



Part 2 : Acupuncture meridians – myth or reality?

A. Bensoussan

Faculty of Health, University of Western Sydney, Australia

Author of The Vital Meridian: a modern exploration of acupuncture. Churchill Livingstone, 1991, from which the following is an edited extract.

SUMMARY. This second paper concludes the article published in the January issue of *Complementary Therapies in Medicine*.

DISCUSSION

As a consequence of the investigations into propagated channel sensation (PCS) a debate has unfolded for some time over whether this sensation is predominantly a 'peripheral' or 'central' phenomenon. Electromyograms are one significant piece of evidence that indicates the general peripheral nature of this phenomenon. Further evidence to support the concept that PCS is largely peripheral excitation also lies in the observations that:

1. The PCS does not follow somatosensory distribution of the nerves in particular regions, for example, the abdomen; and that over a length of the pathway the PCS does not necessarily restrict itself to even one or two dermatomes.
2. Chilling, that is lowering the temperature of the limb, could block PCS in 30 patients with coronary heart disease,⁴² although it could also be argued that chilling may cause overriding signals in the pain and temperature pathways.
3. PCS may be blocked by mechanical pressure.^{25,40,43}

Mechanical pressure is unlikely to exhibit obvious interference in somatic sensations in the cerebral cortex, but does produce a block in PCS and acupuncture effects. This supports the notion that propagated channel sensation is likely to be a peripherally generated effect.

In contrast, the results of other investigations argue that the PCS is an excitation that occurs within the central nervous system, although it may be observed peripherally, such as in the case of electromyographic responses. In support of this belief is the existence of phantom limb sensation, where the *Qi* sensation propagates along the meridian on the amputated limb.^{44,45}

Local injection of saline, local or spinal injection of procaine, and spinal sections, all prevent (at least our awareness of) the propagated channel sensations.^{3,46,47} Under lumbar anaesthesia, the subjective *Qi* sensation felt by the patient, the needle grip response registered by the practitioner, and the EMG changes all disappear entirely in the regions below the level of the anaesthesia.³⁵ It could be concluded that they all involved spinal cord reflexes or mediation to higher centres by way of the spinal cord. In further support, recall the Shanghai researchers already mentioned, who demonstrated that patients with disturbed pain and temperature pathways could not obtain the propagated channel sensation.³⁶

The model for 'central excitation' conceives that the impulses from particular points are transmitted to a spinal segment from where they may travel upward to the brain-stem and cerebral cortex, and are then able to generate an awareness of the *Qi* sensation. Following this theory through, Bossy proposed that each point communicates with others across different spinal segments (and hence dermatomes) via interneuronal networks of the laminae II and III of Rexed (which correspond to the substantia gelatinosa and receive information from pain and temperature afferents).⁸ The fine (A- δ and C class) fibres of Lissauer's tract, which communicate between adjacent spinal segments, were suggested much earlier in China as having a similar responsibility for the development of PCS.^{29,48} Somatotopic patterns of communication at this level result in other nerve fibres, not directly stimulated by the needle, transmitting sensation not only centrally to the cerebral cortex (where the sensation is felt) but also peripherally to the needled region. Hence, under the model for central excitation, somatotopic organisation at higher levels in the central nervous system may account for the propagated channel sensations and thereby form a definition of the meridians themselves.

Most of the research in the area of the propagated channel sensations has been performed in China, unfortunately obtainable only with difficulty and has been frequently poorly reported and poorly controlled. Nevertheless, the outcomes of these studies do provide an impression of the clinical concepts of the meridians and points and needle sensations, and also provide some insight into the current thinking in China to explain these phenomenon.

AN ELECTRICAL PHENOMENON?

Electromyograms appear to represent an objective measurement of propagated channel sensation and the sensations themselves seem to travel in a way consistent with the distribution of the acupuncture channels. It arises then that the meridians themselves may also be identified with measurements of electrical impedance and conductance.^{3,49-52} In fact, the objective existence of the meridian system is argued most strongly by the electrical specificity of acupuncture points.⁵³⁻⁵⁵

The determination of the existence of acupuncture points via electrical means started as early as the 1950s and 1960s, particularly with the work of Niboyet in France and Nakatani in Japan.^{9,53} By applying a direct current of 12 volts to the body surface, Nakatani discovered points on the skin of higher electrical conductance than surrounding areas. He subsequently connected these points with (imaginary) lines of good conductance, which showed correspondence with the meridians. The medical colleges of Fujian, Lanzhou and Anhui (China) performed independent research to confirm these results in animals as well as humans.^{43,53}

Amongst the dozens of publications in this area, most more rigorous research confirms that there is a significant difference between the electrical identity of true points and nonpoints, with the conclusion that acupuncture points represent *at least an area of high conductivity (electrical permeability) relative to nearby tissues*.^{54,56-63} For example, Reichmannis, Marino, and Becker⁶⁴ assessed the alternating current impedance of part of the meridian with anatomically similar non-meridian regions and concluded that meridians are electrically distinguishable. They showed that impedance between two Heart channel points was significantly lower than between two adjacent non-meridian points. In contrast, the study of McCarrol and Rowley,⁶⁵ although isolated, sheds some doubt on these conclusions. They used a multielectrode grid to show that low skin impedance was only a result of lingering over the same point.

