Acupuncture in Modern Medicine

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Summary
Acupuncture, developed thousands of years ago in the Orient, is increasingly being integrated into modern Western Medicine. Its neurophysiological basis is partly understood, and controlled trials are demonstrating its efficacy and safety.

Key words
Acupuncture, Disease Management, Neuroanatomy, TENS.

Introduction
In the last two decades or so there has been a tremendous change in the attitudes of the public and the medical profession towards acupuncture (1).

At first there was widespread ignorance amongst lay people; whereas doctors, if they knew about acupuncture at all, generally dismissed it as a form of hypnosis or suggestion at best, or charlatanism at worst. Quite rapidly, as changes in medicine go, knowledge of this therapy has spread widely throughout the United Kingdom. The attitude of most of the profession has become much more open; a sentiment of "Let's see what it can do", with a number of doctors using acupuncture enthusiastically in their everyday practice.

The cause of this transformation is easy to find: it is the enormous amount of publicity that acupuncture has received in the public media and to a lesser extent in medical journals. There are two reasons for this dramatic publicity. The first is that acupuncture is a somewhat bizarre form of treatment. The second is: it works! As Aldous Huxley wrote: "That a needle stuck into the skin of the foot should help a case of migraine is obviously incredible; it makes no sense. Within our system of explanation there is no reason why the needle prick should be followed by an improvement. Therefore we say it cannot happen. The only trouble with this argument is that as a matter of empirical fact, it does happen".

Medical use of this treatment has always lagged behind in the United Kingdom compared to other countries in Europe (and, of course, in the Far East), but now several hundred NHS general practitioners use it for some of their patients; it is available from full time private medical acupuncturists; and anaesthetists and other pain relief specialists include it in their armamentarium for treating chronic pain on an "in-" or "out-patient" basis. Some specialists in orthopaedics, rheumatology and sports medicine use acupuncture to provide rapid, safe relief from stiffness, pain and muscle spasm; and obstetricians and midwives use it to relieve the pain of labour.

One reason for the enormous interest that acupuncture generates is a general dissatisfaction with conventional medicine. Despite the wonderful advances in so many areas in the years since the Second World War; as a whole patients are not satisfied. This may be due in part to the well publicised side effects which have occurred in patients receiving conventional treatment, or to our failure to advance substantially in reducing mortality and morbidity from diseases such as the common malignancies, strokes, heart disease and senile dementia. Perhaps because of this seeming lack of progress, the quality of the relationship between doctor and patient has deteriorated and, with a growing dissatisfaction in our community with some aspects of mainstream medicine, there has been increasing interest in such things as philosophy, alternative religions, mysticism, more natural ways of eating and fringe medicine. "Alternative" or "fringe" medicine includes, of course, a wide range of different forms of treatment (2). The cynic might say that they are all characterised by two things: an element of absurdity or bizarreness in the way that they are carried out, and the need for great faith on the part of those who receive them. Acupuncture certainly qualifies as "fringe" medicine according to this definition. It is really a very odd form of treatment indeed, involving pushing small needles into the skin at various points, often a long way from the site of the medical problem, and perhaps on the opposite side of the body. On other occasions the traditional acupuncturist may place a small ball of dried herb on a slice of fresh ginger onto the skin, and set light to it! And, as with all such treatments, the patient is required to make an act of faith in accepting this therapy. There is no doubt, also, that the association of acupuncture with the Far East increases its
popular appeal. Since the days of "ping pong diplomacy" when the bamboo curtain started to lift, Chinese matters have become of great interest to the public. News that "barefoot doctors" in rural areas, finding modern drugs next to impossible to obtain, achieve considerable success with acupuncture techniques, certainly satisfies the "back to nature" enthusiasm and promotes an image of natural medicine without the dangers of side effects to the artificial chemical drugs which are anathema to this group. Another characteristic of acupuncture, which adds to its popularity, is its antiquity - acupuncture probably dates back five thousand years and there is a tendency at the present to deride modernity and to look to history for acceptable values.

