Research reviews

This section is designed to give a synopsis of some of the latest research published in Medline listed journals over the last year or so. It will concentrate on controlled trials and systematic reviews, but will also include other papers that may be of interest to the readership. Some papers will be reviewed in more detail than others. If the reviewer's comments are based on an abstract only, this will be indicated. Most summaries are an edited form of the abstract from the original paper. The main reviewer in this section is Mike Cummings, London. Other reviewers are indicated after the relevant review.

SR

TENS reduces postoperative analgesic consumption


**Summary**

In this paper the authors investigated the literature of randomised placebo-controlled trials to find out if transcutaneous electrical nerve stimulation (TENS) or acupuncture-like transcutaneous electrical nerve stimulation (ALTENS) can reduce analgesic consumption after surgery. Subgroup analysis for adequate treatment was performed (pulse frequency: 1-8Hz [ALTENS] or 25-150Hz [TENS], current intensity: “strong, definite, subnoxious, maximal tolerable” or above 15mA, and electrode placement in the incision area). Twenty-one randomised, placebo-controlled trials with a total of 1350 patients were identified. For all trials, the mean reduction in analgesic consumption after TENS/ALTENS was 26.5% (range -6 to +51%) better than placebo. Eleven of the trials, comprising 964 patients, had reports which stated that a strong, subnoxious intensity at an adequate frequency in the wound area, can significantly reduce analgesic consumption for postoperative pain.

**Comment**

Conceptually this is a sound paper. This reviewer has not critically appraised the review process or the statistics; however, the interesting and novel features are contained within the question. The authors asked whether optimal TENS treatment reduced postoperative analgesic consumption, and they concluded that it did. Why is this different from the previous negative reviews of TENS,1;2 and why is Bandolier's commentary regarding TENS so negative?3 There are two key reasons. First, using optimal treatment parameters as an inclusion criterion seems a sensible thing to do; however, the previous reviews did not do this. This is a problem in the assessment of many physical therapies, and in pharmacological terms it is like using a range of different doses of a drug, and performing systematic reviews that include trials of sub therapeutic doses. Second, the authors use analgesic consumption as their primary outcome, rather than pain scores. They point out that many trials have used TENS as a co-intervention with patient controlled analgesia (PCA), so measuring pain scores alone will not adequately reflect the efficacy of TENS. Previous reviews have simply considered pain scores, which, if patients are using PCA, are unlikely to differ greatly, since if you are in pain you keep pressing the demand button on the device until the pain reduces.

The evidence based medicine gurus may well be
A review of the evidence for the effectiveness, safety, and cost of acupuncture, massage therapy, and spinal manipulation for back pain


**Summary**

Few treatments for back pain are supported by strong scientific evidence. Conventional treatments, although widely used, have had limited success. Dissatisfied patients have, therefore, turned to complementary and alternative medical therapies and providers for care for back pain. The purpose of this review was to provide a rigorous and balanced summary of the best available evidence about the effectiveness, safety, and costs of the most popular complementary and alternative medical therapies used to treat back pain. Data sources used were: Medline, Embase, and the Cochrane Controlled Trials Register. Systematic reviews of randomized, controlled trials (RCTs) that were published since 1995 and that evaluated acupuncture, massage therapy, or spinal manipulation for nonspecific back pain, and RCTs published since the reviews, were analysed. Two authors independently extracted data from the reviews (including number of RCTs, type of back pain, quality assessment, and conclusions) and original articles (including type of pain, comparison treatments, sample size, outcomes, follow-up intervals, loss to follow-up, and authors’ conclusions). Because the quality of the 20 RCTs that evaluated acupuncture was generally poor, the effectiveness of acupuncture for treating acute or chronic back pain is unclear. The three RCTs that evaluated massage reported that this therapy is effective for subacute and chronic back pain. A meta-regression analysis of the results of 26 RCTs evaluating spinal manipulation for acute and chronic back pain reported that spinal manipulation was superior to sham therapies and therapies judged to have no evidence of a benefit, but was not superior to effective conventional treatments. The authors concluded that initial studies have found massage to be effective for persistent back pain. Spinal manipulation has small clinical benefits that are equivalent to those of other commonly used therapies. The effectiveness of acupuncture remains unclear. All of these treatments seem to be relatively safe. Preliminary evidence suggests that massage, but not acupuncture or spinal manipulation, may reduce the costs of care after an initial course of therapy.

**Comment**

The scope of this review was broad, and so it is no surprise that the authors of this review, like many before them, failed to unpick the validity of the original research questions posed by the included reviews and RCTs. The obvious example from the acupuncture literature is a question concerning the efficacy of ‘acupuncture’ tested in a trial that compares two forms of invasive needling. There are many examples of this in the literature, and this failure may equally apply to the other physical therapies.

As with many systematic reviews published in prestigious journals, most health professionals...
Experimental Studies (humans)

Active trigger points (TrPs) are biochemically distinct from normal muscle or latent TrPs (n=9)


Summary

The authors’ objective was to determine (1) whether a novel microdialysis needle could successfully sample the biochemical milieu of trigger point 1 (TrP1) in the upper trapezius muscle in healthy subjects, and (2) whether there are measurable differences among those with symptoms and physical findings related to myofascial trigger points (MTrPs). This was a prospective, controlled trial, set in a biomedical research hospital. Three subjects were selected based on history and physical examination for three groups (n=9): group 1, normal (no neck pain, no MTrP); group 2, latent (no neck pain, MTrP present); and group 3, active (neck pain, MTrP present). Pressure algometry was performed at TrP1 to determine pain pressure threshold (PPT). Samples were obtained continuously with a microdialysis needle at regular intervals, starting with needle insertion, elicitation of a local twitch response, and then post-twitch. The main outcome measures were PPT and levels of pH, substance P, calcitonin gene-related peptide (CGRP), bradykinin, norepinephrine, TNFα, and IL-1β.

Overall, the amount of substance P, CGRP, bradykinin, norepinephrine, TNFα, and IL-1β was significantly higher in the active group than in the other two groups (p<0.01). Overall, pH was significantly lower in the active group than in the other two groups (p<0.03). At five minutes, peak levels of substance P and CGRP differed significantly in all three groups (3>2>1, p<0.02). This technique recovered extremely small quantities (<0.5 µL) of very small substances (molecular weight, <100kd) directly from soft tissue. There were significant differences in the levels of pH, substance P, CGRP, bradykinin, norepinephrine, TNFα, and IL-1β in those subjects with an active MTrP (symptoms, MTrP present) compared with subjects with a latent MTrP (no symptoms, MTrP present) and normal subjects (no symptoms, no MTrP).

