

Anterolateral Arthroscopic Posterior Subtalar Arthrodesis: The Surgical Technique



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Abstract: The effectiveness of subtalar arthrodesis has been well documented in treating degenerative subtalar joint disease. The arthroscopic subtalar approach for arthrodesis has also been proved to give excellent results in terms of bone fusion rates and reduction of wound-related pain and complications. To date, the main concerns about arthroscopy have regarded incision-related neurologic complications such as lesions of the tibial, fibular, and sural nerves. In this context, we present a 2-portal lateral (anterior and middle) approach to arthroscopic subtalar arthrodesis, recently documented in the literature, that provides similar excellent access to the joint with a lower risk of nerve damage.

Arthroscopy of the subtalar joint has been described by Parisien and Vangsnæs,¹ whereas in 1994 Tasto first reported arthroscopic subtalar arthrodesis (ASA).² Subsequent studies have consistently shown that the arthroscopic approach to the posterior subtalar joint leads to a high fusion rate associated with a lower complication rate than open surgery. In the current literature, 2 approaches have been classically described: a 2-portal³ or 3-portal⁴ posterior approach and an approach using 2 anterolateral portals plus a third posterolateral portal (for joint distraction),⁵ with a related risk of lesions of the peroneal and sural nerves⁵ for the former and of the tibial or sural nerve for the latter.⁶

In this context we present a 2-portal lateral (anterior and middle) approach for ASA named ALAPSTA (anterolateral arthroscopic posterior subtalar arthrodesis), recently proposed by Lintz et al.⁷ and consisting of 2 anterolateral portals (anterior and middle) without the need for an accessory third portal, keeping all the advantages of arthroscopy but reducing the risk of a

neurologic lesion. This approach is indicated in patients diagnosed with primary or secondary subtalar arthritis who complain of hindfoot pain exacerbated by weight bearing and walking on uneven ground and present (not systematically) with swelling and stiffness of the subtalar joint on physical examination. Weight-bearing plain radiographs or computed tomography (PedCat; Curve-Beam, Warrington, PA) is usually performed to confirm the diagnosis and to characterize the stage of arthritis. As for other kinds of ASA, this procedure is rarely contraindicated, as in the case of important hindfoot malalignment, significant bone loss, or revision for previous nonunion requiring autologous grafting.

Surgical Technique

Patient Positioning and Landmarks

The patient is placed in the lateral position on the operating table under general or locoregional anesthesia, and a well-padded high-thigh tourniquet is inflated (Video 1). The position may also be supine with a pad positioned under the homolateral gluteus maximus muscle to obtain lower-limb internal rotation.

The main skin landmarks are identified as the peroneal malleolus, the base of the fifth metatarsal bone, and the anterior process of the calcaneus corresponding to the floor of the sinus tarsi. The calcaneocuboid joint and the sural nerve trajectory can be considered additional landmarks (Fig 1). A “soft point” (sinus tarsi lateral projection) and the superficial peroneal nerve trajectory (if seen through the skin) are also marked. By introducing a posteriorly oriented needle in the sinus tarsi, 10 to 15 mL of 0.9% saline solution is injected.

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Fig 1. External anatomy of portal placement during arthroscopic left posterior subtalar arthrodesis. The main landmarks are identified as the lateral malleolus (1), the base of the fifth metatarsal bone (2), the sinus tarsi (3), the calcaneocuboid joint (4), and the sural nerve skin projection (5). The anatomic locations of the subtalar arthroscopy portals are also marked (6 and 7).

The consequent slight forefoot dorsiflexion and adduction confirm the correct position of the needle (Video 1).

Arthroscopic Technique

First, a posterior (or middle) portal is placed 1 to 5 mm distal to the malleolar tip—the posterior limit of the 4- to 5-mm horizontal incision corresponding to the vertical projection of the malleolar tip along the axis of the fibula (Fig 1). This is followed by blunt dissection of the subcutaneous tissue and the extensor retinaculum by use of a Halsted mosquito clamp parallel to the main posterior subtalar joint axis and perpendicular to the tibia. The saline solution evacuation confirms that the arthrotomy has been correctly performed.

