Acupuncture is a complementary therapy that is being increasingly used in the day-to-day management of pain. It originated in China, over 3000 yr ago and is practised worldwide. This article offers a summary of the models of its suggested mechanism of action, the evidence-base for its effectiveness and the clinical applications for which acupuncture can be considered.

**Traditional theory of action**

Fine needles (32–36 gauge) are inserted into body locations known as acupoints. Classic texts describe up to 356 mapped points located on meridians or channels of energy flow on the surface of the body. In the traditional Chinese medicine (TCM) system, the body is seen as a delicate balance of two opposing and inseparable forces: yin and yang. Yin represents the cold, slow, or passive principle, while yang represents the hot, excited, or active principle.

A major assumption in TCM is that the health is achieved by maintaining the body in a ‘balanced state’ and that disease is as a result of an internal imbalance of yin and yang. This imbalance leads to blockage in the flow of Qi (vital energy) along pathways known as meridians. It is believed that there are 12 main meridians and 8 secondary meridians and that there are more than 2000 acupuncture points on the human body that connect with them. Whether we believe this or not, the correlations are based on close clinical observations that have existed for millennia.

**Techniques**

**Basic needling**

Needles are inserted to a depth of 4–25 mm and left in place for a period of time (from a few seconds to many minutes). There are often 6–12 needles (and sometimes more) inserted at different acupoints at the same time. The sensation often described as a tingling or dull ache at the entry point. Many people say they feel very relaxed or sleepy, and some report increased energy levels afterwards.

**Electro acupuncture (EA)**

A tiny focused electric current is applied to the skin at the acupoints or can be applied to the needle itself. There are various modalities to consider.

**Frequency of stimulation**

Specific endogenous opiate responses have been reported:

- low-frequency stimulation (1–2 Hz) causes the release of endorphins and enkephalins (Aβ mediated). Less than 1 Hz is ineffectual;
- mid-range (12–15 Hz) stimulation results in the production of all three opioid classes;
- high-frequency (100 Hz) results in dynorphin release and has no effect on endorphins or enkephalins (Aβ-mediated). There is no further gain in opioid peptide release beyond 200 Hz.

**Amplitude of stimulation**

One to three milliampere is the range used most commonly in clinical practice. This intensity produces a non-painful fasciculation of the muscle in which the needle is embedded. Higher amplitudes cause pain and give rise to a stress response. Stress-induced analgesia depends in part on diffuse noxious inhibitory control and does not usually form a part of acupuncture analgesia.

**Duration of stimulation**

At least 10 min is required for the production of the endorphins, with maximal release after 20 min. When stimulation is prolonged beyond 1 h, or if the stimulation is repeated (e.g. 30 min bursts repeated after a 1 h interval), the analgesic effect is attenuated.

**Key points**

Acupuncture originated 3000 yr ago and has been used as a modality for treatment of acute and chronic pain. There are five main techniques practised. Dry needling is probably the most common, but electro acupuncture (EA) possesses the most promising research endorsement. Many expert panels have convened worldwide and have found at least 40 different indications for acupuncture. However, further research is needed.

Thus far, the use of acupuncture, along with other therapies, has proved to be very promising in osteoarthritis of the knee and in intractable neck pain. Despite minimal contraindications and an excellent safety profile, cynicism still exists, mainly as a result of the evidence-based climate in which we practise today.

Jonathan Wilkinson MB ChB MRCP FRCA
Specialist Registrar and Fellow in Thoracic Anaesthesia Nottingham University Hospitals NHS Trust Hucknall Road Nottingham NG5 1PB, UK

Richard Faleiro BSc (Hons) DCH FRCA
Consultant in Anaesthesia and Pain Management Derby Hospitals NHS Foundation Trust London Road Derby DE1 2QY, UK
Tel: +01332 225 4963
Fax: +01332 225 4963
E-mail: richard.faleiro@nhs.net (for correspondence)
Acupuncture in pain management

Moxibustion
A stimulating heat may be applied onto the needle over the acupoints. Traditionally, this was a smouldering herb.

Laser acupuncture
In laser acupuncture, a fine low-energy laser beam is directed onto the acupoint.

Acupressure
Here, pressure is used to stimulate the acupoints. This can be in the form of a bracelet or strap. This method is commonly used to alleviate motion sickness.

Acupoints and their locations
The Standard Acupuncture Nomenclature published by the World Health Organization (WHO) listed about 400 acupuncture points and 20 meridians connecting most of the points. The exact anatomical locations of these points are beyond the scope of this article.

There are 12 meridians on the arms and the legs. The meridians are divided into Yin and Yang groups. The Yin meridians of the arm are: heart, lung, and pericardium. The Yang meridians of the arm are: small intestine, large intestine, and triple warmer. The Yin meridians of the leg are: stomach, bladder, and gall bladder.

Mechanisms of action
How can unmedicated needles, inserted at sites so distant from their desired application, work? Why does placing a needle on the lower leg, for example, affect gastric function? Many maintain that this is a placebo effect, as these meridians and their Qi cannot be measured, dissected, or observed using standard anatomical or physiological techniques. The acupoints are located at sites that have a high density of neurovascular structures and are generally between or at the edges of muscle groups.

