Perforation of the median nerve with an acupuncture needle guided by ultrasound

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Abstract
In an experiment on one of the authors, we used ultrasound to visualise an acupuncture needle completely perforating the median nerve at the acupuncture point PC6. During this procedure only a slight sensation occurred, and no pain. We conclude that, in individual cases, the median nerve might be perforated without causing pain or neurological problems.

Keywords
Acupuncture, median nerve, PC6, ultrasound.

Introduction
Various prospective investigations and reviews show that acupuncture is a relatively safe intervention when practised by regulated practitioners,1 in spite of the fact that there are locations where the needle is next to vulnerable structures like the pleura,2 or the median nerve in case of acupuncture at PC6.3 While there are many case reports of pneumothorax due to acupuncture, we know of only one case report of median nerve neuropathy which was caused by a broken acupuncture needle.4 However, unrecognised nerve penetration might occur in routine acupuncture practice with or without typical nerve sensations.

The situation in regional anaesthesia is similar. Combining high frequency ultrasound with the nerve stimulation technique, the needle tip is sometimes recognised to be close to the nerve without any response to the nerve stimulator and without any sensation in the patient. Even cases of intraneural injection are reported in patients who did not describe any paraesthesia or dysesthesia.5

An acupuncture needle is much thinner than needles used for regional anaesthesia. Despite the proximity of nerves at many acupuncture points, nerve injuries are very rare.6 In a previous study we demonstrated that in routine acupuncture therapy at PC6 the median nerve was penetrated in 14 of 96 cases without any nerve damage.7 The needle tip was identified by the movement of tissue using an in-plane and out-of-plane technique. In this clinical study, the needle was first inserted perpendicularly, as usual in a therapeutic setting, and then we controlled the needle position by ultrasound. Therefore we were not able to see the complete movement of the needle from the skin surface to the nerve.

Report of an experiment
To describe and visualise a possible needle penetration of the median nerve in detail we performed an experiment on one of the authors, a healthy 37 year old male anaesthetist and acupuncturist (KS). He inserted a sterile stainless steel acupuncture needle with a length of 25mm and a diameter of 0.20mm (Asia Med, Munich, Germany) in the area of the acupuncture point PC6 on his own left forearm at an angle of 45°. After insertion of the needle the investigator, who is experienced in sonography and ultrasound guided nerve blocks (JK), visualised the needle using an in-plane technique with the nerve in a long axis view,6 using a Sonosite MicroMaxx™ with a high frequency transducer (13 MHz). With the in-plane technique it is possible to visualise the complete needle. With ultrasound control the needle was slowly pushed in the direction of the nerve. In the first attempt the needle failed to touch the nerve, but even without any contact with the surface of the needle the test person (an expert in

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acupuncture) described the typical de qi which is characterised as sensations like aching, dull, heavy, numb, radiating, spreading and tingling. In the second attempt, the needle entered the median nerve without causing any acute local or radiating pain or dysesthesia, even when turning the needle and moving it back and forwards (Figure 1). Therefore we advanced the needle until it completely penetrated the median nerve and appeared on the other side. The only sensation was a slight de qi with a dull feeling during the whole procedure. No neurological impairment occurred after removing the needle.

**Discussion**

In a previous study we showed that, in routine acupuncture treatment, the needle might penetrate the perineurium without causing neurological problems. Now we wanted to follow the complete movement of the needle and the process of nerve penetration. It was surprising to see the needle going through the nerve without pain, paraesthesia or dysesthesia occurring, even when we repeated the procedure. This was the first demonstration of a complete perforation of the median nerve with ultrasound.

From a study of the human sciatic nerve we know that a peripheral nerve consists of 50% neurons and 50% fat and connective tissue. With the acupuncture needle we used in this case, we were able to visualise the tip of the needle going through the mesoneurium and epineurium but we cannot be sure if it penetrated the nerve fascicle itself and made contact with the perineurium or even the endoneurium.

It is reasonable to argue that nerve penetration with a thin acupuncture needle might occur without causing significant nerve fibre damage. On the other hand we know that, even after treatment with microelectrodes, an individual axon can show a conduction deficit. In our experiment the needle was pushed forward very slowly and carefully. The needle tip has no cutting or grinding action and therefore might hit only the connective tissue within the nerve and displace the axons. Our experiment confirmed with a precise view of the needle that intraneural insertion and even complete nerve penetration using a thin needle is possible without eliciting acute pain. Only a dull feeling described as de qi was elicited during penetration. De qi was also elicited in a first attempt without touching the nerve. This finding was limited to one individual, who performed the experiment on himself. However, since we know that nerve penetration can be quite painful and we cannot exclude nerve lesions completely, further investigations with deliberate nerve penetration are ethically problematic. Rather, ultrasound guided acupuncture might be used to get as near as possible to a nerve without penetration.

**Summary points**

- Using ultrasound, it was possible to demonstrate nerve penetration with an acupuncture needle
- In this case the needle perforated the nerve completely without eliciting acute pain and without any neurological sequela
- This finding is limited to a single case and does not exclude acute pain or even neurological impairment during nerve penetration in other cases
- According to the literature neurological problems due to acupuncture are quite rare
Reference list


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