Whilst acupuncture has become very popular with patients, its status within the medical establishment has lagged far behind. One reason for this is the pseudo-philosophical mumbo jumbo that occurs in many classical texts of acupuncture, which is extremely unpalatable to the scientifically trained Western physician. Another major reason is the dearth of properly controlled, double blind clinical trials demonstrating efficacy and safety. There are active research programmes underway in various European countries, as well as in the East, in America and in Russia. Unfortunately, the latest upsurge of interest has coincided with a period of near bankruptcy for medical research in the UK, and such funds as there are have tended to be diverted to areas of very high priority such as the treatment of malignancy or heart disease. A technical difficulty arises in setting up controlled trials with acupuncture since it is very hard to devise an acceptable placebo treatment which is very similar to the active therapy and yet is itself inactive. A further difficulty is lack of organisation amongst medical acupuncturists in the West, so that it is hard to assemble a suitably large group of patients with the same disease for random allocation of treatment by acupuncture and a comparative technique. Most medical acupuncturists work in isolation, seeing relatively small numbers of patients with a very wide range of medical conditions. Notwithstanding all these problems some carefully controlled trials have now been carried out (3) and a steady stream of reports has appeared in the medical press, particularly in the last decade. Naturally results have been negative or unclear in some cases, but in general, the definitive demonstrations of efficacy and safety which have been made in many different clinical situations have been a potent force in changing the tide of Western medical opinion from scepticism to acceptance, albeit cautious acceptance as yet.

The British Medical Acupuncture Society
The BMAS has been instrumental in encouraging the acceptance of acupuncture by the medical profession. It was founded in 1980 to foster the medical practice of acupuncture in the United Kingdom and elsewhere. Currently it has just under 1000 members with a medical qualification and a few vets and dentists. About two-thirds of its members are general practitioners and the rest hospital doctors in a wide range of specialties including rheumatology, anaesthesia, orthopaedics and general medicine. The BMAS encourages original research, provides an information service, conducts introductory and advanced training in acupuncture, publishes a journal twice a year, holds scientific meetings, lobbies official bodies on behalf of its members, and carries out an unceasing Public Relations campaign designed to increase the level of awareness of acupuncture within the medical profession and amongst the lay population. It is affiliated to the International Council of Medical Acupuncture and Related Techniques (ICMART), whose membership is restricted to medical practitioners. There are two main classes of membership of the BMAS: Associate membership open to all doctors and medical students with an interest in acupuncture, and Full membership which is open to doctors registered with the General Medical Council of the UK who have satisfied the Society as to their training and experience in the technique. Lists of full members on a geographic basis are provided to intending patients who ask for help in identifying a practitioner.

Who should practise acupuncture?
Acupuncture is a powerful form of medical treatment which should be carried out by or under the close supervision of medical practitioners. In fact, the vast majority of acupuncturists in the UK are lay people and whilst many of these are responsible individuals who have had substantial training from one of several organisations set up for this purpose, some have had little or none. The courses run by organisations which train lay persons are often very detailed and prolonged in comparison with the shorter courses attended by medically qualified practitioners. This is because in the case of the doctors their knowledge of diagnosis, pathology, anatomy, physiology, microbiology and other treatment techniques which can be used at the same time as acupuncture can be taken for granted. Another reason for the length of lay courses in acupuncture is that they tend to adopt a traditional Chinese approach. Traditional oriental acupuncture theory is extremely complex, and takes a long time to learn.

Follow up treatment by paramedical personnel under the supervision of a medical acupuncturist seems acceptable, but for lay persons to take clinical responsibility for patients accepted "off the street" without prior medical referral is quite wrong. They do not have the necessary training in anatomy and microbiology to make this a safe procedure. They do not have sufficient diagnostic skills to decide what the condition they are treating is or, if this is already known, to detect a deterioration in it or the onset of concomitant pathology. They are not able to integrate acupuncture with other forms of medical treatment. They have little or no access to

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The grounds that the syllabus was already to be able to treat a wide range of conditions with the curriculum. Fortunately, whilst it takes many teaching, acupuncture will come to find a place in overcrowded. Various surveys of opinion amongst tourists does not introduce infection (4), or needle cases have so far been lost by default because of the strong public interest in acupuncture, the attractiveness of acupuncture as a source of income to lay practitioners, and the lack of regulation in this country.