A study demonstrating the map of a meridian pathway, involved the injection of technetium 99 into both true and sham (minimal-depth needle insertion at sites away from traditional acupuncture points) acupoints. The scans demonstrated random diffusion of the tracer around sham points, but rapid progression of the tracer along the meridian at a rate that was inconsistent with either lymphatic/vascular flow or nerve conduction at the true acupoint. Another demonstrated that needling a point on the lower leg traditionally associated with the eye, activated the occipital cortex of the brain, as detected by the detected by functional magnetic resonance imaging.

There are several postulated mechanisms of action.

Natural opioid substances
Needling affects the cerebrospinal fluid (CSF) concentrations of the naturally occurring opiate substances: dynorphin (acting at spinal level), endorphin (acting within the brain), and encephalin (acting both in the brain and at a spinal level). Endorphins and enkephalins are potent blockers or modulators of pain arising from the musculoskeletal system. Dynorphin is a powerful modulator of visceral pain; it has a weaker effect on musculoskeletal pain modulation.

The above notions were supported by cross-perfusion experiments in which an acupuncture-induced analgesic effect was transferred from the donor rabbit to the recipient rabbit when the CSF was transferred.² The prevention of acupuncture-induced analgesia by naloxone and by antiserum against endorphins offers further support of involvement of endorphins.

The neurogate theory
Similar to the mechanism of the action of widely used transcutaneous electrical nerve stimulation (TENS), the neurogate theory has also been offered as an explanation to the blockade of pain. The close correlation between local acupuncture points for pain and trigger points as noted by Melzack ³, co-author of the gate theory of pain, represents a major convergence of Western and Eastern knowledge.

Endogenous corticosteroid release
The presence of a foreign body (needle) may act to stimulate vascular and immuno-modulatory factors, including those of local inflammation. Adrenocorticotrophic hormone has been shown to be elevated after acupuncture treatments, suggesting that adrenal activation and the release of endogenous corticosteroids may also result.

Myofibrillary entanglement
Acupuncture may induce relaxation of ‘stuck’ myofibrils within tissue planes. This is thought to have a similar effect to the injection of painful trigger points (a common procedure undertaken in pain clinics).

Local blood flow
In causing minor trauma to an area of the body, it is postulated that acupuncture may increase local blood flow to the surrounding area. This may initiate or catalyze the healing process.⁴

Mesolimbic loop of analgesia
The mesolimbic pathway is one of the neural pathways the brain that link the ventral tegmentum area in the midbrain to the nucleus accumbens in the limbic system. It is one of the four major pathways where the neurotransmitter dopamine is found and produces a pleasurable feeling when stimulated.

It is postulated that, in chronic-pain patients, the mesolimbic loop is in a state of imbalance. After a relatively brief (30 min) period of stimulation with TENS or EA, a self-sustaining reverberation is set up, causing a re-setting of the pain-modulation
Evidence for efficacy

The National Institute of Health (NIH) in the USA has convened a consensus panel to review the available literature concerning acupuncture. The quality of many studies has been poor; enthusiastic practitioners, rather than trained researchers, have performed most studies. The panel concluded that there were only two evidence-based indications for acupuncture: dental pain and nausea (postoperative, chemotherapy-induced and pregnancy-related).

The panel also concluded that it was time to take acupuncture more seriously and their systematic review of the literature indicated that there may, in fact, be far more indications, but better designed studies were needed to confirm its utility in these areas. These include investigation into the basic science of acupuncture and appropriate sham needle approaches to the placebo arm. The WHO has identified over 40 medical conditions that may be effectively treated with acupuncture. Those relating to pain alone are shown in Table 1.

Research into acupuncture has to contend with the concept of a control group. If, in control groups, non-acupoint needling is performed, physiological acupuncture effects are implied. Therefore, the effects shown in this group are often close to those shown in the acupuncture group. In other trials, control groups have received obviously different treatments, such as TENS or TENS-laser treatment; it is not clear if the effects of acupuncture are as a result of only the psychological effects of the treatment. A placebo acupuncture needle has now been developed, with which it should be possible to simulate an acupuncture procedure without penetrating the skin.

Table 1 Conditions that may be amenable to acupuncture identified by the WHO

<table>
<thead>
<tr>
<th>Upper respiratory tract disorders</th>
<th>Acute sinusitis</th>
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<tr>
<td>Gastrointestinal disorders</td>
<td>Acute/chronic gastritis</td>
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<tr>
<td></td>
<td>Chronic duodenal ulcer (pain)</td>
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<tr>
<td>Neurological disorders</td>
<td>Headache</td>
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<tr>
<td>Musculo-skeletal disorders</td>
<td>Tennis elbow</td>
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<tr>
<td>Other</td>
<td>Asymptomatic chest pain</td>
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Clinical applications

The most common indication is for chronic pain unresponsive to standard therapy, where other options have been exhausted. It is often seen as a last resort for pain relief, as a result of the inconclusive evidence base thus far. This creates an adverse selection bias, leaving acupuncture as an option only for those patients who fail to respond to all other methods and can create unrealistic expectations from patients.

