MENTORS IN ORTHOPEDICS

CHRONIC QUADRICEPS RUPTURE REPAIR: CHAMBAT TECHNIQUE OR SARDINE TIN TECHNIQUE

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SUMMARY

Background: Quadriceps tendon ruptures account for less than 2% of knee extensor injuries. While acute repairs typically yield favorable outcomes, chronic ruptures—defined by a delay exceeding three weeks—present significant surgical challenges. Tendon retraction and fibrous adhesions often necessitate complex reconstruction methods, such as V-Y lengthening plasties, autografts, or allografts, which may be associated with donor site morbidity or patellar weakening.

Objective: This article describes a direct tendon reinsertion technique reinforced with a temporary metal frame to address tendon retraction in chronic injuries without the requirement for supplemental grafting.

Key Points: The procedure involves an anterior longitudinal incision and excision of fibrous tissue to expose the tendon stump. Three 2 mm transosseous tunnels are created in the patella. A 2 mm transverse pin is placed through the patella and another through the proximal tendon stump. Metal wires are looped between these pins, allowing for the gradual distal mobilization of the retracted quadriceps tendon toward the proximal patellar pole. Once positioned, reinsertion is performed using high-strength sutures through the transosseous tunnels. Postoperative management includes 45 days of immobilization in extension with progressive weight-bearing and restricted range of motion. This method utilizes standard equipment and minimizes the risk of patellar fracture by avoiding large-diameter tunnels required for graft passage.

Conclusion: This technique provides a reliable, cost-effective solution for chronic quadriceps tendon ruptures. Utilizing a metal frame for mechanical traction facilitates stable reinsertion of retracted tendons while avoiding the morbidity associated with autologous or allogeneic grafts.

KEYWORDS

Tendon Injuries; Quadriceps Muscle; Orthopedic Procedures; Reconstructive Surgical Procedures; Patella

INTRODUCTION

Quadriceps tendon ruptures are uncommon injuries of the extensor apparatus and account for fewer than 2% of knee tendon injuries.[1] As with all extensor apparatus tears, they have serious functional limitations due to the inability to lock the knee when walking. The incidence of quadriceps tendon ruptures is three times lower than that of patellar tendon ruptures.[2] Patients are usually aged over 40 years. Nearly three quarters of cases have a predisposition, whether metabolic (diabetes, chronic kidney injury, hyperparathyroidism, uremia), inflammatory (polyarthritis, tendinopathy) or due to medication use (corticosteroids, quinolines).[3],[4],[5] The rupture is usually traumatic due to eccentric contraction of the quadriceps when flexed. There have also been a few rare reports of non-traumatic ruptures.[6],[7]

Authors describe numerous techniques for repairing recent quadriceps ruptures, involving either trans osseous reinsertion or suture anchor fixation.[6],[8],[9]Surgical treatment for acute injuries is associated with excellent functional outcomes and a low failure rate of around 2%.[6],[8],[9] In contrast, chronic injuries or failed reinsertions are much more complex and there is a lack of consensus due to the retraction of the tendon and the difficulties in getting the tendon stump to reach down to the proximal patella.[11],[12],[13],[14],[15],[16],[17],[18],[19] Published articles describe techniques involving either lengthening surgery[16],[10],[12],[13]autografts [14],[15],[16] or allografts [17],[18]. We propose a direct tendon reinsertion technique reinforced with a metal frame to help lower the retracted tendon down to the proximal end of patella without the need for these other tricks.

DIAGNOSIS

Patients usually describe a history of trauma involving eccentric contraction of the quadriceps and hyperflexion. Immediate after the event there is often haemarthrosis, a visible indentation above the patella (Fig. 1) and a loss of active extension.[9],[19],[20],[21]

Figure 1: Indentation above the patella (blue arrow) indicating retraction of the tendon stump, more clearly visible in flexion.

A late diagnosis is reported in 10–50% of cases due partly to the haemarthrosis which can mask the hollow[6],[19], [22], and partly to the continued ability to lock out the knee if the rupture was only partial or if the medial and lateral retinacula are still intact. Asymmetry in active extension compared to the healthy knee is another diagnostic sign.[9],[19]

In chronic forms, patients commonly complain of anterior pain and instability when walking on sloped ground. A physical examination will reveal a loss of active extension and a indentation above the patella.