Medical acupuncture training

Whilst postgraduate training in acupuncture is certainly very valuable, the ideal situation would be for some simple, brief instruction in the technique to be given to all undergraduates as part of the medical syllabus. This is the case in some countries such as New Zealand, but in the United Kingdom when the BMAS recently contacted all the Deans of the medical faculties there was little interest in this, on the grounds that the syllabus was already overcrowded. Various surveys of opinion amongst medical practitioners towards complementary medical techniques have shown a high level of interest particularly in younger members of the profession. It may be that, as these doctors assume positions of responsibility for undergraduate teaching, acupuncture will come to find a place in the curriculum. Fortunately, whilst it takes many years to become fully skilled in this technique and to be able to treat a wide range of conditions with complete expertise, it is also possible for any doctor to learn quickly sufficient to treat many common conditions safely and effectively.

The place of acupuncture in disease management

Acupuncture has certain major advantages compared with other forms of medical treatment. Firstly, it is relatively safe. Provided the acupuncturist does not introduce infection (4), or needle nerves, arteries, or the pleural cavity (5) it is very hard to do harm with acupuncture, and that is certainly not true of other techniques we use including, of course, drugs. The next attribute, which should certainly appeal in today's penurious times is that it is cheap. It involves little equipment, although rather more time for carrying out and following up than, say, prescribing drugs. Thirdly, acupuncture works very well in selected conditions, many of which are very common, troublesome to the patient and intractable to conventional medical therapy. Examples of these are migraine (6) and low back pain (7).

Because acupuncture is simple, cheap and effective there is a strong case for using it first, before other more expensive and possibly hazardous methods of treatment are tried. Anyone who has practised acupuncture for some time will have experienced the irksome fact that most of the patients seem to come to the acupuncturist absolutely as the last resort. They have had drugs, manipulation, ultrasound, traction etc., etc., in an attempt to find a cure. Then someone finally thinks of the acupuncturist. As a result he sees the chronic case, by definition resistant to treatment, often with superadded features which make response to acupuncture uncertain, such as surgical intervention with section of local nerves. The only good side to this is that if he can manage to bring about an improvement, the patient, relatives and previous medical attendants are usually very grateful. But how much better to see cases in the early phase before the problem has become entrenched and perhaps some irreversible pathological change has occurred, and what an improvement that would make to our response rates.

Conditions amenable to treatment with acupuncture

Unfortunately, early Oriental experience with acupuncture is of little guide in informing the modern Western practitioner which conditions he should use this technique to treat. Concepts of disease in China thousands (8) or even hundreds of years ago were very different from those of today in the West and the list of diseases in which acupuncture was claimed to be highly effective was extremely broad. Everyday clinical experience strongly suggests that acupuncture is not helpful in many of these cases, for which effective modern alternatives are in any event readily available.

Acupuncture seems particularly effective in treating various causes of chronic pain (3,9); in musculoskeletal disorders (10); in relieving the symptoms of the arthritides (11,12); in treating stress induced symptoms; in conditions characterised by a disordered physiology without irreversible pathological changes, such as naso-sinusitis, nausea and vomiting from pregnancy (13), anaesthesia (14) or motion; in managing the withdrawal of addictive substances such as opiates (15,16), benzodiazepines, cigarettes or alcohol (17); and providing symptomatic relief in some other conditions such as multiple sclerosis or malignancy (18,19). Electro-acupuncture is known to speed the healing of limb ulcers (20-22), and there is well documented
Evidence that acupuncture can provide operative analgesia (23-25) as well as post-operative pain relief (26).

**Mechanism of action**

The fact that acupuncture has a chance of relieving suffering in illnesses where other more conventional approaches have failed (27, 28) is, of course, a major benefit. A second major benefit, however, is acupuncture's value in neurophysiological research. In acupuncture we have a way of tapping into the central nervous system to alter its responses in a delicate and selective manner. Here we are putting in plugs and throwing switches, not just taking a hammer to the switchboard. There is immense potential in acupuncture for learning more about the functioning of the nervous system and it is likely that acupuncture itself will be modified in this process. For instance if we are using acupuncture to release chemicals in various parts of the spinal cord and brain, it may in the end be better just to give these chemicals to the patient. Certainly modifications of technique are resulting gradually from such fundamental research as is being carried out.

