Ultrasonography in acupuncture: potential uses for education and research

BACKGROUND
Ultrasound has been commonly used to guide clinical procedures in Western medicine, such as peripheral nerve blocks, biopsies, and fluid aspiration. Ultrasound is a useful tool because it is non-invasive, allows real-time visualisation of body images, and poses no risk to the human body, as it uses sound waves that are generally safe. In addition to guiding clinical procedures, ultrasound has been used to train medical students to perform clinical examinations.1 From a review of the literature, only one study has explored the use of ultrasound for acupuncture, and this focused on detecting soft-tissue displacement from movement of the needle.2 No study has explored the use of ultrasound in demonstrating the relationship between an acupuncture needle and the surrounding anatomical structures real-time in vivo. The aim of our study was to evaluate its feasibility and to discuss the implications for education and research.
METHODS
This study was conducted on a human cadaveric hand. Ultrasound scans were conducted using a Siemens Acuson P300 ultrasound system with a 6–18 MHz linear probe. Aquasonic 100 was used as the coupling gel.

A 0.25×40 mm disposable stainless steel acupuncture needle (Hanyi) was used. The following acupuncture points were selected for this study by a board-certified acupuncturist and were located on the cadaveric hand as illustrated in figure 1: LU11 (Shaoshang), LU10 (Yuji), and LU7 (Lieque). The intention was to include a variety of depths and angulations: LU11 was chosen as a superficial acupuncture point with a 90° angle of insertion; LU10 was chosen as a deeper acupuncture point, also with a 90° angle of insertion; and LU7 was chosen on the basis of its 45° angle of insertion. The ultrasound probe was placed adjacent to the needle at an angle of 70–80° for LU10 and LU11, and directly above the point of needle insertion at LU7.

RESULTS
The needle was seen on ultrasound as a linear hyperechoic bright line in the longitudinal plane (figure 2A) and as a dense white spot in the transverse plane (figure 2B). The position of the needle in relation to the myofascial plane and bone could be observed. Depth of insertion from the skin level could also be measured (figure 2B).

The needle tip was detected at all three acupuncture points (figure 2B–D) as a small white spot. Gentle manipulation of the needle confirmed the position.

DISCUSSION
This study has shown that an acupuncture needle can be observed by ultrasound imaging, and can be used to track needle insertion and manipulation at both superficial and deep acupuncture points. The anatomical structures around the needle were clearly seen. Ultrasound could also be used to measure the depth of insertion from the surface of the skin.

However, the use of ultrasound for acupuncture point localisation has its challenges. For those

Figure 1 Acupuncture points.

Figure 2 Acupuncture needle on ultrasound image.
acupuncture points where perpendicular insertion is necessary, it is not feasible to place the probe directly above the skin. Hence, it was necessary to angle the needle at least 70° in order to visualise the needle tip on the ultrasound image.

Ultrasound has been commonly used to educate students in Western medicine, for example, regarding how to perform peripheral nerve blocks.\(^3\) \(^4\) We could also potentially use ultrasound to teach students learning acupuncture. Currently, students are taught to locate acupuncture points by palpating the relevant surface landmarks. Also, adequate depth of insertion is important to achieve the desired effects of acupuncture.\(^2\) Ultrasound may enable the students to have a better awareness of the anatomical structure that they are penetrating with the needle as well as the depth of insertion in real-time, instead of an otherwise ‘blind’ insertion. In addition, ultrasound could be used to demonstrate the safe angulation and depth of insertion for acupuncture points overlying the chest and back. If adequately developed, this could provide a systematic and scientific method of training students.

In research, ultrasound could be a useful tool to study variations in the required depth of insertion, angle of entry and anatomical structures between individuals. Whether an adequate degree of somatosensory stimulation is achieved with an acupuncture needle is mainly assessed based on patients’ self-reporting of the de qi sensation, felt as a dull ache, heaviness, distention, tingling, or electrical sensation either around the needle or radiating proximally or distally.\(^3\) This sensation is subjective among individuals and few anatomical studies have been performed to describe the relationship between de qi and the exact location and depth of needling. Hence, ultrasound may be a safe, cheap and non-invasive tool for future research.

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