Osteoarthritis of the knee

A major study involving 570 patients looking at the effect of acupuncture on osteoarthritis of the knee has found that it can both relieve pain and improve movement. A US NIH study concluded that acupuncture is an effective complement to standard care. Patients who took part in the study received acupuncture, sham acupuncture, or guidance on self-help, alongside standard drug treatment.

Previous studies of acupuncture for osteoarthritis have had conflicting results. This may have occurred because most studies have included small samples, a limited number of treatment sessions, or other limitations. Improvement in a standard pain and function score was more likely in the traditional- and sham-acupuncture groups than in the standard-treatment group (53 and 51% vs 29%, respectively). However, the placebo effect could be operating here, because similar improvements were observed regardless of whether or not the needles were inserted into defined acupuncture points. Commentators have questioned the use of sham acupuncture as a control in this study and others, arguing that sham acupuncture may be too similar to real acupuncture to be a valid control, thereby skewing results towards showing a relative lack of efficacy. Others questioned the success of blinding, because the study plan was published on the Internet before the study ended.

Chronic neck pain

Researchers at the University of Southampton compared genuine and sham treatments from the same therapist on 124 patients with chronic neck pain aged between 18 and 80. Over 12 weeks, patients from both groups reported a decrease in pain levels of more than 60%. This may imply that most of the improvement gained from acupuncture is not as a result of the needling process itself, but predominantly as a result of the non-specific yet powerful effects which are probably part of the treatment process.

Low back pain

For low back pain, a Cochrane review stated: Thirty-five RCTs covering 2861 patients were included in this systematic review. There is insufficient evidence to make any recommendations about acupuncture or dry-needling for acute low-back pain. For chronic low-back pain, results show that acupuncture is more effective for pain relief than no treatment or sham treatment, in measurements taken up to three months. The results also show that for chronic low-back pain, acupuncture is
more effective for improving function than no treatment, in the short-term. Acupuncture is not more effective than other conventional and 'alternative' treatments. When acupuncture is added to other conventional therapies, it relieves pain and improves function better than the conventional therapies alone. However, effects are only small. Dry-needling appears to be a useful adjunct to other therapies for chronic low-back pain.

Contraindications and adverse effects

The absolute and relative contraindications to acupuncture are listed in Table 2. Acupuncture is technically an invasive procedure and has rare associated risks (Table 3). Serious injury is extremely rare given the millions of needles placed annually worldwide. A well-trained practitioner can prevent most of these problems. The introduction of single-use disposable needles has eliminated cross infection. The most common complication is syncope or pre-syncope (the so-called needle shock reaction). In most cases, removal of the needle and performing the technique in the recumbent rather than the sitting position is enough to prevent this.

Conclusion

Acupuncture may work via the same mechanisms other complementary therapies work namely:
- Placebo.
- Diversion.
- Cyclical nature of the illness—it went away by itself anyway.
- Incorrect diagnosis.
- Mood improvement due to the intimate nature of the treatment.
- Psychological investment of the patient in the success of the therapy.
- Other medications the patient may be taking.

Whenever the conventional standard of care is not effective, acceptable to the patient or has intolerable side effects, acupuncture can be considered within an integrated care plan. Although not a panacea, it is often an option considered too late. It must be noted that delaying conventional proven therapy in order to use acupuncture as the initial treatment modality for a condition, may be unwise. This is particularly true if there is insufficient validation from scientific studies for that condition. Explanations offered by traditional Chinese medicine are admittedly rich in metaphor and allegory and results of studies are often conflicting; however, doctors hate to admit that acupuncture can work. Why? They find it hard to believe what they can’t see. Now there’s something to look at.

References


Please see multiple choice questions 22–26

### Table 2 Contraindications to the use of acupuncture

<table>
<thead>
<tr>
<th>Absolute contraindications</th>
<th>Relative contraindications</th>
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<tbody>
<tr>
<td>Needle phobia</td>
<td>Pregnancy—avoid any points known to stimulate uterine contractility</td>
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<tr>
<td>Severe bleeding diathesis</td>
<td>Points over nipples, umbilicus, and major vessels are forbidden by conventional texts</td>
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<tr>
<td>Inability to remain still for treatment</td>
<td>Point over infant fontanel</td>
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<tr>
<td>Systemic sepsis</td>
<td>Application during menses (less effective)</td>
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<tr>
<td>Unco-operative—hallucinating, delusions, etc.</td>
<td>If patient is on corticosteroids, benzodiazipines, or narcotics (less effective)</td>
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<tr>
<td>Cellulitis</td>
<td>Anticoagulant drugs</td>
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<td>Burns</td>
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<td>Ulceration</td>
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<td>EA—do not apply over heart or brain</td>
<td>Do not apply in region of pacemaker or implanted medical pump</td>
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### Table 3 Adverse effects of acupuncture

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<td>Pneumothorax</td>
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<td>Cardiac tamponade</td>
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<td>Neurovascular damage</td>
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<td>Infection</td>
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<td>Metal allergy</td>
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<td>Local pain</td>
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<td>Bruising</td>
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<td>Bleeding</td>
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<td>Haematoma formation</td>
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