

ACUPUNCTURE AND STROKE

About stroke

Stroke is defined as a neurological deficit of sudden onset which results from cerebrovascular disease and persists for longer than 24 hours.(DTB 1998) Stroke is very common, with, for example, around 110,000 people each year in England alone experiencing a first or recurrent episode.(DH 2007) Consequences of stroke can include disability and early death, and the condition costs the UK economy around £7billion annually.(NICE 2008)

Around 80% of first strokes are ischaemic (i.e. due to the thromboembolic or thrombotic occlusion of an intracranial artery).(NINDS 1995) Primary haemorrhage (haemorrhagic stroke) and subarachnoid haemorrhage account for a further 10% and 5% of strokes, respectively.(DTB 1998) Overall, about 10% of patients die within a month of a first ischaemic stroke, and by 6 months, up to around 20% are dead and 30% or more are dependent on others in day-to-day activities.(Warlow 2008) Of patients who have a stroke, those aged 80 years or over are more likely to die or be disabled as a result than are younger patients.(Poppe 2008) Patients with very mild strokes or rapidly improving symptoms usually have a good prognosis, while patients with major strokes have a very poor prognosis.(Rajajee 2006; Adams 2003)

Following treatment of acute stroke, patients are advised of lifestyle changes that can help to prevent a further vascular event. These include smoking cessation, weight reduction for those who are overweight, reducing dietary salt intake, taking regular exercise and avoiding excess alcohol. They are also considered for drug therapy, such as antiplatelets, a statin and antihypertensives, to prevent further vascular events.

References

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How acupuncture can help

This Factsheet focuses on the evidence for acupuncture in the management of patients post-stroke, both acutely and for rehabilitation. Some other Factsheets may be relevant as they cover conditions commonly associated with stroke: acupuncture and hypertension, acupuncture and depression, acupuncture and chronic pain, and acupuncture and urinary incontinence.

There have been a large number of systematic reviews and randomised controlled trials looking at the effects of acupuncture in the management of acute stroke and for poststroke rehabilitation. Many of these have been conducted in China and are published in Chinese Journals (stroke is the most prevalent condition treated with acupuncture for in-patients at Chinese hospitals). The authors of an overview of evidence from systematic reviews and meta-analysis on the effectiveness, safety, and cost of acupuncture for stroke concluded that acupuncture treatment seems to be relatively safe, but that the evidence for the effectiveness of acupuncture was inconclusive, mainly due to poor methodological quality and small samples (Zhao 2012). In fact most of the individual systematic reviews have found acupuncture to be superior to conventional treatments, or to provide added value to them. This is particularly the case for post-stroke depression (Zhang 2012, Zhang 2009), aphasia (Pang 2010) and dysphagia (He 2009). For more general functional recovery the results are less clear-cut (Kong 2010, Lee 2010, Wu 2010, Gi 2009), primarily due to the inclusion of sham-controlled trial data. So-called sham interventions function more as an alternative form of acupuncture than as a placebo (Lundeberg 2011), which may lead to underestimation of the treatment effects. The Canadian review of Wu et al (2010) combines expert knowledge of acupuncture and research methodology with coverage of Chinese and Western databases for stroke recovery in general. It concluded that acupuncture may be effective for post-stroke rehabilitation. Two earlier Cochrane reviews found too little evidence to draw conclusions (Xie 2008, Wu 2006): updated versions that draw on Chinese as well as Western literature are awaited.

There have been many randomised controlled trials published in the last few years. All have found a positive effect with acupuncture (though not necessarily for all outcome measure) but the methodological shortcomings identified in the reviews largely still apply. Some examples are provided below for a wide range of post-stroke symptoms: functional recovery in general (Hsing 2012, Cheng 2010), motor function (Han 2011, Cheng 2011, Zhang 2010), cognition (Li W 2012), speech problems (Wang 2011), dysphagia (Xie 2011), shoulder pain (Li N 2012), urinary incontinence (Chu 2011), constipation (Xiao 2011), depression (Wu 2010), fatigue (Zhou 2010), and as a secondary preventive intervention for ischaemic cerebral apoplexy (Cheng 2010).

In general, acupuncture is believed to stimulate the nervous system and cause the release of neurochemical messenger molecules. The resulting biochemical changes influence the body's homeostatic mechanisms, thus promoting physical and emotional well-being.

