



Endoscopic SpeedBridge Procedure for the Treatment for Insertional Achilles Tendinopathy: The Snake Technique

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Abstract: Surgical treatment of insertional Achilles tendinopathy is indicated in case of failure of conservative therapy. A choice is then made within a large spectrum of procedures from minimally invasive techniques such as endoscopic calcaneoplasty to more invasive procedures, such as dorsal closing wedge calcaneal osteotomy. Isolated calcaneoplasties can lead to poor results in cases of pre-existing Achilles tendon lesions; in these cases the tendon disinsertion is justified. In this context, we describe an endoscopic treatment of insertional Achilles tendinopathy.

Insertional Achilles tendinopathy, often wrongly labeled Haglund disease, is rarely limited to bone impingement.¹ Surgical treatment is only considered if conservative treatment has failed after 6 months.² Open treatment is based on an extensive posterior approach, excision of the degenerative and ossified tendon tissue, wide bursectomy, bone resection of the posterior superior calcaneal protuberance, and tendon reinsertion.² Witt and Hyer³ described a knotless reinsertion technique with anchors, derived from shoulder surgery, named calcaneal SpeedBridge. However, open techniques have risks of complications ranging from 6% to 30%, those being predominantly skin healing problems.^{2,4-6}

In this context, mini-invasive techniques have been developed but they are mainly limited to bone resection.⁷ In cases of pre-existing Achilles tendon lesions, a combined tendon procedure is indicated for better outcomes²; however, only a few authors have described an endoscopic calcaneoplasty combined with a tendon procedure.⁸⁻¹⁰ This Technical Note presents an endoscopic calcaneoplasty combined with the SpeedBridge suture (Arthrex, Naples, FL) for the treatment of insertional Achilles tendinopathy.

Surgical Technique (With Video Illustration)

This Technical Note presents an endoscopic SpeedBridge technique for the treatment of insertional Achilles tendinopathy, also known as the “snake technique” (Video 1). The technique consists of 8 steps (Table 1). Pearls and pitfalls of this technique are described in Table 2.

Patient Setup

The patient, under general anesthesia, is placed in a prone position, with the feet protruding from the operating table. The operated foot is placed in a neutral position. To ease the work around the calcaneus, the contralateral lower limb is placed in a lower position. A tourniquet is positioned at the root of the thigh.

The order in which the 6 portals are performed results in a snake-shaped approach (Fig 1). Steps number 2, 3, and 4 are performed in the pretendinous space, whereas steps 5 through 8 are performed at the retrotendinous level (Fig 2).

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Table 1. Surgical Steps and Their Respective Arthroscopic Portals

Step	Action	Workspace	Arthroscope in the Approach Number
2	Calcaneoplasty	Pretendinous	1, 2, and 3
3	Disinsertion and debridement of the Achilles tendon		3 and 4
4	First-row anchors		5 and 6
5	Subcutaneous preparation/bursectomy	Retrotendinous	5 and 6
6	Preparing the second row		3 and 4
7	Intratendinous passage of the tapes		5 and 6
8	Second-row anchors		5 and 6

Step 1: Endoscopic Portals

Six endoscopic portals are performed consecutively, starting with the superior-lateral portal at the level of the tip of the fibula and just lateral to Achilles tendon (described by Van Dijk et al.¹¹); then, the superior-medial at the same level of the previous one, on the medial side of the tendon, and so on, in a S-shaped sequence (snake technique), as represented in Fig 1.

Step 2: Posterosuperior Tuberosity Resection of the Calcaneus or Calcaneoplasty

A posterior arthroscopy is performed. Two approaches are used, one superior-lateral (portal 1) and the other symmetrically medial (portal 2). Calcaneus posterosuperior tuberosity resection requires 2 additional distal approaches.

A 4-mm 30° arthroscope is introduced through the portal number 1 toward the first commissure, and a 5.5-mm shaver (Arthrex) is introduced through the portal 2 perpendicularly so as not to take any risk to

the posterior tibial neurovascular pedicle. The posteromedial and upper lateral borders of the calcaneus are then delimited.

