Ultrasound Visualization of Radial Nerve Excursion During Acupuncture

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ABSTRACT

Objective: Nerves are likely to be contacted by needles somewhat regularly during acupuncture treatments. However, the effects of this are not well-known or described. The aim of this article is to describe the effects of acupuncture needling to the radial nerve in a single healthy subject.

Materials and Methods: In this experiment, conducted at an academic medical center (Washington University School of Medicine in St. Louis, St. Louis, MO), ultrasound-guided acupuncture needling was performed to the radial nerve of one of the authors (C.-T.T.) in the upper arm at acupoint LI 13. The main outcome measures sought were ultrasonic visualization of the nerve during acupuncture needling and the sensations experienced during acupuncture needling of the nerve.

Results: The radial nerve was seen to “roll” out of the way when it was needled. Two De Qi responses were elicited *en route* to the nerve, but, during nerve contact and penetration, minimal-to-no sensation was experienced.

Conclusions: Healthy nerves can show side-to-side excursion when needled, and providers and patients cannot know reliably whether or not a nerve has been contacted or penetrated based on the sensations the patient experiences.

Keywords: acupuncture, ultrasound, peripheral nerves

INTRODUCTION

ACUPUNCTURE HAS BEEN SHOWN to be an extremely safe modality of treatment with low rates of adverse events.¹ However, whenever a needle penetrates the body, the risk for structural damage exists. In Western Medicine, in order to minimize potential adverse events, practitioners typically try to avoid contacting nerves and blood vessels when dry needling or performing soft-tissue injections. Ultrasound (US) guidance can be used to accomplish this task.² In contrast, in acupuncture, many common acupuncture points lie directly over peripheral nerves, and, in some instances, the nerves may even be the target of needling. Examples include KI 3 (tibial nerve of the ankle), SI 8 (ulnar nerve at the elbow), HT 7 (ulnar nerve at the wrist), BL 40 (tibial nerve of the posterior knee), BL 54 (sciatic nerve in the

posterior pelvis), SP 9 (saphenous nerve of the knee), SP 12 (femoral nerve in the groin), LU 1/LU 2 (brachial plexus near the coracoid process), LU 5 (radial nerve at the elbow), LU 7/LU 9 (superficial radial nerve at the wrist), LI 11 (radial nerve at the elbow), PC 3 (median nerve at the elbow), PC 6 (median nerve at the wrist), and GB 34 (peroneal nerve of the knee).

Given the frequency with which these acupuncture points are used, it is surprising that there are not more reports of nerve damage caused by acupuncture needling. In an article examining rare, but serious, complications of acupuncture, there were only 2 published case reports of peripheral-nerve damage: 1 involving a broken needle in the carpal tunnel that caused neuropathy of the median nerve; and 1 involving a needle inserted in the region of the fibular head, which led to peroneal-nerve palsy and subsequent foot drop.³ There

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have also been anecdotal reports from China of nerve damage due to use of a special acupuncture technique that specifically targets nerves.

Two prior studies have offered some insight into what happens when acupuncture needling is performed near nerves.^{4,5} In the first study, PC 6 was needled to achieve a De Qi response, and then needle-tip location was visualized using US.⁴ It was found that the median nerve was contacted 52/96 times and penetrated 14/96 times. Immediately after needling, a couple of patients reported having prolonged paresthesias, and 1 patient needed to have the needle removed due to electric pain. During the week following needle insertion, 4 patients reported some transient unpleasant sensations; however, at 1 week post needling, the neurologic examination yielded normal results for all of the patients.⁴ In a follow-up study involving the same researcher, the median nerve was intentionally penetrated at PC 6, using an acupuncture needle under US guidance.⁵ Interestingly, the test subject experienced only a slightly dull sensation and had no pain.⁵

Although needling a nerve directly might not be painful, most Western Medicine providers still advise against intraneural injections, lest they potentially cause nerve damage. Even when performing peripheral nerve blocks where the nerve is the target, direct intraneural injections are not necessary to achieve efficacy and are discouraged.⁶ Therefore, the purpose of this experiment was to characterize what happens to a healthy nerve further when it is needled, so that the risks of nerve penetration during acupuncture needling can be understood better.

MATERIALS AND METHODS

The institutional review board of Washington University School of Medicine in St. Louis, St. Louis, MO, was consulted regarding this study and it was deemed not be human subject research. It was therefore exempt from needing approval.

In this experiment, 1 of the authors (C.-T.T.; the sole subject), who is a physiatrist trained in both medical acupuncture and diagnostic US, inserted an acupuncture needle willingly into himself at LI 13, ~ 3 *cun* above the cubital crease on the anterolateral aspect of his arm, over the radial nerve. This was performed with the researcher having knowledge of potential risks associated with nerve penetration. He had no history of pain, paresthesia, weakness, or other neurologic symptoms in the arm prior to the needling.

