Acupuncture needle sensation: the emerging evidence

Mark I Johnson, Alex E Benham

There is a long held belief that de qi is important to achieve positive therapeutic outcomes in acupuncture.\(^1\,\,2\) Recently, a panel of experts considered adequacy of acupuncture dose from a neurophysiological perspective and suggested that a patient’s sensory experience during needling (de qi) was important because it may be related to treatment outcome.\(^3\) Previously, we have debated whether the intensity of acupuncture needle sensation (de qi) is positively correlated with analgesic outcome and whether acupuncture needle sensation can indicate adequacy of needle technique.\(^4\) In this issue of the journal White et al\(^5\) conducted a secondary analysis of data gathered in a randomised controlled clinical trial (RCT) and found no relationship between the strength of de qi and pain reduction for osteoarthritis of the knee and hip (see page 120). Their suggestion that less emphasis should be placed on eliciting painful de qi during acupuncture is certain to raise debate, although it was not clear from the report whether this recommendation extended to non-painful de qi.

In the past decade investigators have emphasised the need to generate needle de qi sensations during real but not sham interventions in RCTs. Some trials find better pain relief for real acupuncture with de qi,\(^6–7\) whereas others do not.\(^10\,\,11\) The secondary analysis by White et al is important because explicit analysis of needle sensation and pain relief is lacking in previous trials. However, there were some confounders that might have biased findings toward a negative outcome.

A gross indicator of de qi sensation was used and this may have lacked internal sensitivity. De qi sensation was measured using the total score of the Park needle sensation questionnaire administered once at the end of a 4-week course of treatment. Each patient was required to summarise on the questionnaire their experience of at least 48 needle interventions staggered over a 4-week period (20 min treatments, minimum of six points, twice a week). There might have been some regression to the mean for both real and placebo (non-invasive Streitberger needle) groups and total de qi sensation intensity scores tended to distribute in the lower half of the scale for both groups. This was less likely for pain intensity data because patients recorded average daily pain intensity each day and the mean of 7 consecutive days taken before and after the intervention. Nevertheless, mean values can mask true differences in the proportions of respondents because scores tend to distribute to scale limits (ie, good pain relief or some/limited pain relief) creating a ‘U’ rather than Gaussian distribution.\(^12\) This does not seem to have been the case in the study of White et al as seen in the distribution of change in pain data presented in their scatter graph. However, there were no differences in change of pain intensity between real and placebo groups with which to explore the de qi sensations. It would be interesting to see if studies with significant differences in change in pain between real and placebo acupuncture also lacked a relationship with de qi sensation. Despite the presence of some potential confounders the analysis is robust and the evidence suggests that de qi does not relate to pain relief for osteoarthritis. Whether this finding holds true for other conditions is not known.

Historically, the term de qi was used to represent a complicated concept within traditional Chinese medicine and traditional Chinese practitioners’ needle points to achieve de qi as they regard it as indicating a likely effect. The definition of de qi is imprecise and ancient traditional Chinese medicine texts use metaphors rather than adjectives to describe the phenomenon.\(^1\) De qi relates to sensations experienced in the fingers of the acupuncturist when the needle is firmly grasped by the skin of the patient (often termed needle grasp), and to sensations experienced by the patient at the site of needle insertion and radiating to other body parts (ie, acupuncture needle sensations, originally termed zhen gan). Research into needle sensation has focused on the development of tools to characterise and quantify these perceptual experiences and on the physiological correlates of the phenomenon using brain imaging techniques.

Early Chinese literature distinguishes painful needle sensations attributed to the needle pricking the skin from de qi sensations when the needle is inserted into deeper tissue. Needle ‘pain’ sensations were considered to reflect poor needling technique and to be unrelated to treatment outcome. MacPherson and Asghar used a group of acupuncture experts to categorise adjectives used to describe de qi sensations.\(^13\) Burning, hot, hurting, pinching, pricking, sharp, shocking, stinging and tender were used to describe needle pain, and aching, dull, heavy, numb, radiating, spreading and tingling to describe needle de qi. White et al\(^5\) found no relationship between change in pain scores and the strength of needle pain sensations or needle de qi sensations using the criteria developed by MacPherson and Asghar.\(^13\) This finding is set against growing evidence from brain imaging studies that needle ‘pain’ sensations are associated with activation of structures in the pain matrix (eg, limbic–paralimbic–neocortical networks), whereas needle de qi sensations are associated