In general, the literature appears to acknowledge the bioelectrical identity of the points and channels; however, before any firm conclusions may be upheld, reasons for the contrary outcomes of other studies must be identified by monitoring the potential range of parameters involved more closely. I am particularly astonished that after two decades of these claims, with research and clinical practice based upon the electrical nature of the points, and given its potentially enormous significance in the medical and therapeutic sciences, that no mention of it appears in anatomy or physiology texts, nor has it aroused any interest in orthodox medical research.

In fact the bioelectric properties of the channels and points have generated a postulated mechanism of action for acupuncture.^{17,54,55,66-68} The basic premises of the 'bioelectric theory of action' are:

1. Acupuncture points and channels exhibit an electro-magnetic nature.
2. Needling induces alterations in the electromagnetic properties of the channels and local tissues.
3. Electromagnetic fields significantly influence biological matter and physiological functions.

The first premise has already been discussed above and acknowledges the electrical identity of acupuncture points and channels and their measurement with various devices in both health and disease.

As regards the second premise there is evidence that electromyographic activity is present during acupuncture and correlates highly with the acupuncture sensation.^{35,36,38,39} This sensation is known to travel extensively away from the site of needling. Hence, needling may produce electrical changes along the channels, and it has been noted that the action of needling alters the electrical resistance of the points.⁶⁹⁻⁷²

Finally, this leads us to our third premise. The influence

of electromagnetic fields on biological matter and physiological functions is well-documented.⁷³ In 1792 Galvani observed that injured tissues generated small electric currents. When the electrical balance of the body is disturbed in an injury, the resulting shift in current flow (referred to as the 'current of injury') triggers a biological repair system. As healing continues, the direct current potential difference approaches the normal electrical balance relative to the surrounding tissues. These electrical phenomena have been measured by Lund in plants,⁷⁴ by Becker in bone,⁷⁵ and by Wolcott and associates in soft tissue.⁷⁶ External electric currents may also be adopted to encourage repair and growth. This was shown in bone repair,⁷⁷ growth in higher plants,⁷⁸ and by the inhibition of bacterial growth in vitro.⁷⁹

Returning to our three basic premises we can now make the following summative statements. The fact that acupuncture meridians and points possess an electrical nature, combined with the observations of the influences of small electric currents on tissues, implies that needling, by altering the electrical field in the immediate vicinity, may bring about physiological changes. In fact, electromagnetic changes in somatic regions may exert a subsequent influence on the internal viscera by neural connection or otherwise. The evidence discussed here on the nature of the meridians lends further credibility to Becker's proposal that DC potentials may interlock with the nervous system, and in fact be its morphological precursor.⁶⁷ Data transmission through the DC potential system need not be radically different to the communication along acupuncture meridians.

OTHER APPROACHES

Some researchers claim to see correlation between acupuncture meridians and the pathway of diffusion of subcutaneously administered radioactive tracers.⁸⁰⁻⁸² In brief, the studies in this field claim the injection of a radioactive tracer at an acupuncture point generates diffusion along the meridian line in contrast to injection of the same tracer at a nearby non-acupuncture control point. Needless to say, this work has also drawn some hefty criticism in that most particularly any diffusion pattern observed was simply a reflection of venous return.⁸³⁻⁸⁵ Unfortunately, the original works are not particularly rigorous and provide a football field of space for misinterpretations and assumptions. On the other hand the criticisms of these works have not generally been based on these problems (assumptions) but involved performing similar work, fraught with the same problems and making contrary but equally fallacious assumptions. Overall, the studies have simply not demonstrated either position conclusively.

Other experimenters, in their search for objective indices of the meridians, have claimed that temperature changes on the surface of the body are a reflection of the

propagated channel sensation,^{86,87} and that sound waves travel more favourably along the meridians than outside of them.^{88,89} However, despite reports in Chinese newspapers, the results of such experiments still remain highly debatable.⁹⁰ Clinically, skin rashes are also claimed to be frequently distributed along the pathways of channels in a fashion distinct from nerve distribution.⁹¹

Research on the nature of the acupuncture points and meridians is difficult to evaluate largely due to the diversity of claims made and the potential variety of parameters involved in the assessment of these claims. Nevertheless, the acupuncture points and meridian system appear to have a distinct identity even if they are defined only as paths of least resistance of myoelectric currents. They do not correlate sufficiently with known anatomical structures including dermatomal distribution and it may be too patronising to assume they represented a primitive concept of dermatomes that never matured.

The phenomenon of radiation of sensations around and away from the point of needling and along the meridians during treatment could direct research into the most fruitful areas for understanding the nature of acupuncture structures and may, in fact, be a phenomenon that is closely interwoven with the electrical identity of the acupuncture points. Given stimulation parameters, most particularly frequency and intensity of electrical stimulus, affect therapeutic outcome so dramatically¹⁷ it seems that ultimately the *electrical* nature of the meridians and points deserves closer scrutiny than has previously been granted if a clearer understanding of these structures is to be developed.

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