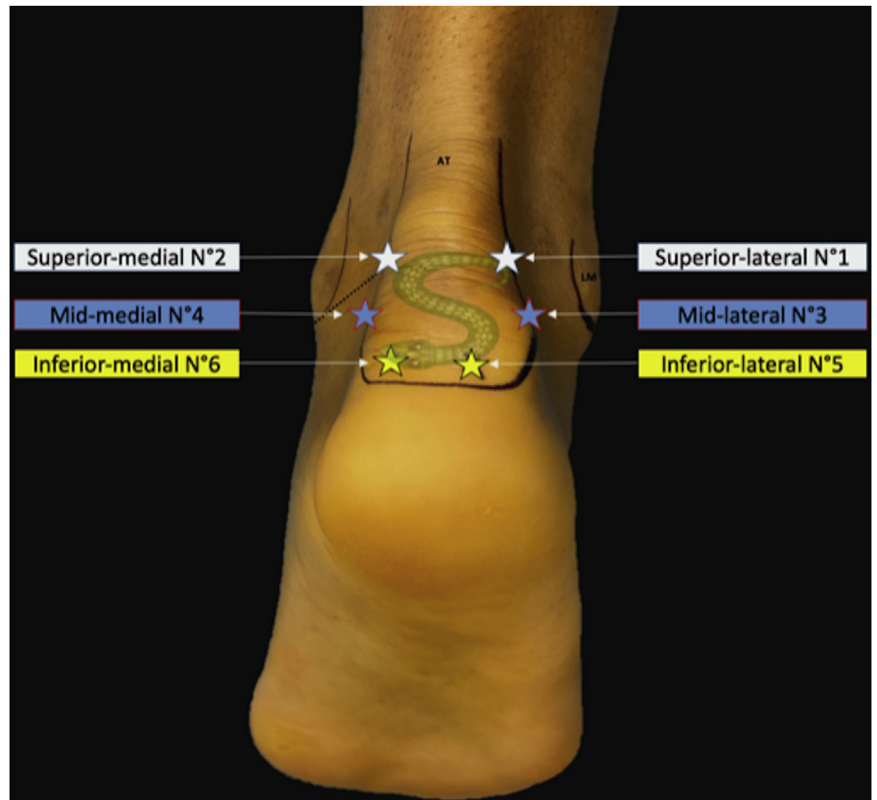
Resection is started with a 4 mm-burr (Arthrex) on the posteromedial corner (Fig 3A). When the resection work is restricted by the skin incision, a mid-medial incision (portal number 3) is marked with a needle (Fig 3B) to provide an overall view of the tuberosity resection to be performed and the tendon insertion zone.

The resection is then continued on the medial border from bottom to top until the Achilles tendon insertion and its reflection point on the calcaneus (Fig 3C). The arthroscope is passed through the portal number 3 and a mid-lateral portal (portal number 4) is located with the needle by transillumination. Lateral bone resection is performed in the same manner from bottom to top until the Achilles tendon insertion. The posterosuperior tuberosity bone resection of the calcaneus is then completed.

Table 2. Technique's Pearls and Pitfalls

Step	Pearls	Pitfalls
1. Endoscopic portals	Portals number 1 and 2 according to Van Dijk et al.'s ¹¹ external benchmarks. Portals number 3, 4, 5, and 6 performed under endoscopic control.	If portals number 3 and 4 are too high, it is harder to achieve complete resection of the posterosuperior tuberosity.
2. Posterosuperior tuberosity resection of the calcaneus or calcaneoplasty	Major resection down to the tendon insertion. Foot in equinus positioning to ensure that the tendon is exposed in its full extension.	Minor resections do not go down to the tendon insertion may limit the technique.
3. Disinsertion and debridement of the Achilles tendon	Wide debridement for easy passage. Resection of the enthesophyte.	
4. Placing the first-row anchors	First row of anchors at 1 cm from the distal insertion of the Achilles tendon. Perpendicular to the resection surface.	This will avoid 2 anchors too close to each other or too proximal.
5. Subcutaneous preparation and bursectomy	A 3.5-mm shaver debriding in the tendon direction up to the portals number 1, 2, 3, and 4.	If the shaving is directed toward the skin, there is a risk of necrosis.
6. Placing the second-row anchors	Second-row placement exactly on the distal insertion of the tendon.	
7. Intratendinous sutures	Scopic supra-tendon control for a good control of tissue uptake. Can be done with a Scorpion suture passer (Arthrex, Naples, FL) as in rotator cuff ruptures.	Sutures passing too close to each other or too proximal.
8. SpeedBridge	The foot is positioned in equinus to perfectly apply the SpeedBridge.	If the foot is misplaced, this can compromise the exposure of the work area and the application of the SpeedBridge.