Whilst there are still very many basic questions to be answered about acupuncture, we are now in a position to give at least a partial explanation of its underlying mechanism. However, it is first necessary to define the various acupuncture stimuli which the practitioner applies to his patients.

With superficial acupuncture the epidermis may be stimulated by heat, by scarification, by insertion of a fine intra-cutaneous needle or by the passage of a needle of normal diameter through the skin but no further than the subcutaneous tissues. In deep acupuncture the needle passes through the subcutoaneous tissues into muscle or even down to the periosteum. The electroacupuncture (EA) stimulus usually comprises brief (0.2 msec) square wave pulses repeated at a low frequency, for example, 1-4 Hz. The stimulator output amplitude is adjusted to a high level (approximately 30-50mA) which is likely to produce muscle contraction. This set of stimulus parameters is in distinction to that in conventional "high frequency" Transcutaneous Electrical Nerve Stimulation (TENS) where square wave pulses of 100-150 Hz and currents of 15-35 mA are used. So-called "acupuncture-like TENS" employs similar impulses to those for EA, passed through surface electrodes instead of needles. As will be explained, manual acupuncture, EA and acupuncture-like TENS recruits one set of neurological pathways and traditional TENS another, so these distinctions are important.

**The nature of the acupuncture stimulus**

When, in manual acupuncture, a needle is passed through the skin and is manipulated it traumatizes the tissues through which it travels. A patch of inflammation is set up (akin to that caused by a cut or burn), inflammatory mediators such as kalikinine, prostaglandins, histamine, bradykinine and serotonin (5HT) are released, and these make their presence known by causing a classical "Lewis triple response" of flare, blanching and a weal due to increased vascular permeability, at least in susceptible subjects.

The local nerve endings are stimulated mechanically whilst the needle is in situ and are also sensitised by the chemical products of inflammation so that for some days afterwards a state of hyperesthesia and hyper-algesia exists and the nerves fire off in response to mechanical stimuli which would normally be sub-threshold. This may be one reason why the effects of an acupuncture needle last long after its removal, although this could not explain responses lasting months or even years. Both EA and TENS cause direct electrical stimulation of the local nerve endings which is added to the above mechanical effects in the case of EA. It may be relevant to note that TENS tends to produce shorter lived benefit than EA.

**The role of superficial sensory nerves**

From both experimental work and clinical observation it seems clear that normally functioning nerves are required for acupuncture to be effective. If procaine is injected into the skin before needling, the rise of pain threshold normally expected does not occur, whereas if the needle is inserted deeply into muscle, afferents from this tissue transmit impulses centrally and the effect is restored. Acupuncture is not clinically effective when applied to skin whose nerve supply is disrupted mechanically (e.g. by scar tissue) or by a viral infection (e.g. Herpes zoster). Thus peripheral nerve stimulation does seem to be an integral part of acupuncture's mechanism.

Whilst nerve transmission is involved, the underlying events are biochemical and neurotransmitters sometimes spill over into the circulation if the stimulation is prolonged and intense enough. Various early experiments demonstrated this: for instance blood cross circulated into a second rabbit from one exhibiting acupuncture induced analgesia raised the recipient's pain threshold. Cerebrospinal fluid (CSF) from animals given segmental acupuncture showed elevation of endogenous opiate levels when sampled at the level of stimulation but not elsewhere; and, in human patients, blood and CSF enkephalin and endorphin levels changed in response to electroacupuncture of the ear (29).

**The nature of acupuncture points**

There has been a good deal of doubt over the years as to whether acupuncture is effective when the stimulus is applied to the skin at loci not classically listed as acupuncture points (30, 31) and not included in the series of "extra" points discovered in more modern times. It is likely that there is a hierarchy of benefit, with the least effect from stimulating the skin at a position bearing no neurological, anatomical or embryological relationship...
with the area of pathology one is hoping to influence, a greater effect from stimulating areas in the same dermatome or myotome, more by the surface (34) or with "motor points" (35) alone. The theory does seem to predict groups of points which act synergistically in treating various conditions. However there is no established histological basis for the channels.