This needling was performed under US guidance with a Sonosite X-Porte (Fujifilm, Tokyo, Japan) machine using a 15-6 MHz linear transducer. Prior to needle insertion, the skin was cleaned with alcohol, and a sterile US probe cover and sterile US gel were used. Then, a 0.25 × 40 mm (DBC, single use) acupuncture needle was inserted into the anterolateral aspect of the upper arm, with the US probe placed

FIG. 1. Acupuncture needle in contact with the radial nerve. AN, acupuncture needle; RN, radial nerve; Br, brachialis muscle; Tr, triceps muscle; PCNF, posterior cutaneous nerve of the forearm.

lateral and proximal to the elbow crease. The radial nerve was visualized in transverse view, and the needle was visualized in-plane. Once the needle had penetrated the skin, the researcher did not watch the needling or the US screen, and the needle was advanced under US guidance to the radial nerve by his colleague (A.L.C.), who is also trained in diagnostic US.

RESULTS

As the needle was advanced, but well before it was close to the nerve, two instances of a De Qi response were felt. In this case, the sensation was described as sharp, electrical sensations, almost like what one would expect to feel if a nerve were contacted. Interestingly, when the needle actually came into contact with the nerve, the subject experienced little-to-no sensation. As the needle contacted the nerve, it was observed to “roll” out of the way and dodge the needle (Fig. 1 and 2). The needle was then

FIG. 2. Excursion of the radial nerve as it moved in a “rolling” motion. AN, acupuncture needle; RN, radial nerve; Br, brachialis muscle; Tr, triceps muscle; PCNF, posterior cutaneous nerve of the forearm.

redirected to penetrate the epineurium. Even then, the subject experienced little-to-no sensation. After needling, he noticed a temporary aching sensation in the upper arm that persisted for 2–3 hours, but no sensory or strength changes occurred distal to the needling site along the radial-nerve distribution.

DISCUSSION

Consistent with previous studies, direct needling of the nerve did not result in much, if any, sensation.⁵ Instead, the De Qi phenomenon—which, in the present study, included electrical sensations—was elicited during needling of the myofascial tissue. The present study was unique because, compared to the previous study involving US-guided needling of a nerve,⁵ the nerve was visualized in a transverse view. This enabled observation of the nerve “rolling” out of the way when the needle was advanced directly toward the nerve. This phenomenon of nerve excursion was described previously in healthy median nerves at the wrist as well as in the sciatic nerve in the posterior thigh.^{7–9}

In contrast, a lack of median-nerve excursion at the wrist has been linked with carpal tunnel syndrome.^{7,8} Therefore, a diseased nerve may not “roll” as much as healthy nerves would during acupuncture needling, and the risk of nerve penetration might be greater when needling near pathologic nerves than near healthy nerves. In the present study, the needling location was near where the radial nerve pierces through the lateral intermuscular septum. In this location, the nerve lies directly over bone, and is typically thought to be less mobile than in the proximal one-third of the upper arm, where the triceps brachii muscle is interposed between the radial nerve and the humeral shaft.¹⁰

It is likely that the amount of nerve excursion during needling will vary depending on the anatomical location that is needled and the surrounding structures. Fascial bands will tend to tether nerves and limit mobility. One factor that could influence the movement of a nerve when needled is what kind of needle is used. In the present study, an acupuncture needle was used that did not have a cutting edge. If a hypodermic needle with a beveled edge had been used to perform the needling, it is not certain if the nerve would have reacted in the same fashion. Another factor that could influence the movement of a nerve is needling technique. A quick jab at a nerve may be more likely to penetrate or perforate the nerve, compared to a slow advance of the needle. There are acupuncture techniques used in China that specifically target nerves, where a quick jabbing motion is used. Further study is warranted.

Given how patients will often describe nerverlike sensations with acupuncture needling, and sometimes even have persistent paresthesia or pain after needling, it is interesting

to note that, most likely, the nerve was never in contact with the acupuncture needle during the present experiment. Patients can be reassured that the sensations they feel are not likely to be caused needles contacting the nerves. However, practitioners need to have a solid understanding of anatomy that includes where nerves are located, because inadvertent nerve penetration can occur without a patient having any sensation. Nerve penetration will likely not result in nerve injury but should still be avoided if the nerve is not the specific target of the needling.

CONCLUSIONS

There are two clinical implications of this experiment. First, healthy, untethered nerves can “roll” when contacted by an acupuncture needle, which may reduce the risk of nerve penetration. Importantly, this observation cannot yet be extrapolated to diseased nerves with associated fascial restrictions. This observation might also not necessarily apply when hypodermic needles are used. Secondly, neither the practitioner nor the patient can necessarily know when a nerve has been contacted or penetrated by an acupuncture needle based on patient-reported symptoms. In fact, sharp, electrical De Qi sensations can be elicited by needling the myofascial tissue, whereas minimal-to-no sensation might be experienced during penetration of a nerve.

AUTHOR DISCLOSURE STATEMENT

No competing financial conflicts exist.

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