There have been numerous physiological studies on acupuncture and stroke, largely from China; examples from the last three years are presented in the table below. They indicate multiple possible mechanisms by which acupuncture treatment may help in the management of stroke:

- Harnessing the anti-inflammatory effects of acetylcholine receptor activation (Wang 2012);
- Protecting the brain from ischaemic injury by increasing cerebral blood flow (Zhou 2011, Du 2011);
- Alleviate cerebral oedema after cerebral ischaemia (Zhang F2011);
- Preventing the impairment of cortical GABAergic neurons (Zhang 2011b);
- Regulating differential expression of multiple serum proteins involved in stroke, and enhancing muscle strength recovery (Pan 2011);
- increasing production of glyco-metabolic enzymes and hence improving post-stroke cognition (Zhao 2011);
- Improving motor cortical excitability, and facilitating motor function recovery after focal cerebral ischaemic injury (Lin 2010);
- Restoring the expression of Na(v)1.1 and Na(v)1.6 (sodium channel sub-unit genes that are down-regulated in cerebral ischaemia) thus reducing infarction volume and decreasing stroke damage (Ren 2010);
- Up-regulating bcl-2, hence reducing the expression of caspase-3, one of the enzymes involved in programmed cell death in stroke (Chen 2009);
- Promoting neuroprotective effects against focal cerebral ischaemia (Kang 2010);
- Modulating brain glutamate release (excessive glutamate in the ischaemic zone is neurotoxic) (Lee 2010);
- Increasing the production of endocannabinoid 2-arachidonylglycerol and N-arachidonylethanolamine-anandamide, which elicits protective effects against transient cerebral ischaemia through CB1 receptors (Wang 2009);
- Acting on areas of the brain known to reduce sensitivity to pain and stress, as well as promoting relaxation and deactivating the 'analytical' brain, which is responsible for anxiety and worry (Hui 2010; Hui 2009);
- Increasing the release of adenosine, which has antinociceptive properties (Goldman 2010);
- Reducing inflammation, by promoting release of vascular and immunomodulatory factors (Kavoussi 2007).

Lundeberg T et al. Is Placebo Acupuncture What It is Intended to Be? Evid Based Complement Alternat Med. 2011;2011:932407

About traditional acupuncture

Acupuncture is a tried and tested system of traditional medicine, which has been used in China and other eastern cultures for thousands of years to restore, promote and maintain good health. Its benefits are now widely acknowledged all over the world, and in the past decade traditional acupuncture has begun to feature more prominently in mainstream healthcare in the UK. In conjunction with needling, the practitioner may use

techniques such as moxibustion, cupping, massage or electro-acupuncture. They may also suggest dietary or lifestyle changes.

Traditional acupuncture takes a holistic approach to health and regards illness as a sign that the body is out of balance. The exact pattern and degree of imbalance is unique to each individual. The traditional acupuncturist's skill lies in identifying the precise nature of the underlying disharmony and selecting the most effective treatment. The choice of acupuncture points will be specific to each patient's needs. Traditional acupuncture can also be used as a preventive measure to strengthen the constitution and promote general wellbeing.

An increasing weight of evidence from Western scientific research (see overleaf) is demonstrating the effectiveness of acupuncture for treating a wide variety of conditions. From a biomedical viewpoint, acupuncture is believed to stimulate the nervous system, influencing the production of the body's communication substances - hormones and neurotransmitters. The resulting biochemical changes activate the body's self-regulating homeostatic systems, stimulating its natural healing abilities and promoting physical and emotional wellbeing.

About the British Acupuncture Council

With over 3000 members, the British Acupuncture Council (BAcC) is the UK's largest professional body for traditional acupuncturists. Membership of the BAcC guarantees excellence in training, safe practice and professional conduct. To find a qualified traditional acupuncturist, contact the BAcC on 020 8735 0400 or visit www.acupuncture.org.uk

ACUPUNCTURE AND STROKE

The evidence

Research	Conclusion
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Overview of systematic reviews

<p>Zhao XF et al. Acupuncture for stroke: evidence of effectiveness, safety, and cost from systematic reviews. <i>Top Stroke Rehabil</i> 2012;19(3):226-33.</p>	<p>An overview of evidence from systematic reviews and meta-analysis on the effectiveness, safety, and cost of acupuncture for stroke. Nine articles were identified: one focused on acute stroke; one on subacute or chronic stroke; five on stroke (of variable chronicity); and two addressed dysphagia after stroke. There was a split among reviewers regarding the effectiveness of acupuncture for stroke recovery. The most reliable evidence showed that there was no clear benefit for stroke patients in acute, subacute, or chronic stages. There was not a single economic analysis of acupuncture for treatment of stroke. The authors concluded that acupuncture treatment seems to be relatively safe, but that the evidence for the effectiveness of acupuncture for stroke was inconclusive, mainly due to poor methodological quality and small samples.</p>
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Systematic reviews