Fig 1. Arthroscopic portals. Posterior view of right ankle. White stars: lateral and medial superior portals; blue stars: lateral and medial mid-portals; yellow stars: lateral and medial inferior portals. (AT, Achilles tendon; LM, lateral meniscus.)



Step 3: Disinsertion and Debridement of the Achilles Tendon

With the arthroscope still in the mid-medial portal (portal number 3), the inferior-lateral portal (portal

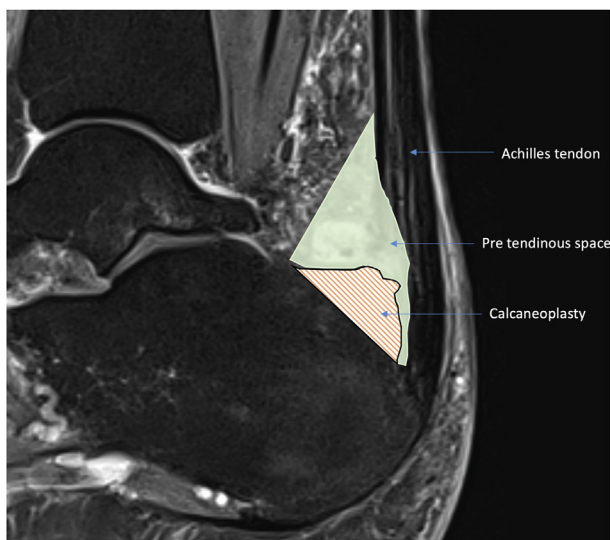


Fig 2. Workspace relationships. Magnetic resonance imaging of the ankle, sagittal view, showing the relationship amongst the Achilles tendon, the retrotendinous space, and the bone region to be resected.

number 5) is located with the needle by transillumination (Fig 4A). The inferior lateral portion of the Achilles tendon is disinserted using the scalpel (Fig 4B).

The shaver is introduced through the inferior-lateral portal (portal number 5) and the disinserted hemitendon is debrided (Fig 4C). In case of calcifications, these are easily identified at this stage and excised with the shaver.

The arthroscope is then positioned in the mid-lateral portal (number 4) and symmetrically the inferior-medial portal (portal number 6) is performed. The medial hemitendon is sectioned and then debrided with the shaver.

Step 4: Placing the First-Row Anchors

The arthroscope is placed in the distal portals (portals number 5 and 6) to provide a global view of the bone area resection. Via mid-medial and mid-lateral portals (portals number 3 and 4), the pre-hole on the first row is made 1 cm proximal to the native tendon insertion with the 3.5-mm drill. The holes are finalized with the ancillary before the two 4.75-mm SwiveLock anchors (Arthrex) are inserted (Fig 5). In each anchor, a FiberTape strip (Arthrex) is inserted in its eyelet. The infratendinous and bony step is then completed with the insertion of the tapes in the first row.