IMAGING

A strict lateral x-ray will help the diagnosis by revealing signs of pre-existing tendinopathy or a low-riding baja[6] The existence of a suprapatellar mass will sometimes indicate and help evaluate the tendon retraction (Fig. 2).

Figure 2: Lateral x-ray revealing a low-riding patella and retraction of the tendon (blue arrow).

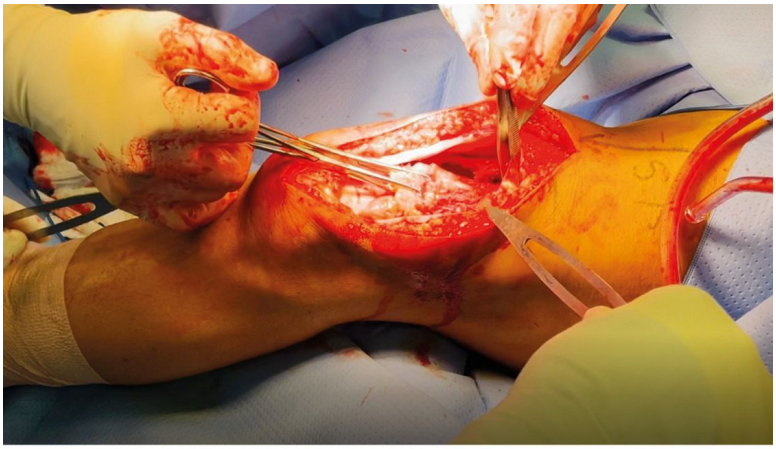
If there is any doubt, ultrasonography can be used to confirm the diagnosis and the extent of the retraction. [23]Likewise, an MRI can evaluate the extent of the retraction and any associated fatty atrophy of quadriceps.[13], [21],[24]

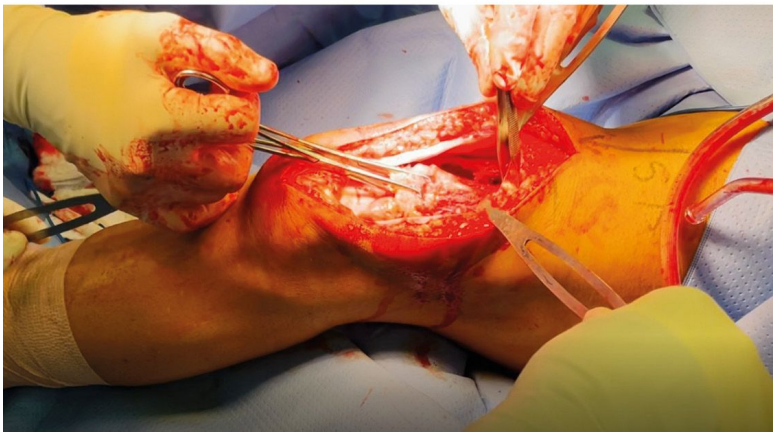
SURGICAL TECHNIQUE

The surgery is performed under general or spinal anaesthesia. The patient is placed in a supine position with a pneumatic tourniquet at the proximal end of the thigh. A counter-support is placed against the lateral thigh and a knee bar used to position the knee at 90° flexion. A second bar can be placed more distally to flex the knee to about 30° and make the skin closure easier at the end of the operation without placing excessive strain on the repaired tendon (Figs. 3 and 4). In fact, the retraction of the tendon usually means that flexing the joint will pull on the sutures at the end of the procedure.

Figures 3 and 4: Patient set-up using two bars to adjust flexion between 30° and 90°.

A 10–15 cm anterior longitudinal incision is made, centred over the proximal end of patella. The subcutaneous layers are opened. The adhesions are cut to expose and then strip the proximal and distal ends of the quadriceps tendon (Figures 5 and 6).





Figures 5 and 6: Excision of fibrous tissue and exposure of the tendon stump.