<p>Zhang GC et al. Meta analysis of the curative effect of acupuncture on post-stroke depression. <i>J Tradit Chin Med</i> 2012;32(1):6-11.</p>	<p>A systematic review that evaluated the curative effect of acupuncture on post-stroke depression. Fifteen randomised controlled trials involving a total of 1,096 patients were included. Comparison of "effective" rate found no difference between the acupuncture and western medicine groups (95% CI 0.63 to 1.09).</p>
<p>Kong JC et al. Acupuncture for functional recovery after stroke: a systematic review of sham-controlled randomized clinical trials. <i>CMAJ</i> 2010;182(16):1723-9.</p>	<p>A systematic review that assessed the efficacy of acupuncture for functional recovery after stroke: this review included only comparisons against sham acupuncture. Ten studies met the inclusion criteria; seven were for acute and subacute stages after stroke. A meta-analysis of the five studies that assessed functionality did not show a significant difference in favour of acupuncture, with high heterogeneity. No beneficial effects were seen with acupuncture on activities of daily living at the end of the intervention period (95% CI -0.18 to 0.32) or after follow-up (95% CI -0.15 to 0.35). For the chronic stage after stroke, three trials tested effects of acupuncture on function; all failed to show favourable effects. The reviewers concluded that their meta-analyses of data from rigorous randomised sham-controlled trials did not show a positive effect of acupuncture as a treatment for functional recovery after stroke.</p>
<p>Pang Y et al. Acupuncture therapy for apoplectic aphasia: a systematic review. [Article in Chinese]. <i>Zhongguo Zhen Jiu</i> 2010;30(7):612-6</p>	<p>A systematic review that assessed the therapeutic effect of acupuncture for apoplectic aphasia. Eleven randomised controlled trials involving a total of 756 patients were included. Meta-analysis indicated that there was statistical difference between acupuncture and language training groups on cured</p>

	<p>rate (95% CI 1.10 to 2.74) at the end of treatment. Moreover, the acupuncture plus language training group was statistically superior to the language training group alone in terms of cured rate (95% CI 1.81 to 5.01), language function score (95% CI 7.86 to 13.21), oral expression (95% CI 7.38 to 10.35). The reviewers concluded that acupuncture (or acupuncture combined with language training) is effective for apoplectic aphasia, but more trials of higher methodological quality are needed.</p>
<p>Wu P et al. Acupuncture in poststroke rehabilitation: a systematic review and meta-analysis of randomized trials. <i>Stroke</i> 2010;41(4):e171-9.</p>	<p>A systematic review that assessed the efficacy of acupuncture in poststroke rehabilitation. Thirty-five randomised controlled trials written in Chinese and 21 trials written in English were included. The overall quality of the studies was "fair" and most studies were small (median n=86; range, 16 to 241). The majority (80%) of the studies reported a significant benefit from acupuncture; however, there was some evidence of publication bias. Data was pooled from 38 of the trials, yielding an odds ratio (OR) in favour of acupuncture compared with controls (OR=4.33, 95% CI 3.09 to 6.08). The reviewers concluded that randomised clinical trials demonstrate that acupuncture may be effective in the treatment of poststroke rehabilitation.</p>
<p>Lee MS et al. Moxibustion for stroke rehabilitation: systematic review. <i>Stroke</i> 2010;41(4):817-20.</p>	<p>A systematic review that analysed the trial data on the effectiveness of moxibustion for stroke rehabilitation. Nine randomised clinical trials were included, three of which reported favourable effects of moxibustion plus standard care on motor function versus standard care alone (95% CI 0.37 to 1.08). Three of the trials compared the effects of moxibustion on activities of daily living alone but failed to show favourable effects with the treatment. The reviewers concluded that moxibustion has limited effectiveness as an adjunct to standard care in stroke rehabilitation.</p>
<p>Qi YZ et al. Systematic evaluation of acupuncture for treatment of post-stroke spastic Paralysis. [Article in Chinese]. <i>Zhongguo Zhen Jiu</i> 2009;29(8):683-8.</p>	<p>A systematic evaluation that assessed acupuncture and moxibustion for treatment of post-stroke spastic paralysis. Fourteen randomised controlled trials (RCTs) or quasi-RCTs, including a total of 978 patients were included. Meta-analysis of nine trials found no significant difference between the treatment groups and the control groups in four of the outcomes measures whereas two other measures showed superior benefits with acupuncture.. The reviewers concluded that a reliable conclusion cannot be drawn from the present data because of the defects in methodological quality and insufficient numbers of trials, especially lacking in long-term outcomes, although there appears a tendency for acupuncture to improve the conditions of post-stroke spastic paralysis.</p>
<p>Zhang JB et al. Meta-analysis on acupuncture for treatment of depression in patients of Poststroke. [Article in Chinese]. <i>Zhongguo Zhen Jiu</i> 2009;29(7):599-602.</p>	<p>A meta-analysis that assessed the therapeutic effect and the safety of acupuncture for treatment of depression in patients poststroke. Seventeen randomised controlled trials were included. A significant difference in the therapeutic effect between the acupuncture group and the medication group was found. The reviewers concluded that the therapeutic effect of acupuncture for treatment of the depression in patients of poststroke is superior to medication and it is safe, but more large</p>

trials are needed to verify this.