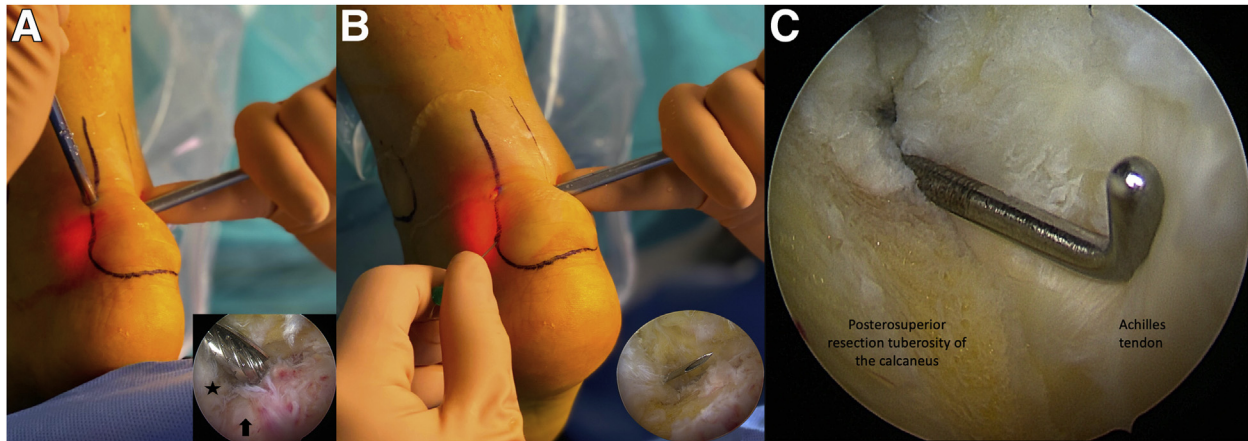


Fig 3. Calcaneoplasty. (A) External view. A 4-mm 30° arthroscope is introduced through the portal number 1 toward the first commissure, and the 5.5-mm shaver (Arthrex) is introduced through the portal 2 perpendicularly (black star: 4 mm-burr; Arthrex; black arrow: posterosuperior tuberosity of the calcaneus). (B) External view. Mid-medial incision (portal number 3) is marked with a needle when the resection work is restricted by the height of the skin incision. (C) Arthroscopic view. Bone resection on the medial border from bottom to top until the Achilles tendon insertion and its reflection point on the calcaneus.

Step 5: Subcutaneous Preparation and Bursectomy

At this moment, the workspace is the retrotendinous space (Fig 6). The arthroscope blunt-tipped trocar is used to prepare the retrotendinous space using distal portals (portals number 5 and 6) alternately. The arthroscope is placed in the inferior-medial portal (portal number 6) and a 3-mm shaver (Arthrex) is introduced through inferior-lateral portal (portal number 5). Bursitis adherent to the subcutaneous plane is visualized at this moment (Fig 7A). The shaver blade is turned toward the tendon to avoid damage to the subcutaneous tissue.

The bursitis is resected from proximal to distal. At this point, communication must be obtained between the retro and pre-tendon space at the most distal part (Fig 7B).

Step 6: Placing the Second-Row Anchors

The image of the disinsertion of the calcaneal tendon through the distal portals, after obtaining communication between the retro and pre-tendinous space, resembles to be a true rupture of the rotator cuff (Fig 7B). With the arthroscope placed in the mid-medial portal (portal number 3), the hole for the lateral anchor on the second row is made through the inferior-lateral portal (portal number 5) in the same manner as for the first row.

The arthroscope is then changed to the mid-lateral portal (portal number 4), and the hole for the medial anchor on the second row is made symmetrically through the inferior-medial portal (portal number 6).

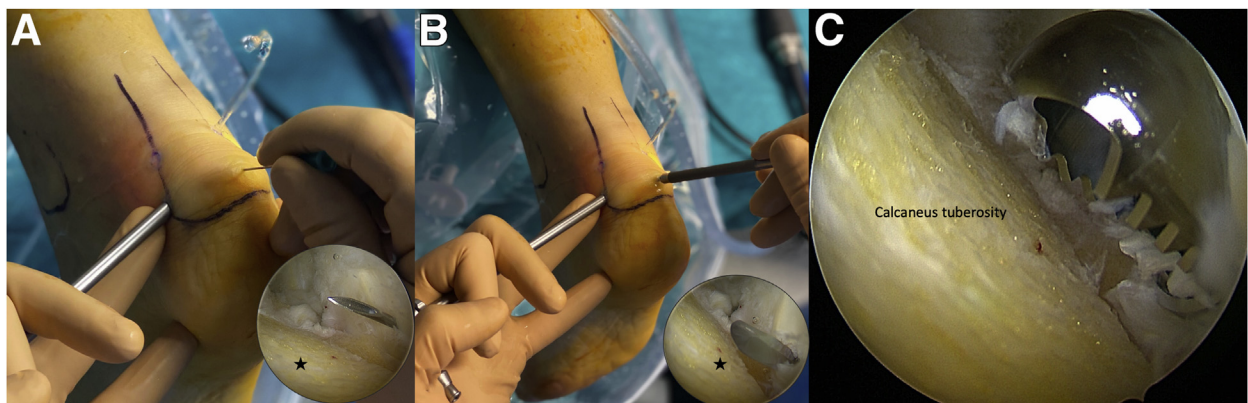


Fig 4. Disinsertion and debridement of the Achilles tendon. (A) External view and arthroscopic view: Inferior-lateral portal (portal number 5) is located with the needle by transillumination. (B) External view and arthroscopic view: Inferior lateral portion of the Achilles tendon is disinserted using the beaver. (C) The shaver introduced through the inferior-lateral portal (portal number 5) for the debridement of the disinserted hemi-tendon (black star: posterosuperior tuberosity resection of the calcaneus).

