Perforator-guided injection and ultrasound of small nerves

We thank Dr. Coraci et al. (1) for their comments on our article about perforator-guided drug injection (2). The aim of our study was to evaluate the use of a standardized protocol for ultrasound Doppler guided injection of botulinum toxin in patients with abdominal wall pain. Diagnostics of nerve pathology was beyond the scope of our study.

We agree with Coraci et al. that power Doppler can be a good alternative to color Doppler, especially when vessels run perpendicular to the direction of the ultrasound probe. However, in perforator imaging arterial perforators are running towards the probe and are usually easy to visualize with color Doppler. When imaging small vessels, it is important to optimize the ultrasound frequency to allow highest possible spatial resolution without sacrificing necessary penetration. It is also important to choose a velocity scale that is in accordance with the flow in the vessels, as illustrated in our article's figures where 10 cm/s is chosen for one patient and 3 cm/s for another. Such adjustments, as well as choosing between color Doppler and power Doppler to optimize images for the individual patient, are basic skills that should be well known to all physicians who work with ultrasound.

Coraci et al. write that ultrasound is able to visualize very small nerves. We agree and regularly examine peripheral nerves. Even small superficial nerves such as digital nerves may be visualized with high frequency ultrasound. However, the article Coraci et al. refer to only describes ultrasound of major peripheral nerves

such as the median, ulnar, radial and sciatic nerves. The cutaneous nerves of the abdominal wall are much smaller and penetrate the anterior rectus fascia deep to the subcutaneous fat tissue. They follow the course of perforating arteries and veins and are difficult to separate from vessels and connective tissue in the neurovascular bundle.

We agree with Coraci et al. that ultrasound may visualize nerve pathology such as neuromas. We have treated several neuromas with ultrasound-guided injection of botulinum toxin. However, unless the patient is very slim one can seldom visualize nerves deep to the abdominal fat tissue. There are no evidence-based ultrasound criteria to separate between healthy and entrapped nerves as they pass through the anterior rectus fascia.

The most important message in our article is that perforators are located in close proximity to the points of maximal tenderness localized by the patients. The patients have no knowledge of the exit points of nerves through the anterior rectus fascia but can tell us exactly where the points of maximal pain are located. When these points correspond with the exit points of perforators through the fascia, we get indirect confirmation of the ACNES diagnosis. Patients may have pain associated with both medial and lateral perforators. Most patients experience pain exaggeration during injection of botulinum toxin close to the neurovascular bundle; this pain usually subsides shortly after the procedure. Perforator-guided injection enables safe and precise drug administration at the location of nerve entrapment.

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