

## Brief Commentary


**Ultrasound-Guided Diagnosis and Treatment of Morton's Neuroma**
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Morton's neuroma is the fibrous enlargement of the interdigital nerve branches, usually in the second and third interspace between the metatarsal heads where the lateral and medial plantar nerves often join. Specific symptoms are dull or sharp pain, numbness and/or tingling in the third and fourth digits, burning sensation, cramping, and a feeling of "walking on a stone" around the metatarsal heads. Numerous clinical tests for Morton's neuroma have been described, such as thumb index finger squeeze, and Mulder's click and foot squeeze tests. Ultrasound and magnetic resonance imaging can be used for confirmation, especially for differential diagnosis, exact localization, and number of neuromas. Further, performing dynamic imaging during the aforementioned tests is paramount and can readily be carried out with ultrasound. The treatment mainly comprises footwear modifications, radiofrequency ablation, physical therapy, local (corticosteroid and anesthetic) injections into the affected webspace, and surgery. Again the use of real-time ultrasound guidance during such interventions is noteworthy.

**Key words:** Morton's neuroma, ultrasound, diagnosis, treatment

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**M**orton's neuroma is the fibrous enlargement of the interdigital nerve branches, usually in the second and third interspace between the metatarsal heads where the lateral and medial plantar nerves often join. It is generally found deep in the fat pad of the foot and the deep transverse metatarsal ligament. Due to the narrower space, the lesion is frequently seen in the third intermetatarsal space (1).

The pathophysiology of Morton's neuroma is generally explained by chronic mechanical trauma and eventual fibrous enlargement due to perineural fibrosis, arterial degeneration, edema of the endoneurium, and axonal degeneration (2).

Specific symptoms are dull or sharp pain, numbness and/or tingling in the third and fourth digits, burning sensation, cramping, and a feeling of "walking on a stone" around the metatarsal heads. While walking and wearing shoes exacerbate the symptoms, resting, shoe removal, and massage usually provide relief (3).

Numerous clinical tests for Morton's neuroma have been described: thumb index finger squeeze, Mulder's click and foot squeeze tests, plantar and dorsal percussion tests, light touch and pinprick sensory test (4). Ultrasound and magnetic resonance imaging (MRI) can be used for confirmation; especially for differential diagnosis, exact localization, and number of neuromas. Further, performing dynamic imaging during the aforementioned tests is paramount and can readily be carried out with ultrasound. In a recent systematic review, while sensitivity of ultrasound (90%) and MRI (93%) were found to be high, specificity of MRI (68%) was found to be relatively lower than ultrasound (88%) for the diagnosis of Morton's neuroma (5). On the other hand, user dependency and difficulty in imaging the small-sized neuromas would be considered as the limitations of ultrasound.

The treatment of Morton's neuroma mainly comprises footwear modifications, radiofrequency abla-

tion, physical therapy, local (corticosteroid, anesthetic, and alcohol) injections into the affected webspace, and surgery (6). Herein, the role of real-time ultrasound guidance during such injections/ablations would again be considered noteworthy (7,8).

**Technique**

A 5-12 MHz linear array probe can be used during imaging. While the patient lies in a supine position, axial scanning over the metatarsal heads from the dorsal/plantar side can be easily performed. After static imaging, Mulder’s maneuver can be used to dislocate/uncover the

neuroma via dynamic imaging. As the metatarsal heads are squeezed by the examiner’s free hand, the anechoic neuroma can be visualized to jump in/out between the metatarsal heads. The enhanced-through transmission artifact can also be used as an indirect clue to search for a neuroma (Fig. 1). Longitudinal scanning and checking other intermetatarsal spaces are crucial as well. After the localization of the neuroma, the injection can be performed using direct in-plane approach whereby the long axis of the needle is visualized during the whole injection. While the probe is kept axially on the plantar/dorsal side, depending on the neuroma’s localization and pref-