He J et al. Systematic assessment of acupoint stimulating therapy for deglutition disorders after apoplexy. [Article in Chinese]. *Zhongguo Zhen Jiu* 2009;29(1):66-71

A systematic assessment that evaluated the therapeutic effects of acupuncture on deglutition disorders after apoplexy. Thirty seven trials, involving a total of 3,697 patients, were included. The effective rate of acupuncture on deglutition disorders after apoplexy was better than that in the control group (95% CI 1.28 to 1.49), as was the cured rate (95% CI 2.15 to 3.04). The reviewers concluded that the therapeutic effect of acupuncture on deglutition disorders after apoplexy is better than that of the control group, but that more randomised controlled trials with good designs are needed to confirm this result.

Xie Y et al. Acupuncture for dysphagia in acute stroke. *Cochrane Database Syst Rev.* 2008 Jul 16;(3):CD006076.

A Cochrane systematic review that compared the therapeutic effect of acupuncture for dysphagia after acute stroke with placebo, sham or no acupuncture intervention. Only one trial of 66 participants was included. The reviewers concluded that there is not enough evidence to make any conclusion about the therapeutic effect of acupuncture for dysphagia after acute stroke.

Wu HM et al. Acupuncture for stroke rehabilitation. *Cochrane Database Syst Rev.* 2006 Jul 19;(3):CD004131.

A Cochrane systematic review that assessed the efficacy and safety of acupuncture for patients with stroke in the subacute or chronic stage. Five trials, involving a total of 368 patients, met the inclusion criteria. Methodological quality was considered inadequate in all trials. Although the overall estimate from four trials suggested the odds of improvement in global neurological deficit was higher in the acupuncture group compared with the control group (odds ratio [OR] 6.55, 95% CI 1.89 to 22.76), this estimate may not be reliable since there was substantial heterogeneity. One trial showed no significant improvement of motor function between the real acupuncture group and the sham acupuncture group (OR 9.00, 95% CI 0.40 to 203.30), but the confidence interval was wide and included clinically significant effects in both directions. No data on death, dependency, and institutional care, change of neurological deficit score, quality of life or adverse events were available. The reviewers concluded that, currently, there is no clear evidence on the effects of acupuncture on subacute or chronic stroke.

Randomised controlled trials

Li N et al. Double-center randomized controlled trial on post-stroke shoulder pain treated by electroacupuncture combined with Tuina. [Article in Chinese]. *Zhongguo Zhen Jiu* 2012;32(2):101-5.

A randomised controlled trial that evaluated the clinical therapeutic effect of electroacupuncture plus Tuina for post-stroke shoulder pain compared with rehabilitation in 300 patients. After 6 weeks treatment and 12 weeks follow-up, the three primary outcome measures (Assessment Face Scale (AFS) score, Fugl-Meyer motor assessment of upper limbs active function and modified Rankin Scale (mRS)) had improved more in the acupuncture plus Tuina group than in the rehabilitation group ($p < 0.05$, $p < 0.01$). However, the clinical incidences of shoulder-hand syndrome of hemiplegia and shoulder joint subluxation of hemiplegia were similar in the two groups. The researchers concluded that electroacupuncture plus Tuina has a beneficial therapeutic effect for post-stroke shoulder

pain, and that it is more effective than comprehensive rehabilitation treatment.

Hsing WT et al. Clinical effects of scalp electrical acupuncture in stroke: a sham-controlled randomized clinical trial. *J Altern Complement Med* 2012;18(4):341-6.

A randomized controlled trial that evaluated the efficacy of subcutaneous electrical stimulation of the scalp compared with sham treatment in spontaneous functional recovery of 62 patients with chronic post-ischaemic stroke symptoms. Results showed that there was a significant difference in functional improvement between the sham and active groups in terms of the National Institutes of Health Stroke Scale (NIHSS) scale, in favour of acupuncture. Also, the acupuncture group had greater functional improvement. There were no differences between the two groups in terms of two functional scales (Rankin and Barthel). The researchers concluded that their results support further testing of scalp electrical acupuncture for the treatment of stroke.

Li W et al. Observation on therapeutic effect of acupuncture combined with medicine on mild cognition disorders in patients with post-stroke. [Article in Chinese]. *Zhongguo Zhen Jiu* 2012;32(1):3-7.