Comment

This is a preliminary communication of a very exciting and novel experimental technique. Since clear histological differences have not been demonstrated between muscle at MTrPs and normal muscle, there is still considerable controversy over whether they even exist. The only positive histological study to date has been consistent with this investigation in that it showed a significantly higher concentration of substance P in the sensory nerves of muscle from active MTrPs compared with normal muscle or muscle from fibromyalgia patients (n=27, nine in each group). This paper was reviewed previously in Acupuncture In Medicine. Details of the full report, and further work with this technique, are keenly awaited.
Functional magnetic resonance imaging (fMRI) and electrical acupoint stimulation (n=48)


Summary

Two or 100Hz electrical acupoint stimulation (EAS) can induce analgesia via distinct central mechanisms. It has long been known that the extent of EAS analgesia showed tremendous difference among subjects. Functional MRI (fMRI) studies were performed to allocate the possible mechanisms underlying the frequency specificity as well as individual variability of EAS analgesia. In either frequencies, the averaged fMRI activation levels of bilateral secondary somatosensory area and insula, contralateral anterior cingulate cortex and thalamus were positively correlated with the EAS-induced analgesic effect across the subjects. In the 2Hz EAS group, positive correlations were observed in the contralateral primary motor area, supplementary motor area, and ipsilateral superior temporal gyrus, while negative correlations were found bilaterally in the hippocampus. In the 100Hz EAS group, positive correlations were observed in the contralateral inferior parietal lobule, ipsilateral anterior cingulate cortex, nucleus accumbens, and pons, while negative correlation was detected in the contralateral amygdala. These results suggest that functional activities of certain brain areas might be correlated with the effect of EAS-induced analgesia, in a frequency-dependent dynamic. EAS-induced analgesia with low and high frequencies seems to be mediated by different, though overlapping, brain networks. The differential activations and de-activations in brain networks across subjects may provide a neurobiological explanation for the mechanisms of the induction and the individual variability of analgesic effect induced by EAS, or that of manual acupuncture as well.

Comment

Electrical acupoint stimulation (EAS) refers to a form of transcutaneous electrical nerve stimulation (TENS) or acupuncture-like TENS applied to acupuncture points. This study used points in the lower limb - ST36 and SP6. It is not stated whether this was unilateral or bilateral. The size of the surface electrodes is not stated, but the parameters of stimulation are well described. At 2Hz a square wave of 0.6ms width was used, and at 100Hz the pulse width was 0.2ms. The intensity was adjusted to the maximum comfortable intensity of each individual. This usually reached a level of 8-15mA (average 11.25mA). The minimal-EAS group received 2Hz at an intensity just above the detectable threshold.

Analgesia was tested with a noxious radiant heat stimulus on the dorsum of the foot, rather like the tail-flick latency test used in laboratory rats. The method of timing the latency was not reported, although the reviewer assumes that it was an automated method rather than an observer with a stopwatch, since the outcomes are reported in percentage time increase (under the noxious radiant heat stimulus) to two decimal places. The tests were performed before and after 30 minutes of EAS, although it is not clear whether the test was performed on the same limb as the EAS. The pain threshold increase ranged from 4.13 to 88.15% (mean ± standard error of mean (SEM): 43.74±9.61%; n=9) in the 2Hz group, 3.67 to 35.25% (mean ± SEM: 21.24±3.29%; n=11) in the 100Hz group, and -1.33 to 2.13% (mean ± SEM: 1.02±0.81%; n=4). A small supplementary study was performed to ensure that the analgesia induced by EAS was repeatable, and this showed a close correlation between levels of analgesia induced on two sessions separated by three days (n=20; r=0.85; p<0.0001).

Reference list

As for the fMRI results, these are rather difficult for the uninitiated (including this reviewer) to interpret. Correlations were made between levels of analgesia and activations or de-activations in the brain, and the authors draw some tentative conclusions from these. It appears that there are several differences between EAS at 100Hz and 2Hz, but it is difficult to know how relevant these are to acupuncture effects without being sure of the principle fibres being stimulated by the different forms of EAS. The authors appear to assume that EAS and electroacupuncture are effectively the same in terms of a peripheral sensory stimulus, and as Ji-Sheng Han is a contributing author, this reviewer is tempted not to argue. The similarity of EAS and EA, that is electrical stimulation of acupuncture points through surface stimulation or through needles, may have been established by prior work of this group, but this reviewer has not actually seen it in published form. Nevertheless, this is interesting work and hopefully this research direction will help to uncover the mechanisms of acupuncture, TENS and related forms of somatic sensory stimulation.

**TENS to LI4 causes temporary drop in blood pressure (n=14)**


**Summary**

To clarify the effect of electroacupuncture (EA) on the activity of the cardiovascular system in normal individuals, haemodynamic parameters including arterial blood pressure (BP), finger blood flow (FBF) and heart rate (HR) as well as paravertebral temperature (PVT) were recorded non-invasively under EA stimulation. A surface stimulation electrode was placed on the Hoku point (LI4). Square wave pulses (0.05ms) were applied from a stimulator with a stimulation frequency of 2Hz (three minutes). The stimulation intensity was five times sensory threshold. BP and FBF were decreased (68.5+/-6.0%, p<0.01 and 96.8+/-1.1%, p<0.01 of control, respectively, n=7) while HR and PVT were increased significantly (115.0+/-5.1 of control, p<0.05 and 0.054+/-0.004 degree C, p<0.01, respectively, n=7) during EA treatment. The authors suggest that their results show an inhibition in sympathetic outflow elicited by EA stimulation, which induced vasodilatation of systemic arterioles and a decrease in BP and FBF.

**Comment**

This study used a form of TENS (transcutaneous electrical nerve stimulation) rather than electroacupuncture (EA). A surface electrode of about 1cm diameter was placed over LI4 and a second, much larger electrode was placed over the brachial plexus. Only half of the subjects tolerated the intended intensity, so the stimulus was probably moderately painful for most of the subjects, but note that the latter is an inference of this reviewer, so it is difficult to determine whether the stimulus was within the parameters of standard therapeutic stimulation. Certainly it was more akin to ALTENS (acupuncture-like TENS), which uses high intensity low frequency stimulation, than standard TENS, which is generally involves high frequency and sub-noxious intensity. If the stimulus was noxious, however, a rise in sympathetic tone and blood pressure would generally be expected. It would be useful to know which fibres are principally activated with this type of stimulation. At a guess, this reviewer would expect the stimulation to activate high and low threshold fibres in the skin (Aδ and Aβ fibres), as well as various muscle afferents, both from direct electrical stimulation, and associated with the likely muscle twitch in the first dorsal interosseous.

Whilst there was a significant drop in blood pressure, it is somewhat disappointing that the level returned to normal before the end of stimulation. There was a small rise in temperature in the skin at T4 on the back that lasted for a few minutes beyond the end of stimulation.
Experimental Studies (animals)

Analgesia and c-Fos expression in the periaqueductal gray induced by EA at ST36 in rats

de Medeiros MA, Canteras NS, Suchecki D, Mello LE. Analgesia and c-Fos expression in the periaqueductal gray induced by electro-acupuncture at the Zusanli point in rats. *Brain Res* 2003;973(2):196-204.