Three 2 mm longitudinal trans osseous tunnels are created at the patella between the proximal end and anterior face. Two or three large calibre sutures (e.g. Fiberwire® no. 2 (Arthrex®) or Mersuture® no. 3 (Ethicon®) are then passed over the anterior face of patella for later use. The procedure is then repeated for the quadriceps stump (Figure 7).

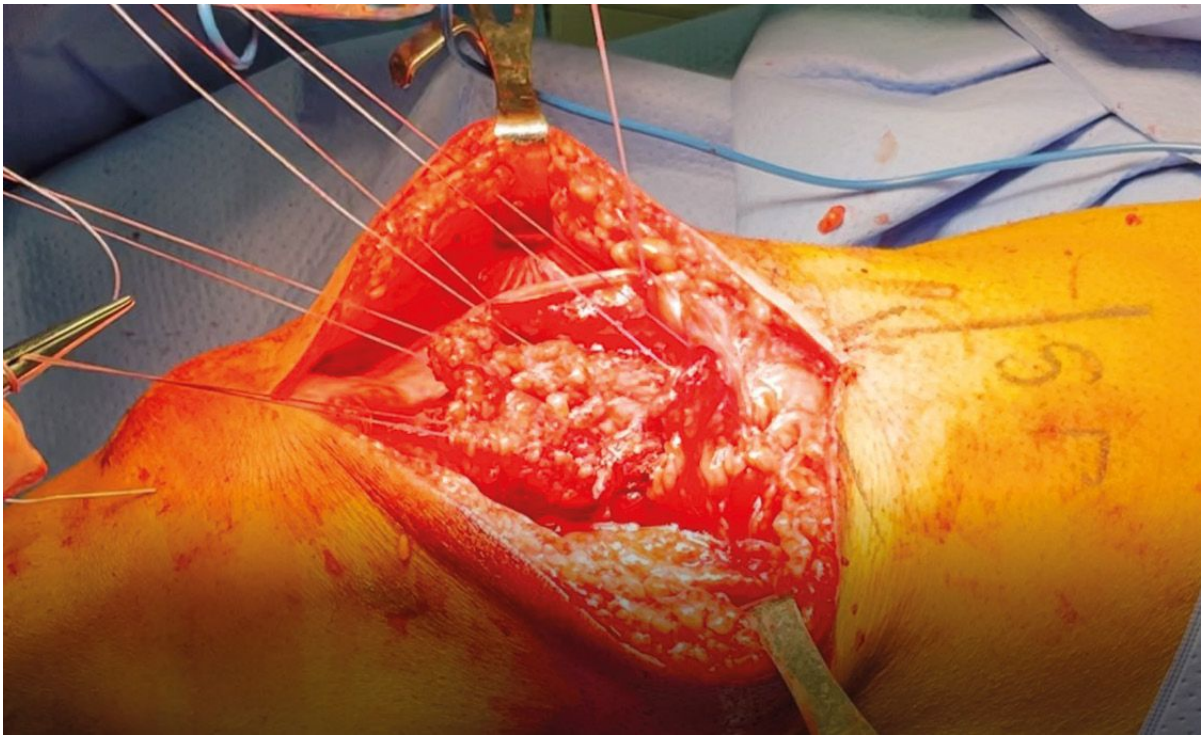


Figure 7: Suture of the tendon stump.

