

Hypertrophy of the abductor hallucis muscle: A case report and review of the literature

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Abstract

Objectives: Muscle hypertrophy is a relatively rare condition that may cause nerve entrapment syndromes. We report the case of a 14-year-old girl with unilateral hypertrophy of the abductor hallucis muscle with entrapment of the medial plantar nerve and review the literature.

Methods: Computed tomography and magnetic resonance imaging revealed unilateral hypertrophy of the abductor hallucis muscle.

Results: Two injections of steroid and lidocaine at the point of tenderness resulted in resolution of the pain.

Conclusions: We report a rare case of hypertrophy of the abductor hallucis muscle considered with entrapment of the medial plantar nerve. Treatment of this condition should be selected according to the pathological condition of each patient.

Keywords

Abductor hallucis muscle, entrapment syndrome, medial plantar nerve, muscle hypertrophy, tarsal tunnel syndrome

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Introduction

Hypertrophy of the abductor hallucis muscle is a rare condition with only 12 cases reported previously.^{1–8} Of these, in seven cases, the patients were young women.^{1,2,4,6,7} Nerve entrapments occurred in nine cases and included five tarsal tunnel syndromes.^{1,3,5,7,8} We report our case with entrapment of the medial plantar nerve and review the English literature for this condition.

Case report

A 14-year-old healthy female presented with pain to the medial aspect of her left sole for 1 year in duration. Pain occurred with first step in the morning, as well as after running, and disappeared within 15 min. She was diagnosed with a flat foot at another clinic, but the use of an orthotic device aggravated the pain.

The patient had no history of any trauma or other diseases. Her body mass index was 32.1 kg/m². Physical examination revealed a soft mass located on the medioplantar surface of the left foot. There was no numbness of the sole and a negative Tinel's sign; however, tenderness was detected at the distal end of the tarsal tunnel. The pain in the medial aspect of her left sole occurred when she attempted ankle

dorsiflexion and hindfoot eversion.⁹ The weightbearing exam revealed flattening of the arch consistent with pes planus (Figure 1).

Radiographs demonstrated a longitudinal arch of normal height and a soft-tissue enlargement. Magnetic resonance imaging (MRI) and computed tomography (CT) scans revealed significant hypertrophy of the abductor hallucis muscle and slight hypertrophy of the flexor digitorum brevis muscle in the left foot (Figure 2). A nerve conduction velocity test was not performed because the patient and her parents did not provide consent.

The patient was diagnosed with unilateral hypertrophy of the abductor hallucis muscle with entrapment of the medial plantar nerve. Two injections of triamcinolone acetonide and lidocaine at the point of tenderness every other month resulted

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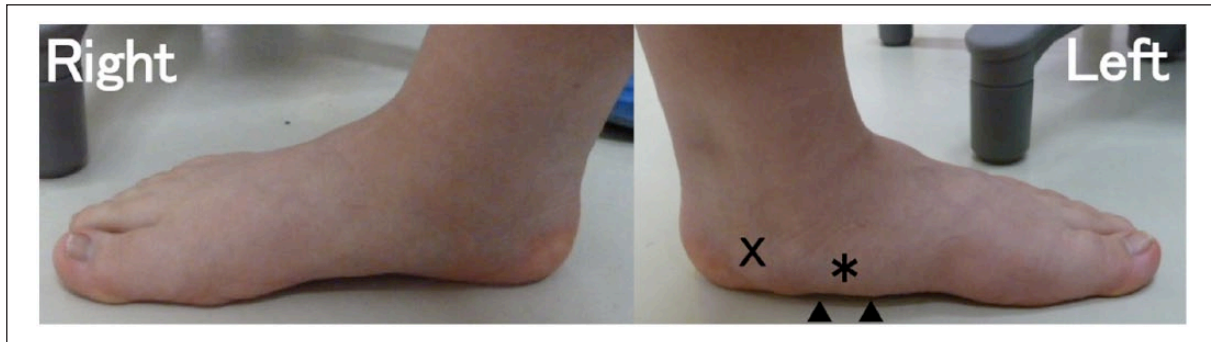


Figure 1. Macroscopic findings. The height of the left longitudinal arch appears decreased (black arrowheads) because of a soft-tissue mass on the medial aspect of the sole (black asterisk). The point of tenderness detected at the distal end of the tarsal tunnel (X).