**Summary**
The need to use anaesthetised or restrained animals in acupuncture research in laboratory animals may represent a confounding variable, since both anaesthesia and stress alter the pain threshold and the activity of pain-related brain areas. In this study the authors assessed the participation of the periaqueductal gray (PAG) in the analgesic effects of electroacupuncture (EA) applied to the *Zusanli* point (ST36) under carefully controlled stress conditions. Repeated immobilisation protocols (6 days, 1 hour/day and 13 days, 2 hours/day) were used to diminish the influence of acute immobilisation stress on c-Fos expression and analgesia (tail-flick test) induced by EA at ST36. Animals submitted to immobilisation alone (IMMO) or to EA (100 Hz, 2-4 V, faradic wave) on a non-point region (EANP) were compared with animals submitted to EA at ST36. In animals not previously submitted to repeated immobilisation, EA at ST36 induced analgesia and c-Fos expression in the PAG that was no different from that induced by EANP. In animals submitted to repeated immobilisation (repeated immobilisation for 6 days or repeated immobilisation for 13 days), however, EA at ST36 led to higher levels of analgesia and c-Fos expression, specifically in the ventrolateral PAG, as compared with animal groups subjected only to immobilisation or to immobilisation and EANP. The authors claim that their findings point to a specific part of the PAG as being involved in the effects of electroacupuncture at the *Zusanli* point.

**Comment**
The authors selected the animals for this trial on the basis of their response to EA at ST36. Only ‘responder animals’, i.e. those in which the tail-flick latency increased to 150%, were used. It is not clear how many animals in total were used, but it is stated that 9 to 12 were used for measurements of tail-flick latency in each subgroup, and four in each subgroup were used for c-Fos analysis.

The non-point used is described as being ‘5mm lateral to the midline of the posterior face of the hindlimb’. It is not adequately explained why this is a non-point in a rat, and it is not clear what tissue was the target of stimulation. Physiologically, there is unlikely to be much difference between these interventions, and the results in this paper confirm this. In the abstract the authors refer to a significant difference between the EA groups, but this difference only occurs at three time points out of eight in only one of the three sections of the trial. As the baseline measurement in the immobilisation-only control group varied by a factor of four across the different sections of the trial, it is tempting to put down the transient difference between the EA groups in one section to chance. With such a small and inconsistent difference between the EA groups, it seems irrelevant to analyse c-Fos expression in the PAG. This was done, however, and there were some significant differences between the groups, but in light of the tail-flick latency results, it is difficult to interpret these.

This reviewer continues to be surprised that such sophisticated physiological experiments are carried out to test hypotheses concerning intangible, non-physiological concepts such as ‘real’ versus ‘non acupuncture point’ location. These techniques should be applied to different physiological parameters, such as different stimulus strengths, or stimulation of different tissues, before the more esoteric philosophical concepts. The fact that they are not thus applied suggests potential ideological bias in the research team. Therefore, it will be important for such teams to consider masking of data collection and analysis in future.
Nocistatin potentiates antinociceptive effects of EA in mice


**Summary**

Nocistatin (NST) and nociception/orphanin FQ (OFQ) are peptides derived from the same precursor that play opposing roles in pain modulation. OFQ antagonises morphine analgesia and electroacupuncture (EA)-induced antinociceptive effect. The present study investigates whether NST potentiates EA-induced antinociceptive effect and reverses chronic tolerance to EA in mice. Intracerebroventricular (i.c.v.) injection of NST (0.5, 5.0 and 50.0 ng) had no effect on basal thermal latency, but produced a dose-dependent potentiation of EA-induced antinociceptive effect in mice, with the maximum response at 5.0 ng. NST (5.0 ng) partly reversed chronic tolerance to EA. These results suggest that NST in the brain might play a role in EA-induced antinociceptive effect and the development of chronic tolerance to EA in mice.

**Comment**

This is an interesting short report concerning the interaction of pain modulating peptides with acute EA-induced effects in mice. Whilst the acute effects of EA may be totally irrelevant to the clinical treatment of chronic pain, it is tempting to imagine that, in the future, there may be one or more pharmaceuticals that potentiate the effects, reduce tolerance and even turn non-responders into responders. Clearly minimal side-effects would be a bonus too!

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NMDA and AMPA receptor antagonists enhance the antinociceptive effects of EA


**Summary**

This study investigated the interaction between electroacupuncture (EA) and an N-methyl-D-aspartic acid (NMDA) receptor antagonist (DL-2-amino-5-phosphonopentanoic acid; AP5), or an (+/-)-alpha-Amino-3-hydroxy-5-methylisoxazole-4-propionic acid/kainite (AMPA/KA) receptor antagonist (6,7-dinitroquinoxaline-2,3 (1H,4H); DNQX), administered intrathecally on carrageenan-induced thermal hyperalgesia and spinal c-Fos expression in rats. Intrathecal (i.t.) injection of 1 and 10nmol AP5, but not DNQX, markedly increased the PWL of the carrageenan-injected paw. At a dose of 100nmol, either AP5 or DNQX significantly increased the PWL of the carrageenan-injected paw, with AP5 being more potent. The PWLs of the non-injected and normal saline (NS)-injected paws were not detectably affected by the administration of NMDA or AMPA/KA receptor antagonists at the doses tested. Unilateral EA stimulation of ST36 and BL60 points (60 and 2Hz alternately, 1-2-3mA) contralateral to the carrageenan-injected paw significantly elevated the PWLs of carrageenan- and NS-injected paws. Although neither i.t. injection of 0.1nmol AP5 nor 1nmol DNQX alone had an effect on the PWL of the carrageenan- and NS-injected paws, both significantly potentiated EA-induced analgesia in carrageenan-injected rats, especially 0.1nmol AP5. Fos expression evoked by intraplantar (i.pl.) injection of carrageenan was examined in the spinal cord with immunohistochemical methods. Three hours after i.pl. injection of carrageenan, the number of Fos-like immunoreactive (Fos-LI) neurons was significantly increased in all the layers of the ipsilateral spinal cord at L(4-5), with the highest density in laminae I-II and V-VI. Intrathecally pre-administered AP5 (10nmol) or DNQX (100nmol) significantly reduced the total number of carrageenan-induced Fos-LI neurons. The reduction was most apparent in laminae I-II and IV-V. Similarly, following bilateral EA stimulation of the ST36 and BL60, the numbers of carrageenan-induced Fos-LI neurons in laminae I-II and V-VI were also markedly reduced. When a
Excitatory amino acid receptor antagonist enhances the antinociceptive effects of EA