An arthroscopic sheath and blunt obturator are then introduced and slightly moved back and forth to create an adequate working chamber. The obturator is removed, and a 4.0-mm 30° arthroscope (Dyonics; Smith & Nephew, Andover, MA) is positioned (hydraulic pump at 50 mm Hg of pressure) (Video 1).

The second more anterior portal is placed with the help of a guide needle under direct endoscopic vision (Fig 2). The 5-mm incision is positioned in the anteroposterior quarter of the sinus tarsi and parallel to the sole of the foot—on a line that we call the “equator” of the sinus tarsi. The subcutaneous tissues are addressed in the manner previously described, and a 4.5-mm arthroscopic synovial resector (Smith & Nephew) is introduced to prepare the subtalar joint (Video 1). After a careful synovectomy and debridement of the fibrous scar tissue, the anterior aspect of the posterior subtalar joint and the talus superiorly, calcaneus inferiorly, and sinus tarsi ligament anterolaterally may be visualized.

Arthrodesis Technique

Joint debridement is usually performed with a 4-mm arthroscopic burr, starting at the anterolateral angle and

realizing 180° rotation movements from lateral to medial. Thereafter, the burr is placed medially to remove cartilage from half of the joint (movements from medial to lateral) and again laterally to continue the resection along the lateral joint aspect up to the posterior area (Fig 3, Video 1). The shaver shield protects the peroneal tendons and the calcaneofibular ligament.

Because of the absence of external distraction and given the physiological posteromedial joint surface curvature, we use a rigid curette (better if curved) to complete the debridement (Fig 3). The flexor hallucis longus tendon lies behind the talar posteromedial process, so it should be used as the posterior limit in the resection to avoid damage to the talar posteromedial process and to the tibial nerve (Video 1). Exchanging the portals allows the surgeon to prepare the more medial joint aspect and to debride the residual cartilage, with no risk to the talar medial process. After this procedure, the articular surfaces may be prepared almost completely. Thereafter, the tourniquet is deflated to appreciate consistent trabecular bone bleeding and to exclude vascular lesions. Bone grafting is never used in our experience, even if theoretically possible. Although cartilage has to be removed as far as possible, the small irregularities of the subchondral bone must be left in place because they contribute to augment the total contact surface, thus helping the healing process (Fig 4). The skin portals are closed by 2 absorbable sutures.

Two cannulated compression screws (AutoFix 6.5-mm Headless Compression Screws; Stryker,



Fig 2. Placement of anterior portal to perform ALAPSTA (anterolateral arthroscopic left posterior subtalar arthrodesis). After the introduction of the arthroscope in the first (more posterior) lateral portal, a needle is used to control the position of the second (more anterior) portal and to determine the correct orientation of the shaver that will replace the needle. The needle's placement in the lateral space defined by the talus (upper) and calcaneus (inferior) is arthroscopically verified, as shown in the inset.