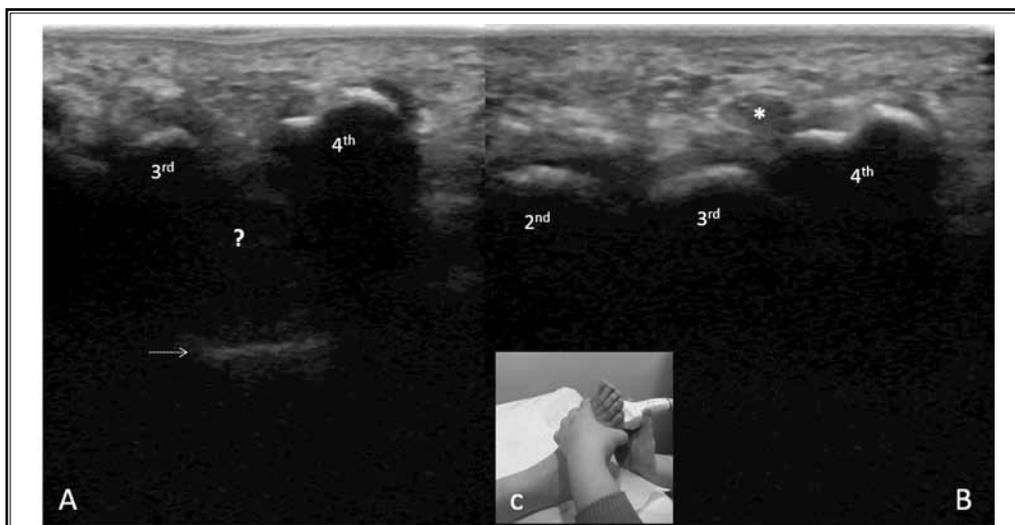


Fig. 1. On ultrasound imaging (axial view), the enhanced-through transmission artifact (dashed arrow) was detected on the third intermetatarsal space (A) and the sonographic image of anechoic neuroma (asterisks) was showed with foot squeeze test (B). The photograph shows the positioning of the transducer during the foot squeeze test (C). 2: Second metatarsal head, 3: third metatarsal head, 4: fourth metatarsal head.

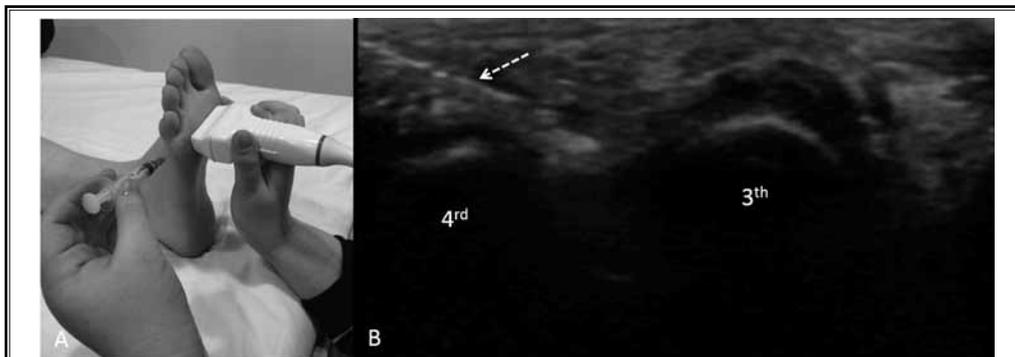


Fig. 2. Direct in-plane technique during axial scanning Morton’s neuroma injection (A): The exemplary photograph shows the positioning of the needle and the transducer for such an injection, (B): The sonographic image (axial view) of injection, 3: third metatarsal head, 4: fourth metatarsal head, Dashed arrow: Needle.

erence of the physician, the needle can be inserted via the medial or lateral approach (Fig. 2).

In short, similar to other peripheral nerve patholo-

gies, we strongly advocate the use of static/dynamic ultrasound imaging for the diagnosis and treatment of Morton's neuroma in daily clinical practice.

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