**Summary**

This study investigated the interaction between electroacupuncture (EA) and an intrathecally administered wide-spectrum excitatory amino acid (EAA) receptor(s) antagonist, kynurenic acid (KYNA) on carrageenan-induced thermal hyperalgesia and spinal Fos expression. Intrathecal (i.t.) injection of 0.1, 1, 10, and 100nmol KYNA markedly and dose-dependently increased the latency of paw withdrawal (PWL) of the carrageenan-injected paw. The PWLs of the non-injected and normal saline (NS)-injected paws were not obviously affected by application of KYNA at the doses tested. However, intrathecal injection of 0.1nmol KYNA significantly potentiated the antinociception induced by EA stimulation of contralateral ST36 and BL60 acupoints either in the carrageenan- or NS-injected rats. Three hours after intraplantar (i.pl.) injection of carrageenan, the number of Fos-like immunoreactive (Fos-LI) neurons was significantly increased in all layers of the ipsilateral spinal cord at L4-L5, with the higher density in laminae I-II and V-VI. Intrathecally pre-administered KYNA (10nmol) significantly reduced the total number of carrageenan-induced Fos-LI neurons with more apparent reduction in laminae I-II and IV-V. Pre-
coapplication of 10nmol KYNA, and EA of bilateral ST36 and BL60 acupoints, further reduced the numbers of carrageenan-induced Fos-LI neurons in laminae I-II and V-VI. The level of Fos expression in the spinal cord induced by carrageenan was significantly lower compared with that of i.t. injection of KYNA or EA alone. These results demonstrate that an EAA receptor(s) antagonist can enhance EA-induced antinociception and anti-hyperalgesia.

Comment
This study is from the same research group as that reviewed immediately above,1 and is almost identical in design. The results are also similar in that the results of the combination of EA with the EAA receptor(s) antagonist (at a sub-therapeutic dose) had an effect similar to the EAA receptor(s) antagonist used alone at 1000 times the dose.

Reference

Effects of EA on natural killer cell activity involves the lateral hypothalamic area in rats

Summary
Electroacupuncture (EA) has been reported to modulate natural killer cell (NK cell) activities. Also it is well known that the hypothalamus directly mediates the effects of EA on analgesia. The lateral hypothalamic area (LHA) is especially related to splenic NK cell activities. In order to investigate the relationship between the hypothalamus and the effects of EA on NK cell activity, lesions were made bilaterally in the LHA of Spraque-Dawley rats. NK cell cytotoxicity in normal and lesioned rats were measured with (51)Cr release immunoassay after EA stimulation for 2 and 14 days. NK cell activity in the EA group was significantly higher than in the normal control group. Lesioning the LHA abolished the effects of EA on NK cell activity at two days, but the effect had recovered by the fourteenth day following lesioning. These results strongly suggest that LHA is closely related to the increase of NK cell activity induced by EA.

Comment
This is a brief report of an experimental trial that examined the effect of EA on NK cell activity in rats with and without lesions of part of the hypothalamus. This reviewer cannot comment on the experimental methods used to create the hypothalamic lesions or to measure NK cell activity. The EA was applied to a pair of needles in the area of ST36 on the right, and 1.5Hz stimulation was given for 30 minutes per day at an intensity sufficient to evoke moderate muscle contraction. This mode of stimulation is rather similar to that used clinically by the reviewer to simulate intense physical activity, with its CNS consequences. In view of the similarities between EA and exercise,1 particularly in terms of immunomodulation,2 it would be interesting to see whether lesioning the LHA would abolished the immune enhancing effects of exercise as well.

Reference list

EA to PC6 in cats inhibits the sympathetic cardiovascular effects of visceral afferent stimulation

Summary
The authors state that they have shown that
electroacupuncture (EA) at the Neiguan-Jianshi (N-J) acupoints over the median nerve reduces myocardial ischaemia by modulating the pressor response induced by application of bradykinin on the gallbladder. The present study was designed to investigate the neural substrate underlying the prolonged modulatory effect of EA on visceral afferent input into the rostral ventral lateral medulla (rVLM). Experiments were performed on ventilated anesthetized cats. Neuronal activity was recorded while either stimulating the splanchnic nerve or applying EA at the N-J acupoints. Thirty-three cells responsive to splanchnic nerve and median nerve stimulation were antidromically driven from the intermediolateral columns in the spinal cord, T2-T4, indicating their function as premotor sympathetic neurons. These neurons also received baroreceptor input demonstrating that they were cardiovascular sympatoexcitatory cells. Arterial pulse-triggered averaging and coherence analysis demonstrated a correlation between cardiac-related discharge activity with 2.8±0.3Hz rhythms and arterial blood pressure. Stimulation (2Hz, 1-4mA, 0.5ms) of the splanchnic nerve for 30 seconds evoked excitatory responses. These neuronal responses were reduced during and after 30 minute stimulation of EA at the N-J acupoints. These splanchnic nerve-induced excitatory responses in neurons subjected to 30 minutes of EA were reduced by 68%. Iontophoresis of naloxone promptly reversed the EA-induced inhibitory effect by 52%. Neuronal activity in the rVLM induced by splanchnic nerve stimulation was reduced for 50 (or more) minutes after termination of EA in 7 of 12 rVLM neurons. Our results indicate that rVLM premotor sympathetic cardiovascular neurons receive convergent input from the gallbladder through the splanchnic nerve and from the N-J acupoints through the median nerves. Through an opioid mechanism, EA inhibits splanchnic nerve-induced excitatory responses of these rVLM neurons. Many of these neurons receiving convergent visceral and somatic input exhibit long-lasting inhibition by EA.

Comment
This is a thorough report of what at a glance at the title suggests is a rather esoteric area of experimental neurophysiology. Again the experimental procedures are beyond the scope of this reviewer to comment upon, but the introduction and discussion sections of the report give the reader a clear idea of the current knowledge in this particular area of neurophysiology.

The points referred to in the summary above (N-J acupoints) are PC6 and PC5 respectively. On a cat this area is on the medial aspect of the thoracic limb (forelimb), just under halfway from the weight bearing surface (foot pads) to the elbow, the latter being tucked in by the ribs at the level of the ventral surface of the thorax in the normal standing posture.

The results of this study indicate that a strong somatic stimulus from deep tissue layers (i.e. those below subcutaneous fat) reduces the cardiovascular sympathetic motor response to visceral pain, and that the effect can last 50 minutes or more from the end of stimulation. The effect was almost completely reversed by naloxone, and is probably mediated by endorphins, endomorphin or enkephalins. The duration of the inhibitory effect may be due to release of neuromodulators or may result from long-term depression (LTD) in the rVLM.

Before the more enthusiastic reader starts using low frequency EA at PC6 to treat myocardial ischaemia, remember that the forelimb of a cat is a weight-bearing limb, and may not be wired up in exactly the same manner as a human limb in terms of autonomic regulation, particularly as cats and humans have been on different evolutionary paths for some 40 million years!

