

ACUPUNCTURE AND ASTHMA

About asthma

Asthma is a chronic inflammatory disorder of the airways characterised by variable airflow obstruction and airway hyper-responsiveness, and the presence of symptoms (more than one of wheeze, breathlessness, chest tightness and cough) (British Thoracic Society 2012). Around 5.4 million people in the UK are currently treated for asthma – 4.3 million adults and 1.1 million children (Asthma UK). Up to 5% of adults with the condition have severe disease that responds poorly to treatment (Dennis 2008), while childhood asthma can be difficult to distinguish from viral wheeze (Keeley 2005).

Many people with asthma are atopic and, when they are exposed to certain stimuli, have inflammatory and structural changes in their airways (Duff 1992, Chan Yueng 1995). There are many such stimuli, for example, environmental allergens, occupational sensitising agents and respiratory viral infections (Duff 1992, Chan Yueng 1995).

The aim of treatment is to minimise or eliminate symptoms, prevent exacerbations and maximise lung function, with minimal unwanted effects (British Thoracic Society 2012). Standard therapy for patients with symptomatic asthma includes a short-acting beta2-agonist for symptom relief as needed, and prophylaxis with an inhaled corticosteroid, sometimes with the addition of a long-acting beta2-agonist (British Thoracic Society 2012). Other drugs used include leukotriene antagonists and theophylline.

References

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How acupuncture can help

This factsheet looks at the evidence for acupuncture in the treatment of asthma. There is a related factsheet on chronic obstructive pulmonary disease.

The respected Cochrane collaboration reviewed acupuncture for asthma in 2003, finding insufficient high-quality evidence to say whether or not acupuncture is effective (McCarney 2003). As well as the general concerns about the validity of sham acupuncture controls (Lundeberg 2009), McCarney also noted that some of the asthma trials used points in the sham arm that are traditionally indicated for the treatment of asthma, potentially biasing the results against acupuncture. There has been no recent systematic review that provides an authoritative evaluation and addresses these concerns.

A Chinese meta-analysis reported acupuncture to be superior to a control group for most subjective and objective measures of asthma but did not specify the nature of the control(s) (Yu 2012). A systematic review of laser acupuncture for childhood asthma located only three low-quality trials and hence was inconclusive (Zhang 2012). Several randomised controlled trials (RCTs) published since the McCarney systematic review have suggested that acupuncture is better than no treatment, and may also be a useful adjunct to standard medical care for asthma (Reinhold 2014, Sheewe 2012, Choi 2010, Lin 2010, Mehl-Madrona 2007, Zhang 2007, Maa 2003). There is also some indication of superiority over placebo (Karlson 2013, Chu 2007). In most of these studies, patients have felt better after acupuncture even if their objective lung function tests were not significantly improved. In contrast, a series of four Chinese RCTs found that moxibustion was as good as long-term asthma medication for pulmonary function as well as subjective symptoms (Chen 2013, Sang 2012, Ouyang 2011, Liang 2010). There is also evidence to support acupuncture as an effective treatment for acute asthma attacks: a large trial showed it to be similar to inhaled salbutamol (Han 2012). Acupuncture has been found to be cost effective by virtue of improving quality of life (Rheinhold 2014). (For further details of all studies see Table overleaf).

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 are many published studies investigating the mechanisms by which acupuncture may have an effect in asthma, showing that it may help relieve asthma by:

- having regulatory effects on mucosal and cellular immunity in patients with allergic asthma, as shown, for example, by changes in levels of immunoglobulins, eosinophils, T-lymphocytes and cytokines (Yang 2013, Carneiro 2010, Joos 2000);
- reducing bronchial immune-mediated inflammation, particularly through the balance between T helper 1 and 2 cells and their associated cytokines (Carneiro 2010; Carneiro 2005, Jeong 2002). Reducing inflammation in general by promoting release of vascular and immunomodulatory factors (Kavoussi 2007, Zijlstra 2003);

- regulating expression of surfactant proteins, that help to reduce airways resistance biophysically and also modulate the immune response (Yan 2010);
- inhibiting structural changes in the airways, and hence reducing airways resistance, possibly by inhibiting T-type calcium channel protein in airway smooth muscle cells (Wang 2012);
- regulating the expression of genes and proteins that control the airways inflammatory response (Mo 2012, Xu 2012, Yin 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).