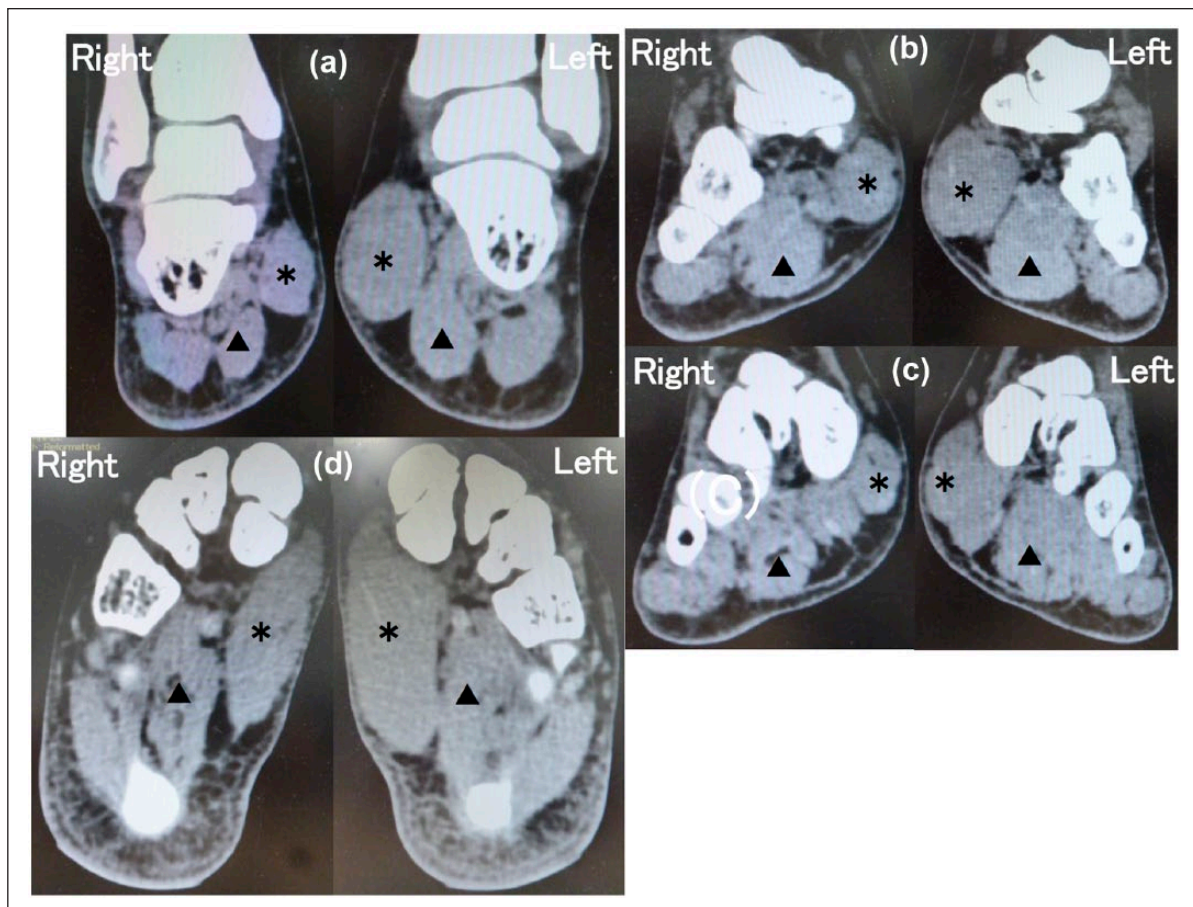


Figure 2. CT findings. CT scans show significant hypertrophy of the abductor hallucis muscle (black asterisks) and slight hypertrophy of the flexor digitorum brevis muscle (black arrowheads) in the left foot in (a–c) coronal planes and (d) horizontal planes.

in resolution of the pain. She experienced no restriction in her activities of daily living except for running 20 months later.