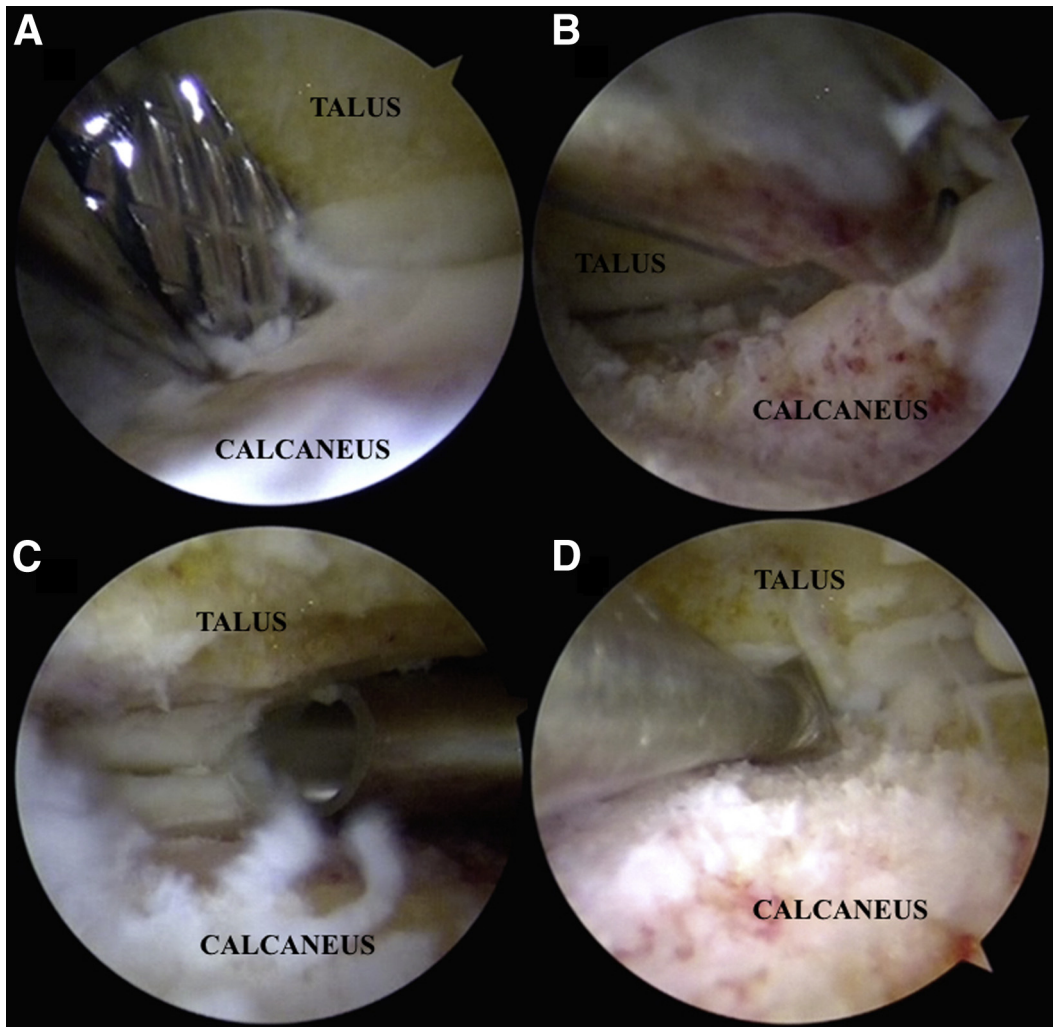


Fig 3. ALAPSTA (anterolateral arthroscopic posterior subtalar arthrodesis) of left hindfoot in a patient with severe idiopathic subtalar arthritis. The patient is placed in the lateral position. Visualization is performed through the posterior portal in A, B, and D and through the anterior portal in C. The sequence shows the different phases of cartilage debridement in the posteromedial (A), posterior (B), and posterolateral area of the subtalar joint; a curette is generally used to remove the residual cartilage (D).

Mahwah, NJ) are used to fix the arthrodesis, with care taken to completely insert the distal threads into the talus (Video 1). The foot is positioned in a neutral position in the sagittal plane and in physiological valgus in the frontal plane. The entry point under the calcaneal tuberosity is identified under fluoroscopy; thereafter, a K-wire is inserted, directed toward the anterior aspect of the tibiotalar joint in the sagittal plane and in the middle of the ankle mortise in the coronal plane. A second K-wire is usually introduced 1 to 2 cm proximally to the first. Drilling and screw insertion are performed and checked under fluoroscopy. The contact between the articular surfaces is also checked arthroscopically.

Postoperative Protocol

The patient is immobilized in a non-weight-bearing cast for 3 weeks. Progressive weight bearing is allowed

first in water and then on land. Full weight bearing (according to the patient's ability) is allowed after this period, and a weight-bearing cone beam computed tomography (PedCat; CurveBeam) assessment is performed to verify bone healing.