A randomised controlled trial that explored the curative effect and safety of acupuncture plus medication compared with medication alone for mild cognitive disorders after stroke. The total effective rate in the combined treatment group was 66.7% (32/48), compared with 30.4% (14/46) for medication alone ($p < 0.05$). The scores of Mini-Mental State Examination, modified Hasegawa Dementia Scale and Barthel Index after treatment were improved in both groups (all $p < 0.01$), with the improvements being greater in the combined treatment group (all $p < 0.05$). There were no adverse events reported with either treatment. The researchers concluded that acupuncture can improve activities of daily living and has significant effect in treating mild cognition disorders after stroke without adverse reactions.

Chu JM et al. Randomized controlled clinical trials for electroacupuncture treatment of urinary incontinence in stroke patients. [Article in Chinese]. *Zhen Ci Yan Jiu* 2011;36(6):428-32.

A randomised controlled trial that looked at the clinical efficacy of electroacupuncture (EA) for post-stroke urinary incontinence in patients. A total of 111 stroke in-patients with urinary incontinence were randomly divided into an EA group and a control group (treated with conventional medicine, such as a calcium channel blocker, an angiotensin-converting enzyme inhibitor, an angiotensin II receptor antagonist, or a thrombolytic). After treatment, the severity of urinary incontinence and symptom scores in both control and EA groups were decreased significantly compared with pre-treatment ($p < 0.01$). The therapeutic effect of EA was greater than that of the control intervention ($p < 0.01$). In addition, the infection rate in the EA group was lower than in the control group ($p < 0.05$). The researchers concluded that EA can lower the severity of urinary incontinence and improve clinical symptoms of micturition in patients post-stroke.

Xie Y et al. Effect of acupuncture on dysphagia of convalescent stroke patients. [Article in Chinese]. *Zhongguo Zhong Xi Yi Jie He Za Zhi* 2011;31(6):736-40.

A randomised controlled trial that assessed the therapeutic effect of acupuncture on dysphagia in 148 patients post-stroke compared with routine rehabilitation training. The recovery rate, assessed by a water drinking test, in the acupuncture group was better than that in the control group ($p < 0.05$). There was no statistically significant difference in the pulmonary infection rate

and mortality between the two groups ($p>0.05$). No adverse reaction occurred in the acupuncture group. The researchers concluded that acupuncture for dysphagia poststroke was better than routine rehabilitation training, and was safe and well-tolerated.

Han DX et al. Evaluation on efficacy of Jin's "Sanzhen" therapy combined with rehabilitation training for hemiplegia of stroke patients by Fugl-Meyer scale. [Article in Chinese]. *Zhen Ci Yan Jiu* 2011 Jun;36(3):209-14.

A randomised controlled trial that assessed the therapeutic effect of acupuncture combined with rehabilitation training on limb-motor function of 254 patients post-. The total effective rates were 93.1% for acupuncture plus rehabilitation, 89.2% for acupuncture alone and 89.3% for rehabilitation alone. The neurological deficit score (of the combination group was significantly lower than that of the rehabilitation group ($p<0.05$). The Fugl-Meyer assessment score for extremity motor function in the combination group was higher than that in the acupuncture and rehabilitation groups ($p<0.05$). No significant differences were found between the acupuncture and rehabilitation groups. The researchers concluded that acupuncture therapy combined with rehabilitation training can significantly improve the limb motor function of patients with hemiplegia post-stroke.

Zhang HM, Tang Q. Rehabilitation evaluation on post-stroke abnormal movement pattern prevented and treated with acupuncture and rehabilitation. [Article in Chinese]. *Zhongguo Zhen Jiu* 2011;31(6):487-92.

A randomised controlled trial that explored the impacts of acupuncture and rehabilitation on post-stroke abnormal patterns of limb movement in 90 patients. There were three treatment groups - acupuncture-rehabilitation, body acupuncture and medication. The effective rate was 93.1% (27/29) in acupuncture plus rehabilitation group, which was superior to 66.7% (20/30) in body acupuncture group and 57.1% (16/28) in control group (both $p<0.01$) separately. After treatment, the Fugl-Meyer score, Modified Ashworth scale (MAS), range of motion (ROM) of the lower limbs and shoulder joint and shoulder pain score (except medication group) were all improved compared with those before treatment in each group (all $p<0.01$). The improvements in Fugl-Meyer score, MAS, ROM of the upper limbs and shoulder pain score in the combined group were significantly superior to those in the other two groups ($p<0.05$; $p<0.01$). The researchers concluded that acupuncture plus rehabilitation therapy and traditional body acupuncture both improve post-stroke movement disorder, but the combination therapy appears to be superior. This therapy can effectively prevent and treat post-stroke abnormal patterns.