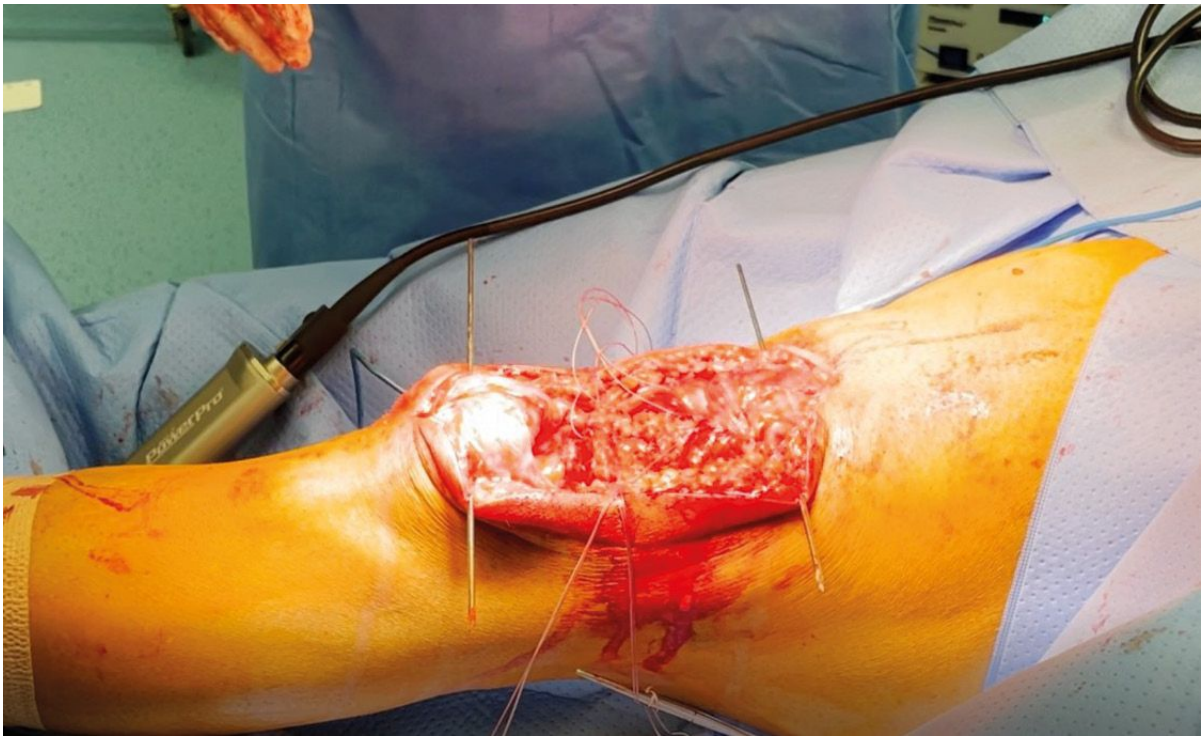


Figure 8: Pins through the proximal end of patella and the tendon stump.

Two 2 mm pins are placed crosswise, one through the patella 2 cm beneath the proximal end, the other through the proximal stump of quadriceps tendon about 2 cm from the tear. The two pins are cut and their ends bent over. Two 2 mm metal wires are then passed in a loop through the ends of the pins. The knee is placed in extension and the retracted stump of quadriceps tendon is gradually moved down towards the proximal end of patella by pulling on the two metal wires (Figure 9).