Discussion

Subtalar arthrodesis is generally proposed as a treatment method for idiopathic subtalar osteoarthritis or post-traumatic or rheumatoid arthritis.⁸ The technique reported in this article allows an ASA to be realized by means of only 2 lateral portals, reducing the risk of vascular, nervous, and tendon lesions (Tables 1-3).

In the recent literature, there is general consensus regarding the benefits of arthroscopy, which include keeping intact the talar and the calcaneal vascular irrigation, together with all the tissues around.

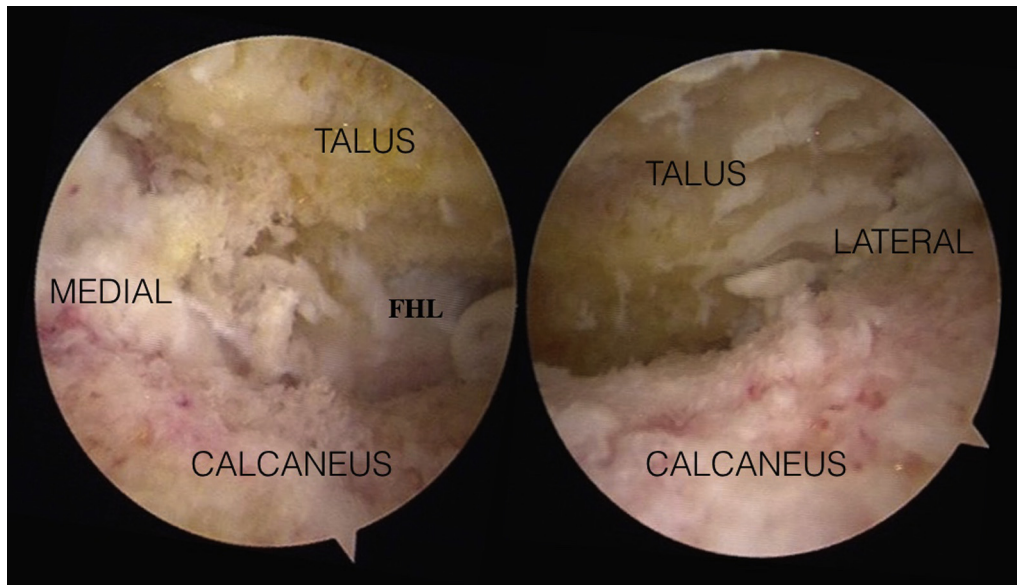


Fig 4. ALAPSTA (anterolateral arthroscopic posterior subtalar arthrodesis) of left hindfoot in a patient with severe idiopathic subtalar arthritis. The patient is placed in the lateral position, and visualization is performed through the anterior portal. At the end of cartilage debridement, an arthroscopic check is performed to assess the correct exposure of the subchondral bone in the whole joint before arthrodesis fixation. Although cartilage has to be removed as far as possible, the small irregularities of the subchondral bone must be left in place because they contribute to augmenting the total contact surface, thus helping the healing process. (FHL, flexor hallucis longus tendon.)

Perioperative morbidity rates are consistently lower than with open surgery,^{9,10} a point thought of as crucial in smokers, diabetic patients, and arthritic patients often requiring this kind of surgery. Furthermore, arthroscopic arthrodesis has proved to be related to shorter times to resuming work and sports activities compared with traditional open techniques, as well as in reaching joint fusion.¹¹

Some authors have argued that in post-traumatic arthritis (especially after calcaneal fractures), ASA should be avoided because of joint space narrowing and abundant peri-subtalar fibrosis,^{2,12} whereas according to others, fracture sequelae do not represent a formal contraindication except in the case of massive bone loss or marked joint compression.¹³ As far as we know, there are no official contraindications to ASA, but our feeling is that important deformation (congenital

or post-traumatic), malunion, or failure of a previous arthrodesis requiring a more extensive debridement might be better tackled by means of open surgery.