There is, though, a histological basis for acupuncture points. The positioning of these is known to coincide, in about 80% of cases, with places where sensory nerve bundles pierce the deep fascia and become subcutaneous (33); with major blood vessels surrounded by their network of nervi vasorum; with nerves passing through foramina, with areas where sensory nerve trunks lie close to the surface (34); or with "motor points" (35) at which efferent nerves enter the bodies of muscles. The nerve bundles which are involved are usually quite mixed, but contain medium diameter Aδ fibres, which subserve "first", "rapid" or "aversive" pain. They also contain sympathetic efferents (36), and this may be the anatomical basis of the observation that there are usually more sweat glands in the skin overlying acupuncture points. Microsecretion of sweat may, in its turn, account for the low electrical resistance of these points as may the fact that the nerve bundle offers a low impedance pathway into the deeper tissues.

Acupuncture points are frequently tender, when they are known as Ah Shi points, and treatment of tender "trigger points" (37) is often of benefit in musculo-skeletal disorders (10). Tissue inflammation is known to be associated with recruitment of small diameter nociceptive nerve fibres which will respond to lower levels of stimulation. A lowering of pain threshold is the result and the area becomes tender on pressure. These tender spots arise around bones and joints and in muscles, and often, although not always, occur at known acupuncture points, where nerve fibre concentrations occur.

The neuro-anatomy of acupuncture

The nerve pathways thought to be involved in the transmission of acupuncture stimuli are now becoming known (38). Acupuncture's effect is easiest to understand in its use to block pain. Most pain is caused by noxious stimulation of specific nerve endings known as nociceptors. There are two sorts of these: firstly high threshold mechanoreceptors found mainly in skin and activated by pinprick and suddenly applied heat. These discharge through medium diameter myelinated Aδ afferents. As stated, they subserve rapid sharp pain. Secondly, there are the bare endings of small diameter, non myelinated C fibres, which are present in virtually all tissues except the central nervous system. These are activated by tissue damage and slowly give rise to a sensation of aching pain (39).

The neurological pathways and transmitters involved in these two modalities of pain are different. Activation of Aδ fibres leads to the release of enkephalins, whereas C fibre activation causes release of either Substance P or Vasointestinal Peptide (VIP). The release of either of these substances leads to the excitation of a transmission (T) cell which gives rise to the crossed spinothalamic tract, thought to be the most important nociceptive pathway in the CNS. This finally synapses in the thalamus, and projections arising from here run to the cerebral cortex where the sensation of "slow" pain is felt.

Neurophysiological studies suggest that acupuncture stimulates principally the medullated Aδ fibres. These synapse with two sorts of cell in the spinal cord. Firstly, they link to the T cells which transmit pain impulses arising from C fibres. Here they can exert an inhibitory influence, "closings the gate" according to the famous theory of Melzack & Wall (40), thus preventing the onward passage of pain impulses. This is a segmental mechanism brought into play by stimulating acupuncture points at the appropriate level. CSF β-endorphin concentrations have been shown to rise in response to low frequency EA in patients suffering chronic pain (41), and blockade of its effect by naloxone presumably accounts for naloxone's reversal of the pain relief caused by this treatment (42,43). Note that there is experimental evidence that excessive acupuncture stimulation can actually "open the gate" probably because the balance of C fibre to Aδ fibre traffic increases, and this is matched by the clinical observation that painful acupuncture is sometimes less effective.

Additionally, Aδ fibres synapse in the spinal cord with Waldeyer cells (44) which give rise to the crossed spinothalamic tracts that also run to the thalamus and sensory cortex. Here the sensation of "fast", "sharp" pain is felt. The neurones of the spinothalamic tract also make a connection within the periaqueductal grey matter of the mid brain with a descending pain inhibitory channel. Serotoninergic (5HT) fibres run back down the spinal cord also linking with T cells at different levels and "closing the gate". This may be the explanation for acupuncture's extrasegmental effect. It also probably explains why the administration of small doses of serotonin reuptake inhibitors, such as the anti depressant amitryptiline, may both benefit...
chronic pain directly and enhance the effect of acupuncture. Acupuncture analgesia is also facilitated by the administration of the serotonin precursor L-tryptophan.

