure 13: Right side surgery completed.
Discussion and Conclusion

Fresh quadriceps tendon ruptures are common in patients older than 40 years and the lesion is usually close the osteotendinous junction [5].

Usually when the lesion is fresh without tendon loss; a technique using suture passed in patella tunnels give good results [5]. Outcomes results in some literature review is good [7]. Other authors use simple anchors sutures [9].

When lesion is neglected repair is difficult. Above all because a tendon large defect could be found. Different techniques are advocated to cover the gap (Scuderi, Codivilla etc.) [5,6]. Anyway, treatment of these kind of lesions is a challenge. When lesion is bilateral, level of difficult is increased.

Bilateral tendon rupture is uncommon [1,3,4] and when happen are usually associated with systematic disorders as renal failure [1,2]. Frequently are related to high level of PTH [11] and phosphatases alkaline and low level of haemoglobin.

Therefore, when we treat bilateral inveterate quadriceps tendon loss, we have to aim for threes fundamental principles: lesion’s gap, bilateral lesion, critical health status of the patient. Some considerations need regarding our philosophy of treatment.

Our algorithm of treatment consists in three different steps related to kind of lesion. First step: fresh lesion with tendon loss less than 2 - 3 cm. Usually is enough to use reattachment of the tendon to patella using three patellar tunnels longitudinally. Sometimes we reinforced structures with anchors.

Second step: tendon loss between 2 - 3 cm and 4 - 5 cm fresh or inveterate lesion. We use autograft (semitendinosus, gracilis or both). Third step: tendon loss more than 4-5 cm fresh or inveterate lesion. In this case we use autograft and allograft.

In bilateral lesion inveterate we believe that extensor knee apparatus is the best allograft because is possible to divide it in patellar tendon and quadriceps tendon to use for both lesions. Also is possible to use bone allograft of the patella to improve fixation. Survivorship of this graft in literature is documented [10].

Other issue is creating conditions for rapid recovery in bilateral case. A strong construction could help rapid protocol of rehabilitation. Allograft and autograft in sandwich manner as in our case show a strong construct and a double point of fixation. The novelty of “sandwich technique” is the key point of the solution for lesion with a large gap. We believe that two layers of our construct is biomechanically safer and at same time is biologically more efficient. The layers built with allograft works as a sort of “scaffold” to improve the cell ingrowth.

Anyway, we reserve allograft for worst lesions for infections risk and lack of osteogenic capacity [8].

Definitely we believe that this technique is quite safe technique and in worst case is also economic.

![Figure 14](image_url)
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