Local EA with muscle contraction increases blood flow to the knee in rats

Summary
Recent reports have focused on the mechanisms of the action of electroacupuncture stimulation (EAS) in the regulation of blood flow to different
tissues. In the knee joint, blood flow is known to be modulated mainly by sympathetic postganglionic fibres, but recently the release or induction of nitric oxide (NO) synthesis in response to electrical stimulation has also been suggested. Therefore, a direct observation of the microcirculation is needed to further understand the mechanism by which blood flow is regulated by somatic afferent stimulation. In the present study, the effects of EAS to the vastus medialis muscle on systemic haemodynamics and the knee joint microcirculation were observed in vivo using a real-time confocal laser-scanning microscope system (CLMS). Electrical stimulation (5mA, 0.5ms, 5Hz) was applied for 30 minutes using a pair of acupuncture needles introduced into the vastus medialis muscle. To clarify a plausible involvement of NO in the responses to EAS, the stimulus was applied either in the presence or absence of N(omega)-nitro-L-arginine methyl ester (L-NAME). Stimulation to either the muscle or the skin of the thigh after blockade of neuromuscular transmission was performed to determine the involvement of muscle contraction during EAS treatment. The changes in mean arterial pressure (MAP) and diameter of the arterioles supplying the knee joint were monitored continuously until 60 minutes post-stimulus. Significant and persistent increases in arteriolar diameter by 26+/−6% and MAP by 17+/−2%, respectively, were observed after EAS to the muscle. EAS to the vastus medialis in the presence of L-NAME produced a strong decrease in diameter of the knee joint arterioles by -38+/−14% under the baseline with a simultaneous increase of 35+/−5% in MAP. EAS to the skin did not produce changes in arteriolar diameter while a slight increase in MAP by 12+/−6% over the baseline occurred after the stimulus. EAS to the muscle after neuromuscular blockade did not produce significant changes in diameter, while an increase in MAP by 24+/−8% was still observed, which suggests that the muscle contraction is required to produce vasodilation. These responses suggest that a dynamic balance between the autonomic nervous system and the release of NO is the primary mechanism mediating the EAS effects on knee joint microcirculation.

Comment
This is another interesting experimental study. The stimulus strength used would not be tolerated by the majority of conscious human subjects, although it is difficult to judge what allowance is required for general anaesthesia. In general, a therapeutic level of stimulus in the clinic would be of the order of 2 to 4mA at a pulse width of 0.18ms. Using a pulse width of 0.5ms is likely to reduce the tolerable current. In other words the stimulus strength used was arguably too high to test appropriate physiological responses.

Nitric oxide is clearly an important mediator of the electroacupuncture (EA) induced vasodilation in this study, but in view of previous work it would have been interesting to examine the role of CGRP under these experimental circumstances. This reviewer was particular interested in the relevance of muscle contraction, and in this study it appears to be a critical component. The previous work suggests that CGRP and other neuropeptides released from afferent nerve terminals, stimulated antidromically by EA, mediate a local increase in blood flow. This effect is only likely to occur within the area innervated by the stimulated nerves, and ought to be independent of muscle contraction, the latter being merely a marker for adequate nerve stimulation in muscle. In this study the EA was performed in vastus medialis, yet the vascular effects were measured on the medial aspect of the knee, distal to the muscle. It is unlikely that the afferent nerves stimulated in the muscle had nerve terminals stretching beyond the outer fascial layer of that muscle: thus a mechanism involving antidromic stimulation of afferent nerves seems less likely in this case. Given the strength of the EA used in this study, the muscle contraction evoked is likely to have been substantial. It could be that the vasodilation noted was merely a reflection of strong regional exercise. Further research will no doubt illuminate the mechanisms involved.

Reference list
Rats run further after acupuncture at ST36 (n=60)


**Summary**
This study investigated the effects of acupuncture on the endurance treadmill exercise, serotonin (5-hydroxytryptamine, 5-HT) synthesis, and tryptophan hydroxylase (TPH) expression in the dorsal raphe nuclei of rats. Acupuncture needles of 0.3mm diameter were inserted at ST36 bilaterally for 20 minutes. Onset of exhaustion time on treadmill running was increased significantly by acupuncture, and exercise-induced increments of 5-HT synthesis and TPH expression in the dorsal raphe were suppressed by acupuncture. The authors suggest that their results indicate one possible mechanism for the apparent ergogenic effects of acupuncture.

**Comment**
This is a well reported study, and results appear to be both internally and externally consistent. TPH is an enzyme that catalyses the rate-limiting step in serotonin biosynthesis, and increased concentrations of serotonin in the brain have been implicated in fatigue and deterioration of exercise performance.

Six groups were used in this study. Three were exercised regularly for seven days (30 minutes a day), and three were not. One of each category received acupuncture for one day before an endurance test and the other outcome measures. One of each category received acupuncture for seven days prior to the outcome measures.

Exercise tolerance was increased by about 25% after one day of acupuncture, and by about 50% after seven days of acupuncture. The numbers of TPH positive cells and the numbers of serotonin positive cells decreased as the exercise endurance increased, as would have been expected.

Why would this happen? Acupuncture at ST36 results in a muscle aching in tibialis anterior. A similar ache to that experienced after intense exercise. Perhaps such afferent input results in changes in central processing to compensate for an external environment that requires higher exercise load and duration. Or perhaps that is just wishful thinking on the part of this reviewer.

Acupuncture for ankle sprain


**Summary**
The lack of suitable experimental animal models for persistent pain showing clear acupuncture analgesia has been the major stumbling block in the investigation of the physiological mechanisms of acupuncture analgesia. This study developed a new rat model of ankle sprain pain. The effect of electroacupuncture (EA) on this model was examined. A common source of persistent pain in humans is the lateral ankle sprain. To model this condition, the rat’s right ankle was bent repeatedly, overextending lateral ligaments, for four minutes under halothane anaesthesia. The rat subsequently showed swelling of the ankle and a reduced stepping force of the affected limb for the next few days. The reduced stepping force of the limb was presumably due to a painful ankle since systemic injection of morphine produced temporary improvement of weight bearing. EA was applied to the SI6 acupuncture point on the contralateral forelimb for 30 minutes under halothane anaesthesia. After the termination of EA, behavioural tests measuring stepping force were periodically conducted during the next four hours. EA produced a 40% recovery in the stepping force of the sprained foot lasting for at least two hours. The magnitude of this improvement was equivalent to that obtained after a systemic injection of 2mg/kg of morphine, and this improvement of stepping pressure was interpreted as an analgesic effect. The analgesic effect was specific to the acupuncture point since the analgesic effect on the ankle sprain pain model could not be mimicked by EA applied to a nearby point (LI4), and EA applied to the SI6 point was not effective in the knee arthritis pain model. The analgesic effect could not be blocked by systemic...
injection of opioid antagonists naloxone or naltrexone. The authors claim that their data suggest that EA produces a potent analgesic effect on the ankle sprain pain model in the rat. They go on to claim that this analgesic effect is produced by applying EA to a site remote from the painful area in a stimulus point-specific way.