A recent study has already proved the safety and efficacy of ALAPSTA.⁷ The mean percentages of resected talar and calcaneal posterior subtalar facets were 94% and 91%, respectively, with a minimum distance of 4 mm from either subtalar portal to the nerves. No nerve injury was observed, and the lateral sinus tarsi arterial network was intact in 93% of cases.

Table 1. Indications and Contraindications for ALAPSTA

Indications	Contraindications
Idiopathic subtalar arthritis	Failure of previous surgery
Secondary subtalar arthritis	Important collapse or frontal malalignment of calcaneus after talar fractures or talar fractures requiring compensation by autologous graft
<ul style="list-style-type: none"> • Post-traumatic • Related to arthritic systemic conditions • Subtalar instability • Bone coalitions • Flatfoot • Neurologic conditions 	

ALAPSTA, anterolateral arthroscopic posterior subtalar arthrodesis.

Table 2. Advantages and Disadvantages of ALAPSTA

Advantages	Disadvantages
Compared with open procedures <ul style="list-style-type: none"> • Reduced risk of wound infection • Reduced risk of wound healing delay • Reduced time to work and sports resumption • Reduced time for joint fusion 	Clinical trials are required to further validate this technique.
Compared with posterior arthroscopic approach <ul style="list-style-type: none"> • Reduced risk of nerve damage • Because of patient position, other surgical procedures on midfoot or forefoot are allowed 	

ALAPSTA, anterolateral arthroscopic posterior subtalar arthrodesis.

Table 3. Pearls and Pitfalls of ALAPSTA

Pearls	Pitfalls
The use of a guide needle under direct endoscopic vision helps place the anterior portal.	To prevent lesions to the peroneal tendons, the posterior limit of the posterior portal must correspond to the longitudinal axis of the fibula.
Interchanging the instrumental and arthroscopic portals enables quicker progressing inside the joint.	To achieve appropriate cartilage debridement, the flexor hallucis longus tendon has to be used as the posteromedial limit and to be clearly visualized (hallux passive movement may confirm its position).
Subchondral bone irregularities may contribute to the fusion process and should be left in place.	When the surgeon is working on the lateral aspect of the joint, the shaver shield protects the peroneal tendons and the calcaneofibular ligament.
Bone grafting is never used.	Because of the subtalar joint curvature, a curette must be used to complete debridement; a preoperative CT scan enables this to be anticipated because it is possible to see to which degree this surface is curved depending on individual and post-traumatic variations.

ALAPSTA, anterolateral arthroscopic posterior subtalar arthrodesis; CT, computed tomography.

The effectiveness of the lateral approach in limiting early complications during subtalar procedures was also confirmed by Carranza-Bencano et al.,¹⁴ who described a lateral open mini-invasive technique to perform subtalar arthrodesis, reporting no skin trouble or neurovascular damage and a fusion rate of approximately 92%.

In the current literature, open subtalar arthrodesis is usually performed through a medial, lateral, or posterior approach^{15,16}; conversely, arthroscopic fusion is usually described from posterior.^{14,17-19} In the latter, to avoid iatrogenic damage to the tibial nerve, caution is mandatory when using motorized instruments around the medial area.^{18,20} In addition, posteriorly approached ASA (with the patient in the ventral decubitus position) is not adequate in case of the necessity for a surgical procedure on the midfoot or forefoot.^{3,8} On the contrary, the lateral or dorsal position is an advantage of ALAPSTA, allowing not only a faster patient installation but also other surgical procedures on the foot. Moreover, the distance from the neurologic structures allows a safer work area, and the absence of a third posterolateral portal further reduces the ASA-related nervous risk.

Finally, regarding bone grafting, in the literature no study has been performed comparing ASA with and without it; however, studies reporting bone grafting

generally have not reported advantages in terms of fusion delay or final fusion rate.^{3,21,22} For this reason, we currently do not suggest bone grafting in ASA.

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