Faculty of Health, Leeds Metropolitan University, Leeds, UK

Correspondence to Professor Mark I Johnson, Faculty of Health, Leeds Metropolitan University, Civic Quarter, Leeds LS1 3HE, UK; m.johnson@leedsmet.ac.uk

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Langevin et al has shown that needle rotation causes winding of connective tissue (collagen and elastic fibres), which increases mechanical stresses in surrounding connective tissue with activation of sensory receptors away from the site of needle insertion. This might explain the spread of needle de qi sensations away from the needle.26 Interestingly, our research found that needle sensation distribution patterns were markedly similar to trigger point referral patterns, leading us to speculate that needle stimulation may be affecting the same structures as those affected when stimulating trigger points25 (figure 1).

Research on the relationship between needle sensations and neural activity is very limited, with Western acupuncture literature citing Chinese studies. For example, Kong et al refer to a study conducted at the Shanghai Academy of traditional Chinese Medicine in 1977 which claimed that stimulation of blood vessels produced pain, nerves branches produced numbness and muscle produced soreness and distension, although we have yet to retrieve the original report to confirm the findings.27 Commonly, commentators cite a study by Wang et al using 34 healthy participants. These investigators recorded the characteristics of needle sensations during the vertical insertion of an acupuncture needle into an acupuncture point while recording single unit discharges of afferent neurons using microelectrodes inserted percutaneously into the nerve fascicle. Needle sensations appeared and disappeared as the...
needle was vertically inserted through the skin and discharge patterns were reported to increase and decrease according to strong and weak sensations, respectively. The investigators used fast Fourier transforms to classify unitary discharges and claimed that manual acupuncture conveyed sensations of numbness in group II (fast myelinated) afferents, heaviness and distension in group III (slow myelinated) afferents and soreness (without pain) in group IV (slow unmyelinated) afferents. When the recording micro-electrodes were inserted into nerve fasicles, ‘abnormal’ and ‘numb’ sensations were also reported. It is over 25 years since the publication of this fascinating study and to our knowledge it has not been replicated using modern techniques.

If needle sensation indicates activity in different types of peripheral nerves this may be useful to clinicians. Neurophysiological evidence from the field of pain science suggests that central analgesic mechanisms differ according to the type of peripheral fibre providing the input. For example, activity in low threshold cutaneous afferents produces a rapid onset and short-lived inhibition of transmission of pain-related information in the spinal cord. In contrast, activity in low threshold muscle afferents produces a longer-lasting inhibition of transmission of pain-related information in the spinal cord. Activity in higher threshold cutaneous and muscle afferents generates activity in descending pain inhibitory pathways arising from the brain, leading to more widespread pain relief. However, neurophysiological evidence from pain science is extensive, complex and difficult to interpret within the context of acupuncture. Whether needle sensation can be used to indicate different peripheral nerve input and whether this input then translates into various analgesic outcomes for different clinical conditions remains to be seen.

A systematic review of clinical studies on the effect of de qi on pain outcome would be useful, although this may prove difficult as it would involve screening all available RCTs in order to extract needle sensation data. From the literature on experimental pain, we discovered one pilot study using 31 participants which found that reductions in experimentally induced thermal pain were associated with needle sensations of numbness and soreness, but not with stabbing, throbbing, tingling, burning, heaviness, fullness or achiness. Presently, we are conducting follow-up experimental studies that precisely control needle technique while carefully monitoring needle sensations experienced and change in pain response.

Sensations similar to those achieved during needling can be obtained using non-invasive techniques such as surface electrical stimulation, although the range of sensations is more limited. Thus, the psychophysics of sensations evoked by peripheral nerve stimulation is not unique to acupuncture and can be studied using a neurophysiological approach and without contamination from traditional Chinese concepts. Hopefully the secondary analysis by White et al and the conclusion that the presence and intensity of de qi sensation has no effect on pain relief for patients with osteoarthritis will galvanise neurophysiological investigators to explore the phenomenon further.

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