Discussion

A total of 12 cases of hypertrophy of the abductor hallucis muscle were reported previously (Table 1).^{1–8} Of these, in seven cases, the patients were young women, from 7 to

20 years of age^{1,2,4,6,7} and the remaining five cases comprised four men^{5,8} and one patient of unknown gender and age.² The three cases reported by Ghosh et al.⁸ were all adult men; however, their case series were recruited to investigate tarsal tunnel syndrome using ultrasonographic measurements. Their case series comprised mostly men, and all of them were adults of more than 42 years of age. The patient in the current case was a 14-year-old girl; however, the reason why

Table 1. Review of the literature.

Authors	Gender	Age (years)	Symptoms	Nerve entrapment (yes/no) Entrapment point	Treatment
Edwards et al. ¹	F	7	Soft-tissue mass	All yes	Release of FR
	F	14	Footwear problem	All TTS	AH fasciotomy
	F	20	Burning pain, tingling, or numbness		and excise excess muscle
Ross and Lepow ²	F	15	Soft-tissue prominence Footwear problem Discomfort, tenderness	No	Change shoes Reduce running
Kerr and Frey ³	Unknown	Unknown	Unknown Only MRI evaluation	Yes TTS	Unknown
Ringeiman and Goldberg ⁴	F	14	Painless soft mass Footwear problem	No	Complete resection of AH
Kim et al. ⁵	M	40	Hypertrophied soft tissue	Yes TTS	Release of FR AH fasciotomy
Sevin et al. ⁶	F	18	Painless soft mass Footwear problem	No	Complete resection of AH and FDB
Boeren et al. ⁷	F	13	Soft-tissue swelling Discomfort, radiating pain	Yes AH/FHL/FDL, AH/QP/FDB	Unknown Refer to surgeon
Ghosh et al. ⁸	M	Unknown	Pain and/or swelling	All yes	Unknown
	M	Unknown	With/without heel	15.8 mm distal to FR	
	M	Unknown	and/or sole pain Ultrasonographic estimation	44.6 mm distal to FR AH/QP	
Current case	F	14	Soft mass pain	Yes TTS (suspected)	Injections of steroid Reduce running

F: female; M: male; TTS: tarsal tunnel syndrome; FR: flexor retinaculum; AH: abductor hallucis; FHL: flexor hallucis longus; FDL: flexor digitorum longus; QP: quadratus plantae; FDB: flexor digitorum brevis.

the hypertrophy tends to be more common in young women is unclear. The exact cause of this hypertrophy is unknown, but foot deformities or microtrauma can cause hypertrophy secondary to alterations in the structure and function of muscle or muscle regeneration.⁸ Therefore, increased body weight, increased activity duration, and footwear may affect this condition of young women.

Hypertrophy of the abductor hallucis muscle itself can cause difficulty with footwear.^{1,2,4,6} In addition, the abductor hallucis muscle covers the tarsal tunnel with the flexor retinaculum. Therefore, hypertrophy can cause tarsal tunnel syndrome. In 9 of the 12 previous cases, nerve entrapments were reported,^{1,3,5,7,8} and tarsal tunnel syndrome was observed in 5 of those 9 cases.^{1,3,5} Tinel's sign was positive in two of five tarsal tunnel syndrome cases.^{3,5} Edwards et al.¹ stated that a positive Tinel's sign or nerve trunk tenderness to direct pressure can be elicited over the tarsal tunnel; however, such signs were unclear in their three cases. The remaining four cases had more distal entrapment points.^{7,8} In the case reported by Boeren et al.,⁷ the entrapment points were among the hypertrophic abductor hallucis muscle, flexor hallucis longus, and flexor digitorum longus and among the hypertrophic muscle, quadratus plantae, and flexor digitorum brevis. The entrapment points in the three cases reported by Ghosh et al.⁸ were 15.8 mm distal to the flexor retinaculum, 44.6 mm distal to the retinaculum, and between the abductor hallucis and quadratus plantae