Comment
This is another of those papers with what appears to be a rigorous experimental design, which fails to adequately define the research question in physiological terms and contains major conceptual shortcomings. First, the authors correctly imply that there is little evidence for the effect of acupuncture in clinically relevant persistent pain, but they have taken a condition commonly affecting a large bipedal mammal and applied it to a small furry quadruped unlikely to be affected in the same way. When a biped suffers a single lateral ankle sprain its fully working locomotor limbs are reduced by 50%. In the case of a small quadruped the reduction is 25%, and the animal can continue relatively efficient locomotor activity. This is perhaps a little pedantic, and the ankle sprain model is likely to produce tissue damage and c-fibre pain at least comparable to the clinical situation in humans. The key mistake may not be the model, but the fact that the outcomes are still measured in hours. A clinician using acupuncture in musculoskeletal pain is interested in effects that last days or weeks, not those that last for a couple of hours.

Second, what is the physiological difference between LI4 and SI6 on a rat forelimb? Well, LI4 is on the radial side of the limb, distal to the carpus between the first and second metacarpals, and SI6 is on the ulnar side just proximal to the carpus. In the report the latter point is stated to be at the ‘posterior distal end of the forearm between the radius and ulna’. It is not stated in the report what the target tissue structure was at either site, although muscle twitch is referred to in terms of the EA intensity settings. There is little or no muscle tissue at these sites in a rat forelimb. The stimulation parameters are described. At each point two 0.3mm needles were inserted 1mm apart to a depth of 5mm. EA was applied for 30 minutes. Four 1ms square wave pulses at 100Hz were applied at a frequency of 2Hz (i.e. the trains of four pulses were applied twice a second, each train lasting 0.034s). The intensity was set to 10 times the muscle twitch threshold, the latter being usually about 200µA. So the intensity applied to most animals was 2mA, and it was given under general anaesthesia. In physiological terms it is difficult to conceive of a difference between these two interventions, yet the results indicate that whilst the stimulation at SI6 had a significant effect on weight bearing at 1-2 hours post-stimulation, the same simulation no more than 10 or 15mm away had absolutely no effect. The other curious thing about the results is that they do not appear to conform to the expected pattern of acute acupuncture analgesia. That is reaching a maximum after 20 to 30 minutes of stimulation and then slowly wearing off. In this paper the effects are not significant at 30 minutes post-stimulation (the first outcome measure), but they are at one hour, and increase further at two hours post-stimulation. The pattern following morphine injection is consistent with what would be expected, i.e. the effect is greatest at 30 minutes, and it reduces to baseline by four hours post-injection.

Third, the authors do not appear to have tested the effect of strong EA to the forelimb on their outcome measure in normal rats. Strong EA can cause post-needling soreness that may peak at 1-2 hours post-stimulus. In a quadruped, if one forelimb is painful to put pressure on, this tends to throw weight onto the opposite rear limb. In this case it would have been onto the test limb. The results could therefore be explained by EA to SI6 causing more pain in the stimulated limb than EA to LI4, thus the animal bears more weight on the test limb not because of analgesia, but because it is temporarily relatively less uncomfortable than the opposite forelimb. This might explain why the observed effect was not reversed with naltrexone. It would also explain the lack of effect on the knee arthritis model, in which the outcome was accessed by vocalisation threshold rather than weight bearing.
EA for sick ferrets


**Summary**
The effect of electroacupuncture (EA) on cyclophosphamide-induced emesis in ferrets was studied at acupuncture point Neiguan (PC6) with various electrical stimulation parameters (5-100Hz, 1.5-3V, 5-20 minutes, n=6/group). The combination therapy of EA (100Hz, 1.5V and 10 minutes) with the lower doses of ondansetron (0.04mg/kg), droperidol (0.25mg/kg) and metoclopramide (2.24mg/kg) significantly reduced the total number of emetic episodes by 52%, 36% and 73%, respectively, as well as the number of emetic episodes in the first phase compared to the sham acupuncture control (p<0.01). These EA/drug combinations also showed a significant effect in preventing emesis compared to either EA or drug alone (p<0.05).

The present study suggests that acupuncture may be useful as an adjunctive therapy in the treatment of chemotherapy-induced emesis.

**Comment**
This is an interesting paper, and, despite being another experimental study on laboratory animals, it probably has more relevance to clinical medicine than most of the experimental studies reviewed in this issue. This ferret model appears to be well established, and the 5-H3 antagonists, such as ondansetron, have been shown to be extremely effective in this setting.

The first part of the study investigated the optimal parameters for stimulation of PC6 in the model. Frankly, this part of the study was unsuccessful. In other words, optimal stimulation parameters were not identified. Indeed, EA did not appear to work compared with ‘sham’ or ‘placebo’. EA was applied across needles in bilateral PC6. ‘Placebo’ involved needles taped to the points, but not inserted, and attached to the EA device but with no electrical stimulation. ‘Sham’ involved manual needling to a point above the lateral epicondyle. Interestingly, the authors did not choose to try EA at the frequency Dundee found to be most useful for post-operative nausea and vomiting (10 to 20Hz),1 although having said that, acupuncture has shown consistently better effects in controlling nausea than in reducing vomiting.

The authors describe the stimulation parameters in terms of voltage applied to, rather than current passed between, the needles. This has inherent problems in that animal tissues are not of uniform nor stable resistance, and the stimulus strength perceived within the nervous system is more closely correlated to current flow. The precise position of the needles in relation to nervous tissue is also likely to be a critical factor in determining stimulus strength. There does not appear to have been any attempt, beyond using the same voltage, to ensure that a consistent stimulus strength was applied to the nearest neural structure. The easiest relevant parameter to use is muscle twitch.

Despite the failure to establish optimal stimulation parameters in the first part of the study, the second part of the study was remarkably successful. The combination of EA with low-dose antiemetics was significantly better than either EA or antiemetics alone. The dose of ondansetron used was 0.04mg/kg. That would be equivalent to (if the reader will allow a direct comparison between a man and a ferret kilogram) a dose of 2.4mg in a 70kg adult; the normal adult dose being 4 to 8mg.

This is a very interesting result. Well designed clinical studies are now needed using a combination of acupuncture and standard antiemetics for treatment of chemotherapy induced nausea and vomiting.

**Reference list**
EA modifies morphine conditioned behaviour in rats

Shi XD, Ren W, Wang GB, Luo F, Han JS, Cui CL.
Brain opioid-receptors are involved in mediating peripheral electric stimulation-induced inhibition of morphine conditioned place preference in rats. 

**Summary**
Conditioned place preference (CPP) paradigm has been suggested as one of the animal models for drug craving. The present study was performed to examine the effect of 100Hz peripheral electric stimulation (PES) on the expression of morphine-induced CPP. Rats were trained with morphine for 4 days to establish the CPP paradigm in a three-chamber “unbiased” apparatus. Morphine-induced CPP was maintained up to four weeks when tests were given once a week. PES of 100Hz administered for 30 minutes a day for three days significantly attenuated morphine-induced CPP (p<0.01). I.c.v. injection of the δ-opioid receptor antagonist naltrindole (NTI) or the κ-antagonist norbinaltorphimine (nor-BNI) but not the μ-antagonist cyclic D-Phe-Cys-Tyr-D-Trp-Arg-Thr-Pen-Thr-NH(2) (CTAP), completely blocked the inhibitory effect of 100Hz PES on the expression of morphine-induced CPP (p<0.05-0.01). These results indicate that the anti-craving effects induced by repeated PES of 100Hz is mediated by the activation of supra-segmental δ- and κ-opioid receptors in the central nervous system.