Wang L et al. Post-stroke speech disorder treated with acupuncture and psychological intervention combined with rehabilitation training: a randomized controlled trial. [Article in Chinese]. *Zhongguo Zhen Jiu* 2011b;31(6):481-6.

A randomised controlled trial that assessed the clinical efficacy of acupuncture plus speech rehabilitation in 120 patients with post-stroke speech disorder. Patients were allocated to one of three groups: speech rehabilitation (control group); speech rehabilitation plus acupuncture group (observation group 1); or speech rehabilitation plus acupuncture combined with psychotherapy group (observation group 2). After 21 days of treatment, the total effective rate was similar with all three interventions - 92.5% in observation group 1, 97.5% in observation group 2 and 87.5% in the control group. However, the markedly effective rate was greater (50.0%) in observation group 2 than observation group 1 (15.0%; $p<0.01$) and the control group (2.5%; $p<0.001$). Oral expression, listening

	<p>comprehension, and reading and writing ability improved in all 3 groups, but more so in group 2 ($p<0.01$ and $p<0.001$, respectively). The researchers concluded that acupuncture and psychological intervention combined with rehabilitation training is an effective treatment for post-stroke speech disorder.</p>
<p>Xiao L et al. Clinical observation of integrated acupuncture and herbal medicine for constipation of excess fu syndrome due to phlegm heat in acute cerebral infarction. [Article in Chinese]. <i>Zhongguo Zhen Jiu</i>. 2011;31(5):400-4.</p>	<p>A randomised controlled trial that looked at the optimal therapy for constipation after acute cerebral infarction in 160 patients. Patients were allocated to acupuncture plus Chinese herbal medicine, Chinese herbal medicine alone, acupuncture alone or glycerine enemas. After 21 days treatment, the total effective rate was 92.5% in the acupuncture plus herbal medicine group, 82.5% in the Chinese herbal medicine group, 80.5% in the acupuncture group and 67.5% in the glycerine enema group (all $p<0.01$ compared with the combined treatment group). The researchers concluded that acupuncture plus Chinese herbal medicine is an effective treatment for constipation after acute cerebral infarction.</p>
<p>Cheng XK et al. Post-stroke hand dysfunction treated with acupuncture at Zhongzhu (TE 3) and Waiguan (TE 5). [Article in Chinese]. <i>Zhongguo Zhen Jiu</i> 2011;31(2):117-20.</p>	<p>A randomised controlled trial that compared the curative effects of acupuncture on post-stroke hand dysfunction in 60 patients with a control group. Routine medicine, physical therapy, occupational therapy and other rehabilitation trainings were given to both groups. After treatment, the scores of hand function, walking ability, activities of daily living (ADL) and the National Institutes of Health Stroke Scale (NIHSS) were improved in both groups (all $p<0.01$), and the hand function, walking ability and ADL in acupuncture group were superior to those in control group (all $p<0.05$). The researcher concluded that routine medicine and rehabilitation training combined with acupuncture improves hand dysfunction after stroke, enhances the abilities of walking and daily living, and increases the curative effect.</p>
<p>Zhou Y et al. Clinical observation on the therapeutic effect of electroacupuncture combined with cupping on post-stroke fatigue. [Article in Chinese]. <i>Zhen Ci Yan Jiu</i>. 2010;35(5):380-3.</p>	<p>A randomised controlled trial that assessed the therapeutic effect of electroacupuncture (EA) combined with cupping on post-stroke fatigue. A total of 128 patients were allocated to EA plus cupping or medication (vitamin E, magnesium gluconate, sertraline). After the treatment, the energy scores of Stroke Specific Quality of Life Scale (SS-QOL) of both the EA plus cupping and medication groups were increased significantly compared with baseline ($p<0.05$), and were higher in the EA plus cupping group ($p<0.05$). The effective rate of EA plus cupping was also higher than that of medication group ($p<0.01$). The researchers concluded that EA plus cupping can effectively relieve post-stroke fatigue and its therapeutic effect is greater than that of medication.</p>
<p>Wu JP. Clinical observation on acupuncture treatment of 150 cases of post-stroke depression according to syndrome differentiation. [Article in Chinese]. <i>Zhen Ci Yan Jiu</i>. 2010;35(4):303-6.</p>	<p>A randomised controlled trial that looked at the clinical therapeutic effect of acupuncture in the treatment of post-stroke depression (PSD) in 300 patients compared with fluoxetine. After treatment, the scores of Hamilton's depression scale (HAMD) in both groups had decreased significantly ($p<0.05$), and more so with acupuncture ($p<0.05$). The researchers concluded that</p>

acupuncture is effective in improving post-stroke depression.