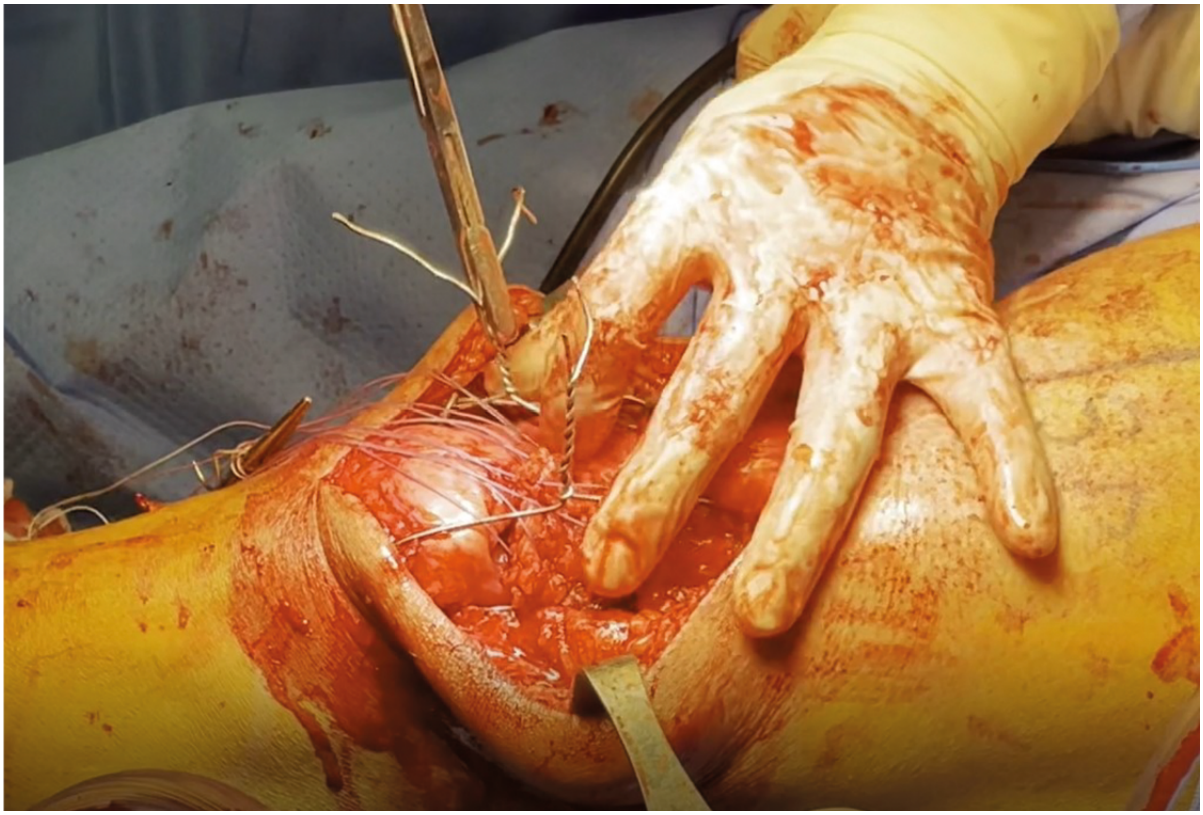


Figure 9: Tightening the metal wires to lower the stump down to the upper end of patella.

Once the two stumps of the tendon are touching, the pre-prepared Fiberwire® or Mersuture® sutures from the proximal end of patella are passed through the proximal tendon stump and knotted together (Fig. 10). The procedure is completed with edge-to-edge repair of the tendon using continuous sutures and Polysorb® no. 2 (Covidien®). Stability is then tested by gradually flexing the knee. The final stage is closure of the subcutaneous and skin layers.

