

# Percutaneous Achilles tenotomy using a 18 gauge needle in the treatment of clubfoot with Ponseti method

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## Abstract

Tenotomy is the final step in the corrective phase for the resolution of residual equinus in the Ponseti method of treating

clubfoot. There are several methods for obtaining a complete section of the tendon, ranging from mini-open techniques to percutaneous with a scalpel or percutaneous with a large-gauge needle. Since April 2022, Vittore Buzzi Children's Hospital has performed 36 percutaneous tenotomies of the Achilles tendon in 24 patients using the percutaneous large-gauge needle technique. When compared to the traditional percutaneous scalpel tenotomy procedure, the use of this procedure has allowed us to reduce operating room time, where we routinely perform this type of surgery to optimize pain control and patient safety during the procedure. The technique has proven to be simple, safe, and effective in obtaining a complete section of the tendon; there have been no reports of excessive bleeding, pseudoaneurysms, or nerve injury. There were no differences in clinical outcome or recurrences of equinus that required reoperation during the average three-month follow-up from the previously used technique.

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## Introduction

The clubfoot is one of the most frequent and difficult congenital disorders to treat in pediatric age due to the complexity of the anatomical alterations present and the natural predisposition to recurrences during the foot's most rapid growing stages.

In recent years in Italy, we have witnessed the gradual rise of the Ponseti method, a protocol capable of effectively treating clubfoot through a precise and standardized sequence of corrective maneuvers combined with eventual Achilles tenotomy and a specific protocol for the prevention and treatment of recurrences.

The Ponseti method is characterized by three distinct and closely interdependent stages:<sup>1</sup> i) The manipulative-corrective phase in plaster casts through which anatomical alterations of the clubfoot are corrected combined with eventual tenotomy for correction of residual equinus deformity; ii) The maintenance phase in an abduction brace through which muscle tendon components are maintained and mechanically stimulated to grow during the foot's most rapid growing phases; iii) The post-discharge monitoring phase from the brace during which the child's proper motor development and the possibility of developing and treating the onset of recurrence are assessed.

Considering various case histories, in the treatment of clubfoot, following the corrective phase in plaster, an Achilles tenotomy is recommended in approximately 80% of cases.

The tendon section in most cases is performed percutaneously using a scalpel. However, viable alternatives have been described, such as sectioning the tendon with a mini-open technique<sup>2</sup> or percutaneously using a large-gauge needle.<sup>3</sup>

The most common complications of percutaneous Achilles tendon tenotomy include: i) Bleeding from an injury to the per-

oneal artery, posterior tibial artery or small saphenous vein; ii) Tibial or sural nerve injury; iii) Incomplete tenotomy of the Achilles tendon.

Although Achilles tenotomy can be performed under local anesthesia with an awake patient, in many Operating Units this procedure is performed in the operating room under general anesthesia or sedation to optimize the child's pain control, increase the surgeon's safety and control over the procedure, and minimize complications.

A modification of the percutaneous Achilles tenotomy technique using a 16-gauge needle instead of a scalpel was described in 2004.<sup>3</sup>

The use of a needle instead of a scalpel has the advantage of making the incision punctiform and minimizing the risks of neurovascular injury; in addition, the high simplicity of performing the procedure makes it more suitable to be performed possibly in an outpatient setting.<sup>4</sup>



Figura 1. Materials for Achilles tenotomy.

## Materials and Methods

From April 1, 2022 to September 30, 2022, 24 children, a total of 36 feet, underwent percutaneous tenotomy with a 18-gauge needle at the Vittore Buzzi Children's Hospital in Milan. All children had idiopathic PTC. PTCs associated with neurological diseases, PTCs associated with syndromes, and patients already treated at other facilities were excluded.

The feet were graded on the first visit according to the Pirani scale and treated according to the Ponseti method by a single practitioner, certified by the Ponseti International Association. Residual equinus was corrected by percutaneous Achilles tenotomy using a 18-gauge needle (Figure 1).

The patient is positioned supine with the knee flexed to 90° and the hip abducted to allow access to the postero-distal portion of the leg. The foot is dorsiflexed maximally highlighting the distal portion of the retracted Achilles tendon (Figure 2). Taking care to avoid the postero-medial neurovascular bundle, the needle tip is inserted from medial to lateral, locating the tendon fibers (Figure 3). The blunt end of the needle is used like a scalpel to allow the tendon to be dissected by moving the needle medially and laterally. After two or three consecutive movements, the snap of the successful tendon section should be apparent, with an increase in dorsiflexion of the foot of about 10°-20° and the presence of a gap at the level of the tenotomy. The procedure takes about thirty to forty-five seconds. Injection of local anesthetic is best performed at the end of the procedure, so that anatomical findings are properly identified. Cleansing of the skin, dressing with a steri-strip and a plaster cast boot, which will be kept on for two weeks, complete the procedure.

At the short-term follow-up of 3 months (range 1-5 months), there were no neurovascular complications, differences regarding the postoperative course, or recurrences of equinus that had to require reoperation.

## Discussion

Achilles tenotomy in the treatment of clubfoot with the Ponseti method for the correction of residual equinus of the foot is necessary in about 80% of treated cases.<sup>5</sup> This surgical procedure consists in the complete division of the tendon at about 1 cm proximal to its calcaneal tendon insertion; tendon regeneration was demonstrated using ultrasound and MRI scans after three to six weeks.<sup>6</sup>



Figura 2. Anatomical landmarks for Achilles tenotomy.



Figura 3. Achilles tenotomy using a 18 gauge needle.

Traditionally in our Operating Unit, Achilles tenotomy is performed using the percutaneous scalpel technique in the operating room with the patient under sedoanalgesia. From our point of view, performing tenotomy in a protected environment is the most suitable solution to allow both the adequate pain control on the child and for the operator to perform the procedure in peace and safety, minimizing the risks of incomplete tenotomy and complications. In contrast, given the large number of clubfeet treated monthly, a considerable portion of the space reserved for our Operating Unit in the operating room was occupied by this type of surgery. Although they are performed in a facility dedicated only to pediatric patients, most of the time of the entire surgical procedure is reserved not for the surgery itself but for patient preparation and anesthesiologic procedures, especially peripheral vein cannulation. To overcome this obstacle and optimize operating room time, allowing both tenotomies to be performed in a protected environment and the greatest number of surgeries to be performed during the day, tenotomy surgeries have been performed using the percutaneous 18-gauge needle technique since April 2022. Anesthesia in the form of gas is administered to the little patient through a mask placed over the face until the child falls asleep; percutaneous needle tenotomy and a plaster cast is made. This allows for excellent pain control of the child and also peace of mind and mastery by the surgeon over the procedure. The needle turns out to be a sharp instrument but small enough to minimize the risks of procedure-related vascular and nerve damage, offering similar outcome results; the instrument costs even less than the scalpel, and the scar is nearly punctiform.<sup>7,8</sup>

## Conclusions

Achilles tenotomy for correction of residual equinus is the final step in the corrective phase in the treatment of clubfoot with the Ponseti method and is necessary in most cases. The goal is to obtain a complete section of the tendon, which can be performed through various techniques, either under general anesthesia/sedation in the operating room or under local anesthesia on an outpatient basis. The choice of technique to be used and the environment in which to perform the tenotomy depend on the surgeon's preference and is closely related to the organization of the health care

facility and the anesthesia department. In our recent experience, percutaneous large-gauge needle tenotomy is proving to be a procedure with similar clinical results to percutaneous scalpel tenotomy and useful for optimizing operating room time. Further comparative studies between the two procedures will be needed to confirm these findings.

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