**Comment**
This is a thorough experimental study from a group with considerable experience in the field of acupuncture research. The apparatus used to measure CPP was quite sophisticated. It was made up of three interconnected chambers: two large black conditioning chambers separated by a small grey chamber. The conditioning chambers were different sensory environments - they had different floors, and a different pattern of LED lights. There was a series of infrared beams throughout the chambers that were linked to a computer to automatically monitor the position of the subject.

The EA was applied between ST36 and SP6 on both hind limbs. Square waves of 0.2ms pulse width at 100Hz were applied at 0.5mA for 10 minutes, increased to 1mA for a further 10 minutes, and then increased to 1.5mA for the last 10 minutes. This was a relatively gentle stimulus. One 30 minute session of this regime had no effect on CPP; however, three consecutive days’ treatment had a cumulative effect that was significant.

Further experiments with opioid receptor antagonists revealed that the effect of EA on CPP was mediated via δ- and κ-opioid receptors in the CNS.

This study supports this reviewers hypothesis that Wen and Cheung’s early observations of the effects acupuncture on withdrawal reactions in opiate addicts was related to the EA used rather than special points in the ear.1

**Reference list**

EA probably stimulates Aδ rather than C fibres


**Summary**
[Abstract only] Fos is expressed in rat dorsal horn neurons after electroacupuncture (EA), but it is unclear which types of afferent fibers are involved in the expression. It is thought that the Fos expression is induced via Aδ afferents rather than C afferents, since the threshold of Aδ afferents (myelinated fibres) to electrical stimulation is much lower than that of C afferents (unmyelinated fibres). Neonatal capsaicin treatment of rats was used to minimise the presence of C afferents in order to clarify this. Fos expression in the dorsal horn after injection of formalin into the hindpaw was severely attenuated by neonatal capsaicin treatment. However, Fos expression after EA to the pads of the hindpaw was unaffected by the same
treatment. These results suggest that EA induces the expression of Fos in the dorsal horn neurons via capsaicin-insensitive afferents, presumably Aδ afferents.

**Comment**

This is a neat little study that adds support to one of the key elements taught in the western medical approach to acupuncture.

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**Immunomodulation by EA?**


**Summary**

Cumulative evidence suggests that immunologic responses are under the regulation of the autonomic nervous system. Since acupuncture has recently been reported to modulate the autonomic nervous system, we investigated the possibility that acupuncture eventually modulates the immune system. In this study, electroacupuncture (EA) was applied in healthy young volunteer subjects. As for the proportions of granulocytes and lymphocytes in the blood, there were three groups: (1) granulocytosis and lymphocytopenia; (2) granulocytopenia and lymphocytosis; and (3) normal pattern. Interestingly, with the administration of acupuncture, the status of subjects with relatively low levels of granulocytes and high levels of lymphocytes shifted to Group 1, whereas that of subjects with high levels of granulocytes and low levels of lymphocytes shifted to Group 2. In other words, acupuncture tended to normalize the pattern of leukocytes. The authors concluded that acupuncture induced parasympathetic nerve stimulation, resulting in a decrease in the heart rate. These results suggest possible mechanisms underlying how acupuncture ameliorates the condition of patients with many chronic diseases.

**Comment**

At first glance the results of this paper seem to be consistent with the traditional idea that acupuncture has a normalising influence on many of the body’s systems. Unfortunately, the paper is far from convincing. The analysis appears to have been entirely post-hoc. Whilst there were significant changes in two of the groups, these groups were only defined after analysis of the outcome measures. The results indicate that blood profiles in terms of granulocyte and lymphocyte counts in the peripheral blood stream were normalised; however, it is not possible to be sure that this was related to the EA rather than simply sitting down for 20 minutes as all subjects received EA.

The EA was applied between LI4 and LU6 (in brachioradialis) on both sides at a frequency of 1Hz for 20 minutes. There are no details of waveform or intensity. The needles used were 0.20x40mm. Depth of insertion was not indicated.

If the blood profile changes observed did result from EA, the authors can suggest a possible mechanism for only one of the observed changes. They suggest that EA stimulates parasympathetic activity, illustrated by the observed effect on heart rate, and as lymphocytes express cholinergic receptors, subjects with low lymphocyte to granulocyte ratios would tend to normalise. However, the subjects in this group did not show a change in heart rate; it was only the group showing the opposite change in blood profile that demonstrated a significant drop in heart rate. Furthermore, the reader is not given any indication of how cholinergic receptors expressed on lymphocytes modulate peripheral blood counts.

So what can be gained from this paper? Well, mainly it raises more questions about acute immunomodulatory effects of EA and the potential role of the autonomic nervous system. Hopefully further research will provide some clearer answers.
Research Reviews

Reports of Adverse Events & Related Papers

Bilateral tension pneumothorax after acupuncture


Summary

Acupuncture is one of the most popular complementary therapies in the world. Pneumothorax due to perforation of the lungs by needle insertion is one of the most common and serious complications of acupuncture treatment. Although there have been several case studies of pneumothorax induced by acupuncture, as far as we know there have been no reports on the pathological findings of autopsy cases. In this report, the authors describe the pathological findings of an autopsy case of bilateral tension pneumothorax after acupuncture. The patient suffered dyspnoea and chest pain soon after the completion of an acupuncture treatment, and died 90 minutes later. Several ecchymoses were macroscopically observed on the parietal pleura in the left and right thoracic cavity, suggesting that needles were inserted into the thoracic cavity and that the lungs were perforated. The many black spots observed on the parietal pleura along the vertebral column microscopically consisted of a number of dust-like black pigments and macrophages containing these pigments. These spots seemed to have appeared because of the previous insertion of needles.

Comment

It seems fairly clear that this death can be attributed to acupuncture. There are two important issues to be drawn from the report. First, the pleura and lungs appear to have been needled on numerous occasions prior to the fatal session. With sufficient training and anatomical knowledge the pleura should not be needled during acupuncture treatment. Second is the issue of the management of tension pneumothorax. Theoretically, it should be possible to identify and treat this condition. Tension pneumothorax resulting from acupuncture is extremely rare. Nevertheless, should acupuncturists undergo training in advanced life support so that they can deal with this event?

Bilateral pneumothorax and cardiac tamponade after acupuncture


Summary

The ‘target’ of acupuncture is usually muscle, but occasionally the needle tip approaches other anatomical structures such as the pleura, which may subsequently suffer damage. During a session of acupuncture, a 25-year-old woman suffered malaise with shock and neurological disorders. The initial examinations revealed a bilateral pneumothorax associated with pericardial and peritoneal effusions. Resuscitation combining dopamine, left pleural drainage and pericardial puncture led to rapid haemodynamic improvement.