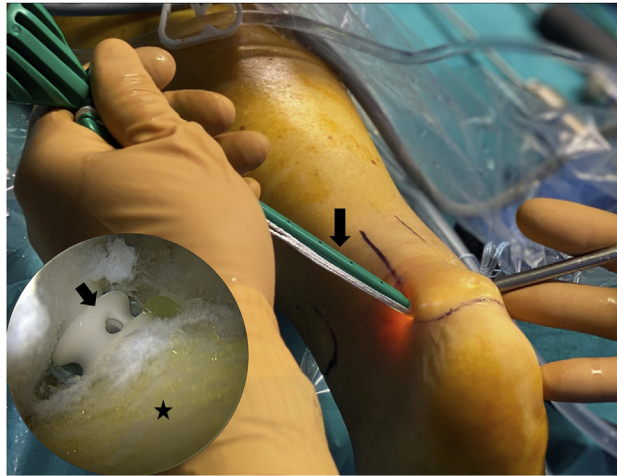


Fig 5. First row anchors. External and arthroscopic view: arthroscope is inferior-medial portal (portals number 6) and the SwiveLock anchors (Arthrex) (black arrow) placed in the inferior-lateral portal (portal number 5). (black star: posterosuperior tuberosity resection of the calcaneus).

Step 7: Intratendinous Sutures

At this point, the sutures of the first row come out through mid-lateral and mid-medial portals (portals number 3 and 4) without passing through the tendon. For the intratendinous suture passage, a Banana SutureLasso (Arthrex) with a large curvature is used. The arthroscope placed in the inferior-medial portal (portal number 6) in the retro-tendinous space allows the passage of the Banana SutureLasso (Arthrex) (inserted through the superior-lateral portal – portal number 1) through the Achilles tendon (Fig 8 A-C). By passing the arthroscope through the pretendon space, the looped suture deployed by the Banana SutureLasso (Arthrex) and the tapes of the lateral anchor of the first row are recovered and removed through the inferior-lateral portal (portal number 5) using a suture

retriever (Fig 8D). The tapes are placed in the looped suture and towed with the Banana SutureLasso (Arthrex) in the superior-lateral portal (portal number 1) (Fig 8E). The same procedure is used to remove the tapes from the medial anchor of the first row through the superior-medial portal (portal number 2). The intratendinous tapes then come out through proximal portals (portal number 1 and 2) (Fig 8F).

Step 8: SpeedBridge

With the arthroscope placed in the inferior-medial (portal number 6), a suture of each anchor is recovered through the inferior-lateral portal (portal number 5). These are loaded onto a 4.75-mm SwiveLock anchor (Arthrex) to form the second row. The first 2 sutures are then tensioned.

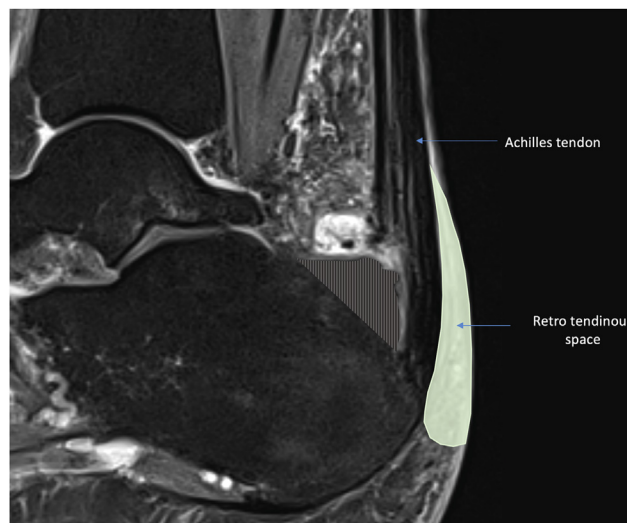


Fig 6. Workspace for bursectomy. Magnetic resonance imaging of the ankle, sagittal view, showing the relationship between the retro-tendinous space and the Achilles tendon.