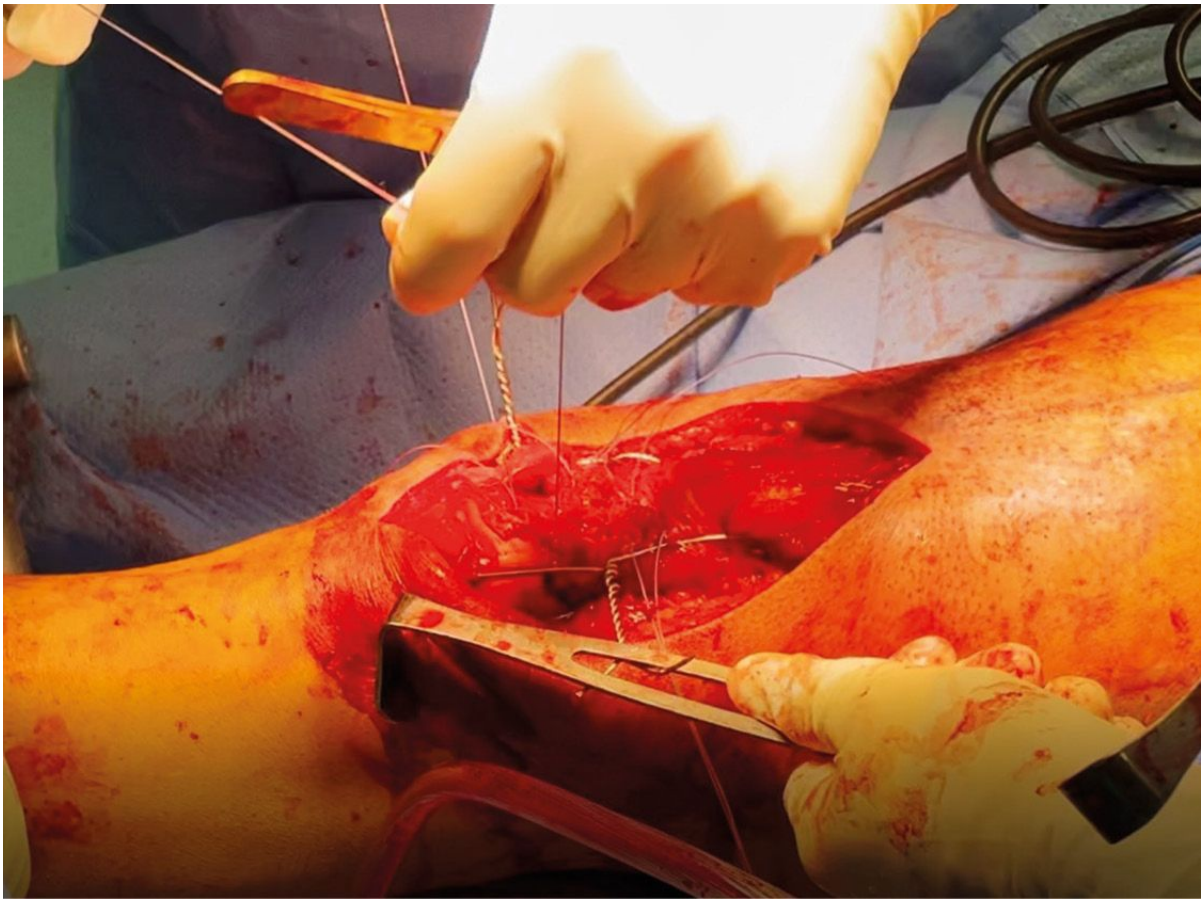


Figure 10: Suturing the tendon to the upper edge of patella.

POST-OPERATIVE RECOVERY

The leg is immobilised in extension for 45 days using a straight brace. Preventive anticoagulant therapy is given until removal of the brace and the patient can walk fully.

Patients are allowed to stand and bear full weight on the leg, provided they wear the brace for protection, from the very first day. Physiotherapy can begin immediately, involving isometric quadriceps movements and gradual recovery of joint range of motion. Flexion is restricted to 30° for the first three weeks, then to 60° for the next three weeks.