Investigation of the cause, having eliminated any underlying pathology, concluded that cardiac tamponade and bilateral pneumothorax had resulted from the acupuncture. The patient presented with two traumatic complications of acupuncture: cardiac tamponade due to haemopericardium, and bilateral pneumothorax.

Comment

It seems incredible that this combination of traumatic events is possible within the framework of a therapeutic intervention. These events can be avoided when performing acupuncture over the ribcage by needling onto a rib, at a tangent to the ribcage, or by needling superficially.

In this case the patient weighed 41kg and was 1.58m tall (BMI 16.4). She suffered sudden malaise on her fourth session of acupuncture. Her blood pressure was found to be 50mmHg, and she was admitted as an emergency to hospital. On
arrival she was unconscious, but with no focal neurological signs or meningism. Her pulse rate was 100 beats per minute, her blood pressure 100/40mmHg, and she had an oxygen saturation of 98%. Her white blood cell count was raised at 19x10^9/L. It is not clear what this patient was having acupuncture treatment for, nor whether she had any underlying medical conditions; however, whatever her medical problems it seems unlikely that haemopericardium and bilateral pneumothorax in such a thin woman was not related to the acupuncture.

**Local infection with Mycobacterium chelonae after acupuncture**


**Summary**

A 58-year-old woman was first seen in November 1999 with a four week history of several tender, deep red or purple, suppurating subcutaneous nodules on the skin of the abdomen, suggestive of panniculitis. She had no history of systemic immunosuppression. Three months prior to examination, the patient had been treated with acupuncture for obesity. Two biopsy specimens of the nodules were taken and sent for culture and histological examination. Histology showed a pattern of panniculitis with chronic inflammatory cells mixed with areas of polymorphonuclear abscesses and necrosis. Culture of the biopsy specimen grew acid fast bacilli within four days, and they were later identified by biochemical and molecular tests as Mycobacterium chelonae. Polymerase chain reaction-restriction analysis was used for molecular identification of mycobacteria. In vitro sensitivity tests showed sensitivity to clarithromycin, amikacin, tobramycin, doxycycline and erythromycin, and resistance to ciprofloxacin, ofloxacin, trimethoprim-sulphamethoxazole, imipenem and cefoxitin. Oral clarithromycin (500mg b.d.) was started and after three months of therapy the lesions had cleared completely.

**Comment**

Local infection related to acupuncture in immunocompetent patients is very rare. In this case it was not possible to identify the source, since the acupuncturist did not cooperate with the study. Previous reports of infection with this organism have been reported at injection sites. In most cases the source has not been confirmed but contaminated water has been suspected. Mycobacterium chelonae is relatively chlorine-resistant and grows well and survives at relatively high concentrations in tap water and distilled water.

**Itching 20 years after acupuncture**


**Summary**

An 83-year-old Japanese woman presented with multiple bluish-black macules and nodules with intense pruritus on the lower back. She had received acupuncture therapy 20 years previously for low back pain. Histology showed a foreign body reaction and brownish pigmented particles in the dermis. Numerous mast cells were found around the pigmented particles. Under electron microscopy, mast cells containing electron-dense silver particles in their cytoplasm showed focal or partial loss of granule contents, suggesting piecemeal degranulation. Mast cells around free silver particles also showed piecemeal degranulation. These activated mast cells probably contributed to the development of pruritis and inflammatory reaction in this case.

**Comment**

It is not clear whether this case is related to the Japanese acupuncture technique ‘umebari’, where needle tips are deliberately embedded under the skin, or whether the fragments of silver were shed from reusable needles. Either way, it is probably no more than an interesting curiosity, as single-use stainless steel needles are not likely to cause such problems.
Peroneal nerve palsy following acupuncture


**Summary**

A sixty-two-year-old woman was admitted to hospital with a left footdrop and anterior pain and numbness in the left leg. There was no history of spinal disorder or diabetes mellitus. Initially, the patient had a spontaneous onset of acute posterior pain in the left leg. Her general practitioner diagnosed sciatica and prescribed bed rest. One week later, because of persistent symptoms, she received the first of a series of acupuncture treatments, and the pain decreased after several treatments. During the sixth treatment, she felt a sudden radiating pain in the anterior part of the left leg when the acupuncture needle was inserted. A burning sensation and numbness in the anterior part of the left leg occurred immediately after this treatment. When the patient was stepping out of the bathtub on the following night, she noticed a left footdrop for the first time, and she experienced difficulty with walking. The pain, burning sensation, numbness, and weakness in the left leg persisted.

After receiving additional acupuncture treatments, she consulted a neurologist, who diagnosed an L5 radiculopathy and referred her to the orthopaedic department. On physical examination in the orthopaedic department, sensation was diminished on the dorsum and lateral side of the left great toe and on the dorsal aspect of the web space between the great and second toes but was otherwise normal. The strength of the tibialis anterior and extensor hallucis longus muscles was graded one out of five, but the strength of the peroneus longus and flexor hallucis longus muscles was graded five out of five. The Tinel sign was positive just posterior to the fibular head. A small brown discolouration was noted in this area, which, according to the patient, was where an acupuncture needle had been inserted. Radiographs showed a metallic needle-like object, approximately 1cm in length, lying near the fibular head, and magnetic resonance imaging demonstrated metallic artifact in the same area. Examination of the lumbosacral spine was normal. Compound muscle action potentials of the peroneal nerve in the left leg showed a remarkable decrease in amplitude distal to the level of the fibular head. Surgery was performed two weeks after, and the peroneal nerve was identified and was traced distally. No foreign body was visible at first, but something firm could be palpated within the nerve. On reflection of the nerve, a broken needle was found just proximal to the point of division of the deep and superficial peroneal nerves. No scar tissue or sign of infection was identified about the nerve. The needle fragment, which was 12mm in length and had penetrated the nerve by approximately 5mm, was removed without difficulty. On the day after the surgery, sensation and strength remained unchanged, but the pain and numbness had disappeared. The patient was provided with a dorsiflexion assist ankle-foot orthosis. Four months after the operation, the strength of the tibialis anterior muscle was graded four out of five, and that of the extensor hallucis longus muscle was graded two out of five. The hyperaesthesia remained unchanged. The gait had become normal, and use of the orthosis was discontinued. Ten months after the operation, the tibialis anterior and extensor hallucis longus muscles had improved in strength and were graded five out of five and four out of five, respectively, but the hyperaesthesia remained unchanged.

**Comment**

The offending needle in this case was inserted just posterior to the fibular head, and directly into the common peroneal nerve. The acupuncturist was probably aiming for GB34, as this is a very commonly used point in the treatment of ‘sciatica’. The needle used was a stainless steel disposable needle 0.16mm in diameter and 40mm in length. The authors assume that it fractured as a result of sudden muscle contraction secondary to the pain of direct needling of the nerve.

This is another case that reinforces the need for good anatomical knowledge as a key factor in safe acupuncture practice. The use of such a fine needle might also be questioned.
Bilateral pneumothorax and cardiac tamponade after acupuncture

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