**Classification of sites of acupuncture stimulation**

The pathways followed by acupuncture-produced stimuli in blocking pain will vary according to the location of the points in relation to the painful area. If the site of the pain itself is needled, transmission will occur via Aδ fibres to "close the gate" at the appropriate spinal segment. Relief of muscle spasm may occur as a direct effect of needling or by a local reflex arc. If points at sites of actual or possible pain referral are treated, large diameter fibres which share the same interneurones in the spinal cord as those arising at the site of the pain are involved.

The efficacy of stimulation of non-related sites may be explained by long intersegmental links, which may be more likely if the sites bear some embryological relationship to the painful area. Additionally, there may be a radiation of effect in somatotopically organised higher brain centres (45). In particular, the sensory representation of the ear, which is very richly innervated, is very close to that of the rest of the base in the thalamus and cortex, and this may be the neuro-anatomical basis for acupuncture therapy.

In some circumstances "diffuse cortical inhibition" is thought to play a part, whereby strong peripheral stimuli, even at non-acupuncture points, may reduce the sensitivity of much of the cortex to incoming painful impulses. Finally, certain major acupuncture points may have a generalised analgesic effect acting to increase brain, CSF and spinal cord endogenous opioids both "closing the gate" segmentally and also increasing descending inhibition. A complete acupuncture therapeutic approach to a painful condition would attempt to recruit most, if not all, of these mechanisms.

**Long term effects of acupuncture**

As stated previously, local inflammation can account for brief persistence of an effect from acupuncture after the needle has been removed, but could not explain long-term resolution of symptoms or disease. Obviously, in some cases, if inflammation or swelling can be relieved for a short period, as in chronic sinusitis, then the body's own healing mechanisms can clear the condition up permanently. But there must also be some long-term effect on the nervous system to account for the disappearance of problems such as migraine (6) or trigeminal neuralgia (46) after four or five weekly treatments. This is not hard to envisage; after all memory is just such an effect. Also there have been various suggestions concerning reverberant loops, which however, remain to be confirmed by appropriate experiments.

**Other effects of acupuncture on bodily homeostasis**

A relatively large amount of research has been carried out into the nervous mechanisms of pain relief by acupuncture and this is now fairly well understood (38,47,48), although there are still many questions to answer. These include some very practical and straightforward ones concerning, for instance, the optimum points to stimulate in particular conditions and the optimal stimulus duration, frequency and intensity.

When it comes to other effects of acupuncture, however, we have very few answers. From work with various animal models, clinical observations and controlled trials, acupuncture is known to have effects on body temperature control (49) and sweat gland activity; circulation in the skin (50) and possibly deeper tissues (51); bowel motility (52) and secretion; urodynamics; exercise tolerance (53); emesis (54); tinnitus (55); lung function (56,57) and the sensation of dizziness (58,59); psychiatric states (60) such as fatigue, anxiety and depression (61,62); immune mechanisms (63); local tissue inflammation (64); and a variety of biochemical and haematological variables (65).

In particular, the effects of acupuncture on nausea and vomiting after cytotoxics (66,67), anaesthesia (14,68,69) or in early pregnancy (13) have been extensively studied by Dundee & co-workers (70). So has the effect of high intensity, low frequency acupuncture-like TENS for the treatment of varicose ulcers (20,22). There are clear and reproducible effects whereby VIP is released (71), presumably improving peripheral blood flow and facilitating healing, but in this situation as in others we have little idea of the underlying physiological mechanisms. Lack of this knowledge we are unable to refine our therapeutic techniques or predict which classes of patients are most likely to derive benefit. All one can say is that these fields of study are wide open and that, apart from the direct benefit to patients which should attend the resulting discoveries, we shall, in the process of research, learn much about the workings of the nervous system.

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**The BRITISH MEDICAL ACUPUNCTURE SOCIETY**

**ACUPUNCTURE SOCIETY** is a society of medically qualified doctors who practise acupuncture or have an interest in it. The society has expanded to include sections for dentists and veterinary surgeons.

The aims of the society are to promote the scientific understanding and practice of acupuncture as part of the normal practice of medicine.

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