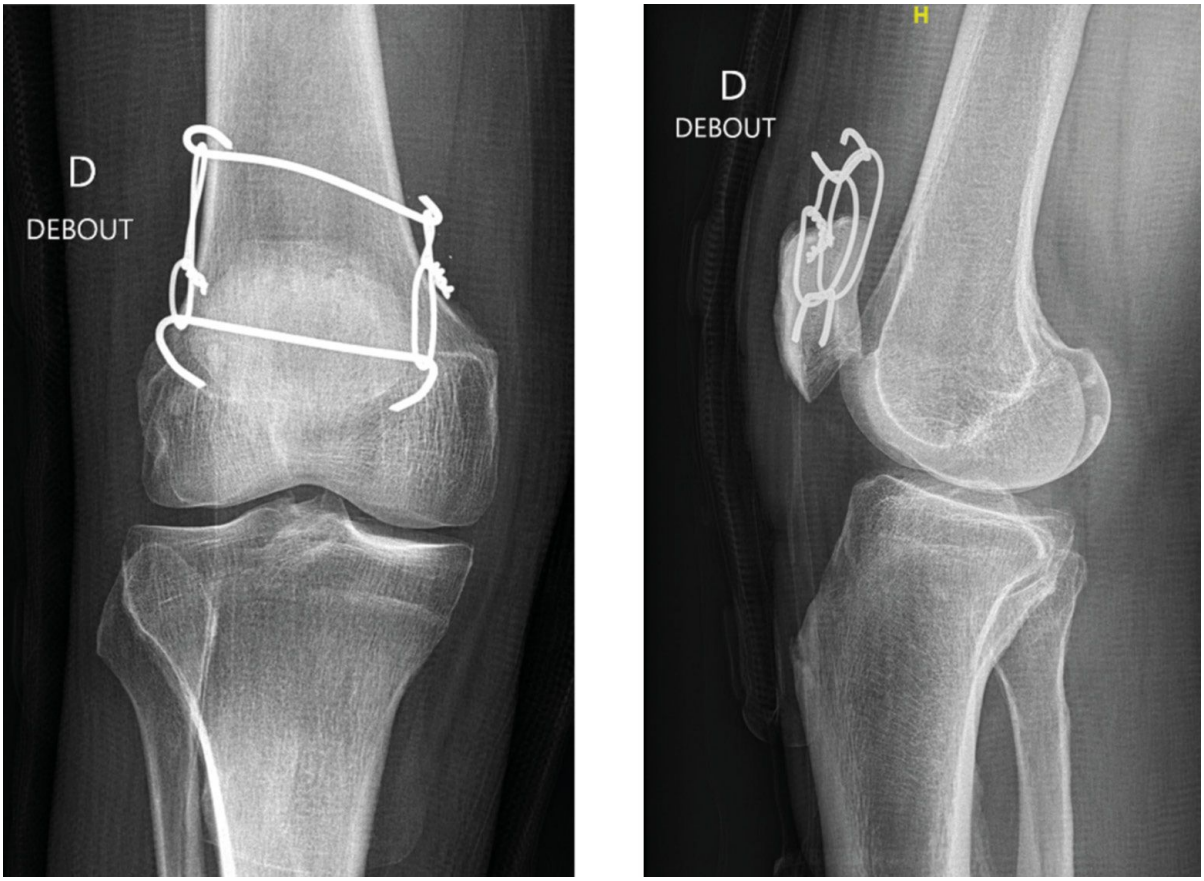


Figure 11: Postoperative x-rays.

DISCUSSION

The time between injury and surgery appears to be a determining factor in the functional outcomes of quadriceps tendon repair. Scuderi10 reports inferior results when there was a 72-hour delay or longer after the trauma. Likewise, Rougraff [25] describes better functional outcomes and higher patient satisfaction for repairs performed within seven days of the rupture. Elattar26 believes the delay should be capped at 2–3 weeks to guarantee an optimum result. We therefore believe that if more than three weeks have passed since the trauma, the suture should be reinforced with a metal structure.

Numerous techniques have been described for repairing chronic quadriceps tendon ruptures, but the series all have small populations. [12],[13],[14],[15],[16],[17],[18],[27]

Some authors suggest direct suturing [27]if there is minimal tendon retraction and the stump can still be drawn down towards the patella. Medial and lateral retinacular release can make this easier. If there would be too much pulling on the sutures or there is a defect making it impossible for the tendon stump to reach the proximal end of patella, other authors propose a stretching V plasty [1],[10],[11] or a lengthening V-Y plasty [6],[12]. However, Siwek et al. report only a 50% success rate using the Codivilla V-Y lengthening technique. [6] Thanks to the pins placed in the tendon stump and proximal end of patella, our technique not only makes it possible to gently and easily lower the tendon down to the patella, but also to obtain a solid primary fixation that protects the reinserted tendon until it has healed. In addition, proximal anchoring using a pin through the proximal stump of quadriceps provides a secure repair, despite the absence of transosseus fixation. In fact, we have experienced no secondary mobilisation of the proximal pin.

If the tendon is severely retracted, some authors suggest using additional support from an autograft or allograft. Leopardi [14] reports one case using an ipsilateral hamstring graft. Others suggest strengthening the repair by harvesting both the left and right hamstrings. The disadvantage of these techniques is the graft-related morbidity. In addition, the need to make tunnels at least 5mm wide in the patella through which to insert these grafts creates the risk of a secondary fracture. Finally, some have suggested supporting the repairs using an allograft harvested from the anterior tibial or Achilles tendon. [17],[18] As with the other autograft techniques, they require the use of tunnels that could potentially weaken the patella. In addition, there may be geographic or economic restrictions on the ability to use allografts. Our proposed technique avoids the need for a reinforcement graft, minimises the risk of patellar weakening thanks to smaller trans osseous tunnels and is readily available because it requires no special equipment.

CONCLUSION

Chronic quadriceps tendon ruptures are rare and there is no consensus over the correct surgical management. The Chambat or sardine tin procedure that we describe is a reliable and simple technique. Trans quadriceps tendon pins provide mechanical stability making it easy to lower the tendon stump to the proximal end of patella and secure the reinsertion, even if the tendon has retracted. They avoid the need for reinforcement autografts which have a non-negligible morbidity. It is a cost-effective technique using equipment available at all operating theatres, unlike the autograft technique.

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