

Nerve Structures at Risk during Tibialis Anterior Tendon Transfer

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Purpose

Tibialis anterior tendon transfer (TATT) is a common procedure for recurrence in clubfeet treated with the Ponseti method.¹⁻³ Fixation usually includes passing the tendon through a drill hole in the lateral cuneiform using sutures pulled through the plantar aspect of the foot. Although the complication rate of TATT is low,^{5,6} neurovascular damage may occur during drilling of the tunnel, passing the sutures to the plantar side of the foot, and tying the fixation button. We conducted a cadaveric study to evaluate plantar nerve structures at risk during TATT.

Methods

TATT was performed to the lateral cuneiform in 12 random fresh frozen adult cadaveric limbs. Three feet were in each group. Four drill directions were used in 3 feet each.

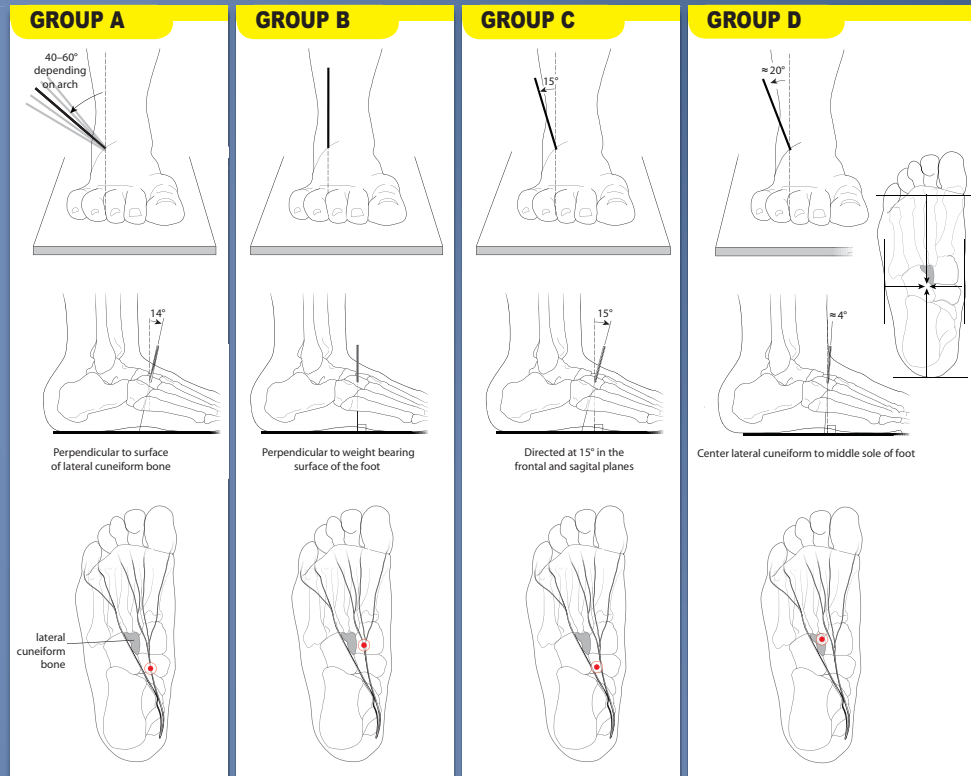
GROUP A: Perpendicular to the surface of the lateral cuneiform

GROUP B: Perpendicular to the weight bearing surface of the foot

GROUP C: Directed medial and caudad 15° in the frontal and sagittal planes

GROUP D: Aimed at the middle of the foot

A goniometer was used to aim the wire inclination before drilling. The tendon sutures were pulled through the plantar aspect using two Keith needles aimed in the same direction as the drill hole. A layered plantar dissection was performed. The distance from the drill hole to the nearest nerve or nerve branch was measured. After dissection, Keith needles were passed 20 times per foot. With each pass, proximity to nerve structures was noted.



Results



In group A, the drill was in proximity to the medial plantar nerve at a mean distance of 1.7 mm (1-3 mm). The bifurcation of the nerve trunk was found more proximally at a mean distance of 5 mm (2-9 mm).



In group B, the drill was found to be close to the lateral plantar nerve branches at a mean distance of 0.3 mm (0-1 mm) with a mean distance to the bifurcation of 25.3 mm (16-37 mm).



The drill hole in group C was at a mean distance of 1.7 mm (0-3 mm) to the lateral plantar nerve bifurcation and at a distance of 1mm to the lateral nerve branch in one case.



In group D, the drill exited in the middle of the plantar aspect at a mean distance of 7.7 mm (5-11 mm) from the medial nerve branch and 13 mm (10-18 mm) from the bifurcation of the medial nerve and at a mean distance of 4.3 mm (3-6 mm) from the lateral nerve branch and 14.7 mm (11-19 mm) from the lateral nerve bifurcation.

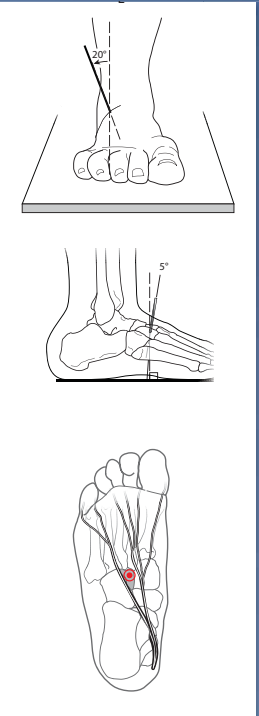
	Average distance to medial or lateral plantar nerve or main bifurcation	Average distance to medial or lateral nerve branch	Number of instances of needle puncture of nerve or main bifurcation	Number of instances of needle puncture of nerve branch
Group A	5 mm (range 2-9 mm)	1.7 mm (range 1-3 mm)	5/20	7/20
Group B	25.3 mm (range 16-37 mm)	0.3mm (range, 0-1 mm)	0/20	20/20
Group C	1.7 mm (range, 0-3 mm)	1 mm (range, 0-1 mm)	0/20	6/20
Group D	13 mm (range, 10-18 mm) medial 14.7 mm	7.7 mm (range, 5-11 mm) medial 4.3 mm	0/20	1/20



Passing the Keith needles resulted in hitting a nerve structure 12 times in group A, 20 times in group B, 6 times in group C and once in group D. Even relatively thin nerve branches were easily punctured by the sharp needles.

Discussion

In TATT, the drill hole should be aimed at the middle of the foot in the transverse and longitudinal planes, which can be achieved by inclining the drill approximately 20° to the plantar surface in the frontal plane and 5° in the sagittal plane. This results in a maximum distance from both the lateral and medial nerve. Use of a blunt tip Keith needle might allow a safer passing of the sutures to avoid potential damage to nerves and vessels.



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