muscles, respectively. They resulted that if ultrasonographic estimation of maximum dorsoplantar thickness is >12.8 mm and mediolateral width >30.66 mm in patients with symptoms of nerve compression in foot, abductor hallucis muscle hypertrophy-associated compression neuropathy may be suspected. In the current case, the maximum dorsoplantar thickness was 43.7 mm and the mediolateral width was 30.7 mm on CT. We could not measure the nerve conduction velocity. However, tarsal tunnel syndrome was strongly suspected because of the pinpoint tenderness at the distal end of the tarsal tunnel, the positive dorsiflexion-eversion test,⁹ and the resolution of the pain after the injections of steroid and lidocaine. In addition, the hypertrophy was severe enough to compress the nerve on CT.

Treatment should be selected according to the pathological condition of each patient. In 5 of the 12 previously reported cases, the treatments were unknown.^{3,7,8} One case reported by Ross and Lepow² was treated conservatively. The patient had difficulty with footwear due to a soft-tissue prominence. A good result was achieved by changing shoes and reducing running mileage. In 6 of the 12 previously reported cases, surgical treatment was selected.^{1,4,5,6} The patient described by Ringeiman and Goldberg⁴ had a painless soft mass on her sole and difficulty with footwear. After complete resection of the abductor hallucis muscle, she could wear shoes of the same size on both feet. The patient described by Sevin et al. also had a painless soft mass and

difficulty with footwear. She underwent complete resection of the abductor hallucis and flexor digitorum brevis muscles, and the problem with her shoes was solved. Although complete resection of the hypertrophic muscle may seem too radical, Schmauss et al.¹⁰ reported postoperative recurrence of a hypertrophic abductor digiti minimi muscle. They performed a subtotal resection of the muscle, preserving its motor nerve. The muscle started to regrow 4 months after the surgery and reached the preoperative size 6 months later.

Surgical treatment is generally selected for tarsal tunnel syndrome caused by hypertrophy of the abductor hallucis muscle. Edwards et al.¹ treated three cases by the release of the flexor retinaculum, fasciotomy of the abductor hallucis, and excision of excess muscle. In one case reported by Kim et al.,⁵ the treatment was by the release of the flexor retinaculum and fasciotomy of the abductor hallucis. Boeren et al.⁷ did not state treatment for nerve entrapment distal to tarsal tunnel. Therefore, it is unclear how to treat such cases; however, decompression at the entrapment point and partial or complete resection of the hypertrophic muscle may be necessary. The traditional operation of tarsal tunnel release involves division of the flexor retinaculum overlying the posterior tibial nerve behind the medial malleolus and the fascia over the abductor hallucis. More recently, it is highlighted to extend the decompression into the foot by retracting the abductor hallucis and releasing the fascia overlying the medial and lateral plantar nerve deep in the sole. Singh and Kumar¹¹ defined three well-defined tough fascial septae in the sole of the foot: the medial septum (dorsal extension of the medial border of the main plantar aponeurosis, also referred to as the deep fascia of the abductor hallucis in some studies), the intermediate septum (the dorsal extension of the lateral border of the main plantar aponeurosis), and the lateral septum (the dorsal extension of the lateral border of the lateral band of the plantar aponeurosis). These septae represent sites of potential nerve entrapment and compression, particularly so in the hind segment of the sole of the foot. In the current case, tarsal tunnel syndrome was also suspected; however, the patient's symptoms were not severe, and she and her family did not desire surgical intervention. Therefore, steroid and lidocaine were injected at the point of tenderness. She experienced no restriction in her activities of daily living except for running 20 months later.

Our study is a single case report and relatively short-term follow up. In addition, both subjective and objective evaluations are lacking. However, we consider this report will help draw attention to this disease. Further research is needed to know the exact cause of this hypertrophy, subjective and objective evaluations, and long-term results of each treatment including surgery.

In conclusion, we report a rare case of unilateral hypertrophy of the abductor hallucis muscle considered with

entrapment of the medial plantar nerve. Treatment of this condition should be selected according to the pathological condition of each patient, for example, the presence/absence of nerve entrapment and the point of nerve entrapment.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Our institution does not require ethical approval for reporting individual cases or case series.

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Informed consent

Written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

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