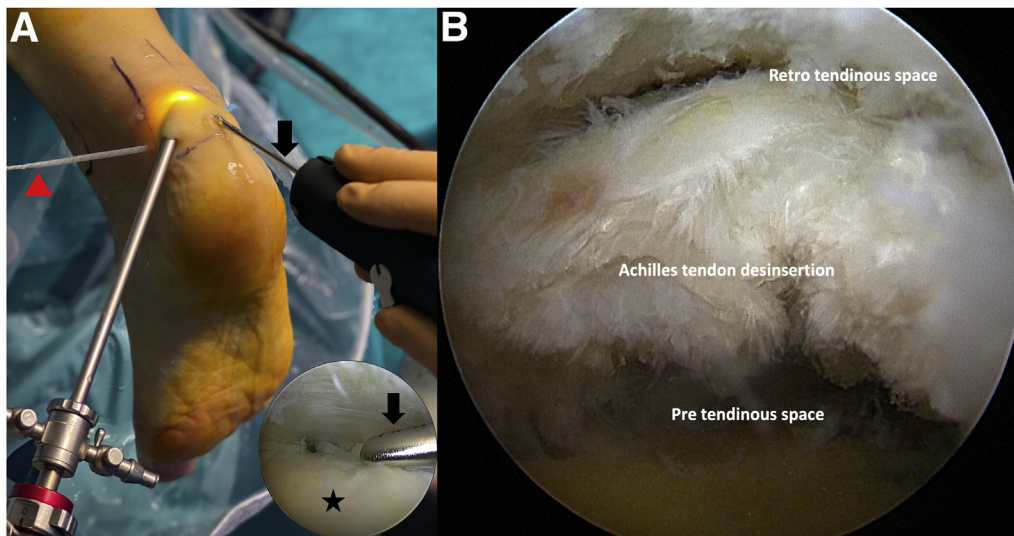


Fig 7. Bursectomy. (A) External view. The arthroscope in the inferior-medial portal (portal number 6) and a 3-mm shaver (Arthrex) in the inferior-lateral portal (portal number 5). The shaver blade (black arrow) turned towards the tendon. (B) Arthroscopic view. Communication between the retro- and pre-tendon space. (red triangle: first row anchors sutures; black arrow: 3 mm shaver; black star: superficial part of the Achilles tendon).

The same procedure is performed by reversing the tracks to position the second anchor of the second row. The result is the SpeedBridge (Fig 9). Fig 10 presents the final skin incisions aspect.

Postoperative Protocol

Surgery is performed on an outpatient basis. A preventive anticoagulation is put in place for 3 weeks.

Walking is authorized immediately with full weight-bearing with a functional walking boot. Physiotherapy is resumed after 2 weeks for the rapid recovery of joint mobility in passive and then active positions.

Discussion

This Technical Note presents an arthroscopic technique for the management of insertional Achilles