Cheng YH et al. Clinical observation on therapeutic effect of three-step acupuncture for the secondary prevention of ischemic cerebral apoplexy. [Article in Chinese]. Zhongguo Zhen Jiu. 2010;30(4):270-4.

A randomised controlled trial that looked at the therapeutic effect and safety of acupuncture and also its preventive value against ischaemic cerebral apoplexy in 120 patients. After 6 months of follow-up, the recurrence rate was 10.2% in the acupuncture plus aspirin group and 16.7% in control group, which was not a significant difference ($p > 0.05$). However, with combined treatment neurologic impairment and activity of daily living improved more than with aspirin alone ($p < 0.01$, $p < 0.001$). The researchers concluded that acupuncture has a therapeutic effect in terms of treatment and in the secondary prevention of ischaemic cerebral apoplexy.

Physiology and animal studies

Wang Q et al. Electroacupuncture pretreatment attenuates cerebral ischemic injury through $\hat{1}\pm 7$ nicotinic acetylcholine receptor-mediated inhibition of high-mobility group box 1 release in rats. J Neuroinflammation. 2012;9:24.

An animal study in rats that found pretreatment with electroacupuncture strongly protects the brain against transient cerebral ischaemic injury, and inhibits high mobility group box 1 (HMGB1) release through $\hat{1}\pm 7$ nicotinic acetylcholine receptors activation. These findings suggest a novel potential for stroke interventions by harnessing the anti-inflammatory effects of $\hat{1}\pm 7$ nAChR activation using acupuncture or pharmacological strategies.

Zhou F et al. Electroacupuncture increased cerebral blood flow and reduced ischemic brain injury: dependence on stimulation intensity and frequency. J Appl Physiol. 2011;111(6):1877-87.

An animal study in rats that found electroacupuncture (EA) effectively protects the brain from ischaemic injury by increasing cerebral blood flow.

Zhang F et al. Electro-acupuncture can alleviate the cerebral oedema of rat after ischemia. Brain Inj. 2011;25(9):895-900.

An animal study in rats that found electroacupuncture (EA) could alleviate cerebral oedema after cerebral ischaemia.

Zhang S et al. Acupuncture to point Baihui prevents ischemia-induced functional impairment of cortical GABAergic neurons. J Neurol Sci. 2011;307(1-2):139-43.

An animal study in mice that found acupuncture improves outcome after ischaemic stroke via preventing the impairment of cortical GABAergic neurons.

Pan S et al. Proteomic analysis of serum proteins in acute ischemic stroke patients treated with acupuncture. Exp Biol Med (Maywood). 2011;236(3):325-33.

A study in patients post-stroke that found muscle strength in the limbs was increased after electroacupuncture (EA). The treatment appeared to have its effect by regulating differential expression of multiple serum proteins involved in stroke, and also by enhancing of muscle strength recovery.

Zhao L et al. Effects of acupuncture on glycometabolic enzymes in multi-infarct dementia rats. Neurochem Res. 2011;36(5):693-700.

An animal study that investigated the effects of acupuncture on behaviour of multi-infarct dementia rats and glycometabolic enzymes protein expression and activities in their brains. Results showed that acupuncture improved the cognitive disorder, and increased the activities of hexokinase, pyruvate kinase, and glucose-6-phosphate dehydrogenase. These actions could