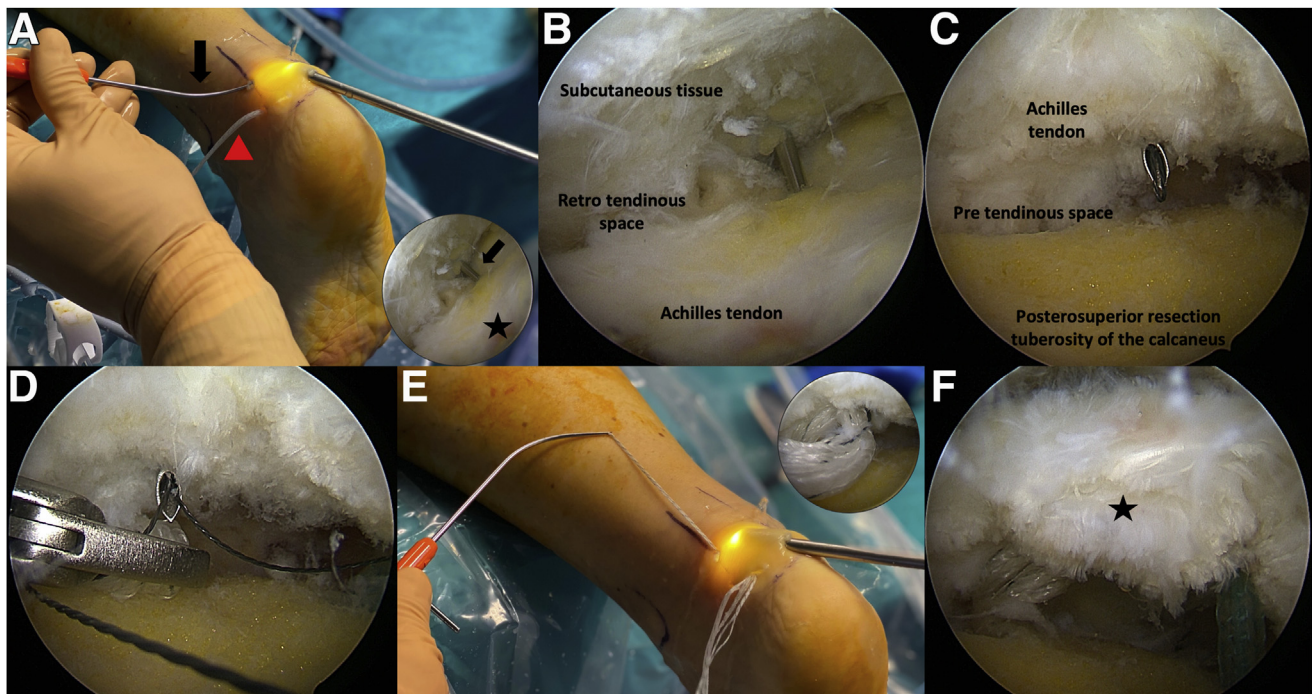


Fig 8. Intratendinous sutures. (A) External view (red triangle: suture tape of the first-row anchors; black arrow: banana SutureLasso; black star: superficial part of Achilles tendon). (B) Arthroscopic view. (C) Arthroscopic view. (D) Arthroscopic view. (E) External view. (F) Arthroscopic view (black star: distal part of disinsertion Achilles tendon).

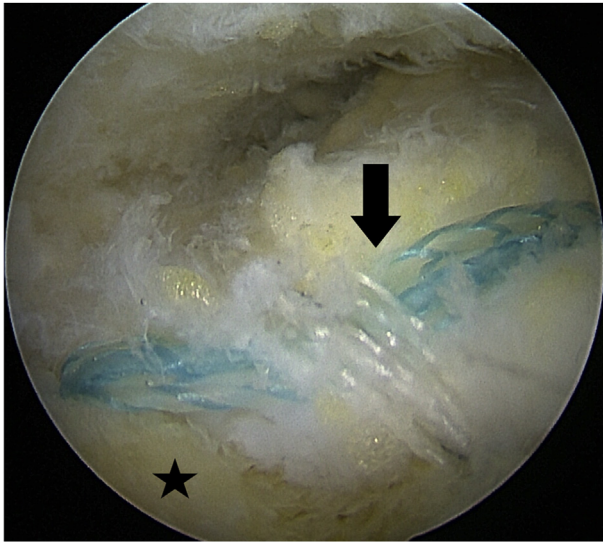


Fig 9. SpeedBridge (arrow). Arthroscopic view of the final aspect of the SpeedBridge procedure (star: distal part of the calcaneoplasty).

tendinopathy with calcaneoplasty, resection of retrocalcaneal and subcutaneous bursitis, debridement and reinsertion of an insertion tendinopathy using a double-row technique whose biomechanical interest is well demonstrated.^{12,13} We have named this technique



Fig 10. Skin incisions, final aspect.

the “Snake technique” in reference to the “S” formed by the order in which the 6 portals are performed.¹⁴

Most insertional Achilles tendinopathy is related to mixed forms with tendinopathy associated with elements of retrocalcaneal conflict. However, most often, for the sake of simplicity, only a bony gesture is performed¹⁵ to treat the bone–tendon conflict but leading to poor results and residual pain inherent to neglected insertion tendinopathy.¹

This technique is a suitable solution for the complete management of these lesions (bone and tendon); however, a greater learning curve is required in comparison to the open technique.

In summary, in cases of pre-existing Achilles tendon lesions, a combined tendon–bone–soft tissues gesture is indicated for better outcomes. This procedure can be considered an effective and minimally invasive option in the arsenal of insertional Achilles tendinopathy treatment.

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