	influence the energy metabolic system, so overcoming the dysfunctional cognition of multi-infarct dementia.
Du Y et al. Angiogenesis and improved cerebral blood flow in the ischemic boundary area were detected after electroacupuncture treatment to rats with ischemic stroke. <i>Neurol Res.</i> 2011;33(1):101-7.	An animal study with rats that found the effect of electroacupuncture might be closely associated with promoting angiogenesis in the cerebral ischaemic condition.
Lin H et al. The effects of electro-acupuncturing DU26 (renzhong) on motor cortical excitability and neurofunction after focal cerebral ischemia injury in rats. <i>Acupunct Electrother Res.</i> 2010;35(1-2):29-44.	An animal study in rats that found electroacupuncture can improve motor cortical excitability, and facilitate motor function recovery after focal cerebral inschaemia injury.
Ren L et al. Effect of electroacupuncture therapy on the expression of Na(v)1.1 and Na(v)1.6 in rat after acute cerebral ischemia. <i>Neurol Res.</i> 2010;32(10):1110-6.	An animal study using a rat model that found electroacupuncture could regulated the expression of Na(v)1.1 and Na(v)1.6, which both play a role in injury due to cerebral ischaemia. This could result in a reduction in the infarction volume and decrease cerebral ischaemic damage.
Chen F et al. Effects of electroacupuncture on cerebral Bcl-2 and caspase-3 expression after cerebral ischemia reperfusion in rats. [Article in Chinese]. <i>Zhen Ci Yan Jiu.</i> 2009;34(6):363-7.	A study that investigated the underlying mechanism of electroacupuncture (EA) in anti-apoptosis effects in rats with cerebral ischemia-reperfusion injury rats. It found that EA may up-regulate bcl-2 expression, so down-regulating caspase-3 expression, and that it can significantly improve erythrocyte deformability and reduce blood viscosity and erythrocyte aggregation.
Kang KA et al. Acupuncture attenuates neuronal cell death in middle cerebral artery occlusion model of focal ischemia. <i>Neurol Res.</i> 2010;32 Suppl 1:84-7.	An animal study that found acupuncture had neuroprotective effects against focal ischaemia in a rat model of middle cerebral artery occlusion.
Lee GJ et al. Acupuncture attenuates extracellular glutamate level in global ischemia model of rat. <i>Neurol Res.</i> 2010;32 Suppl 1:79-83.	An animal study using a model of ischaemic stroke found that the effect of acupuncture might be closely associated with modulation of the brain glutamate release.
Hui KK et al. Acupuncture, the limbic system, and the anticorrelated networks of the brain. <i>Auton Neurosci</i> 2010; 157: 81-90.	Studies have shown that acupuncture stimulation, when associated with sensations comprising deqi, evokes deactivation of a limbic-paralimbic-neocortical network, as well as activation of somatosensory brain regions. These networks closely match the default mode network and the anti-correlated task-positive network. The effect of acupuncture on the brain is integrated at multiple levels, down to the brainstem and cerebellum and appears to go beyond either simple placebo or somatosensory needling effects. Needling needs to be done carefully, as very strong or painful sensations can attenuate or even reverse the desired effects. Their results suggest that acupuncture mobilises the functionally anti-correlated networks of the brain to mediate its actions, and that the effect is dependent on the

	psychophysical response. They discuss potential clinical application to disease states including chronic pain, major depression, schizophrenia, autism, and Alzheimer's disease.
Wang Q et al. Pretreatment with electroacupuncture induces rapid tolerance to focal cerebral ischemia through regulation of endocannabinoid system. <i>Stroke</i> . 2009;40(6):2157-64.	A study involving an animal model of focal cerebral ischaemia that concluded pre-treatment with electroacupuncture increases the production of endocannabinoid 2-arachidonylglycerol and N-arachidonylethanolamine-anandamide, which elicits protective effects against transient cerebral ischaemia through CB1 receptors.
Hui K.K.-S. The salient characteristics of the central effects of acupuncture needling: limbic-paralimbic-neocortical network modulation. <i>Human Brain Mapping</i> 2009; 30: 1196-206.	This study assessed the results of fMRI on 10 healthy adults during manual acupuncture at 3 acupuncture points and a sham point on the dorsum of the foot. Although certain differences were seen between real and sham points, the hemodynamic and psychophysical responses were generally similar for all 4 points. Acupuncture produced extensive deactivation of the limbic-paralimbic-neocortical system. Clusters of deactivated regions were seen in the medial prefrontal cortex, the temporal lobe and the posterior medial cortex. The sensorimotor cortices, thalamus and occasional paralimbic structures such as the insula and anterior middle cingulate cortex showed activation. The researchers concluded that their results provided additional evidence that acupuncture modulates the limbic-paralimbic-neocortical network. They hypothesised that acupuncture may mediate its analgesic, anti-anxiety, and other therapeutic effects via this intrinsic neural circuit that plays a central role in the affective and cognitive dimensions of pain.
Hwang HS et al. Electroacupuncture Delays Hypertension Development through Enhancing NO/NOS Activity in Spontaneously Hypertensive Rats. <i>Evid Based Complement Alternat Med</i> 2008 Oct 7.	An animal study that found electroacupuncture (EA) could reduce early stage hypertension in rats by enhancing NO/NOS activity in the mesenteric artery.
Kavoussi B, Ross BE. The neuroimmune basis of anti-inflammatory acupuncture. <i>Integr Cancer Ther</i> 2007; 6: 251-7.	Review article that suggests the anti-inflammatory actions of traditional and electro-acupuncture are mediated by efferent vagus nerve activation and inflammatory macrophage deactivation.
Kim DD et al. Acupuncture reduces experimental renovascular hypertension through mechanisms involving nitric oxide synthases. <i>Microcirculation</i> 2006; 13: 577-85.	An animal study that found electroacupuncture on St 36 in a hamster model reduced blood pressure by activating nitric oxide synthase signalling mechanisms.