References

Lundeberg T et al. Is placebo acupuncture what it is intended to be? [Evid Based Complement Alternat Med.](#) 2009 Jun 12.

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 ASTHMA

The evidence

| Heading | Heading |
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| Systematic reviews and meta-analyses | |
| Zhang J et al. Laser acupuncture for the treatment of asthma in children: a systematic review of randomized controlled trials. <i>J Asthma</i> . 2012 Sep;49(7):773-7. | A systematic review that assessed the effectiveness of laser acupuncture in the treatment of childhood asthma. It included three randomised controlled trials with a total of 176 patients. The quality of the trials was low. One trial with a parallel group design showed positive results, while two crossover trials showed negative results. There was variation in the type of patients, the interventions, and outcome measures. Because of the significant clinical and methodological heterogeneity, no meta-analysis was done. The reviewers concluded that, because of a lack of randomised controlled trials, their small sample sizes and poor methodological quality, there is no compelling evidence to suggest that laser acupuncture is or is not an effective treatment for childhood asthma. |
| Yu L et al. Meta-analysis on randomized controlled clinical trials of acupuncture for asthma. <i>Zhongguo Zhen Jiu</i> . 2010 Sep;30(9):787-92. | A meta-analysis that assessed the efficacy of acupuncture and moxibustion for asthma. Twenty-two randomised controlled trials including 3058 patients with asthma were included. The findings showed that the total effective rate with acupuncture was significantly superior to that of a control [OR 4.18, 95% CI 3.36 to 5.20, Z = 12.85, p <0.00001]. There was no significant difference in FEV1 measurements between the two groups [OR = 0.20, 95% CI -0.37 to 0.76), Z = 0.68, p=0.50]. There were significant differences in PEFR measurements [OR = 0.42, 95% CI 0.22 to 0.62), Z = 4.06, p<0.0001], FVC measurements [OR = 0.45, 95% CI 0.17, 0.72, Z = 3.22, p=0.001] and FEV1/FVC measurements [OR = 9.58, 95% CI 8.14 to 11.02, Z = 13.03, p<0.00001] between the two groups. The researchers concluded that acupuncture and moxibustion therapy can significantly improve the total effective rate of acupuncture for asthma. |
| McCarney RW et al. Acupuncture for chronic asthma. <i>Cochrane Database of Systematic Reviews</i> 2003, Issue 3. Art. No.: CD000008. DOI: 10.1002/14651858.CD000008.pub2 | A systematic review that assessed the effects of acupuncture for the treatment of asthma or asthma-like symptoms, which involved 12 studies and a total of 350 participants. Two studies used individualised treatment strategies and one study used a combination strategy of formula acupuncture with the addition of individualised points. No statistically significant or clinically relevant effects were found for acupuncture compared with sham acupuncture. However, this review does not include most of the trials included in the table below, as it was completed before these were published. Also, the points that were used in the sham arm of some studies are used for the treatment of asthma according to traditional Chinese medicine. The reviewers concluded that there is not enough evidence to make recommendations about the value of acupuncture in asthma treatment. |

Clinical trials

Chen R et al. Curative effect of heat-sensitive moxibustion on chronic persistent asthma: a multicenter randomized controlled trial. *J Tradit Chin Med.* 2013 Oct;33(5):584-91.

A randomised controlled trial that compared the curative effects of heat-sensitive moxibustion with conventional drugs on chronic persistent asthma. A total of 288 patients were either treated with heat-sensitive moxibustion or inhaled salmeterol 50 microgram plus fluticasone 250 microgram (twice a day). Asthma control test (ACT) scores, forced expiratory volume in 1 second (FEV1), peak expiratory flow (PEF), and attack frequency were measured after 15, 30, 60, and 90 days of treatment. Patients were followed up 3 and 6 months after treatment. There was a significant difference in the ACT score and lung function between the two groups after 3 months of treatment ($p=0.0002$) and during the follow-up visits ($p=0.0003$). In addition, heat-sensitive moxibustion reduced attack frequency in the period from inclusion to the 6-month follow-up visit. The researchers concluded that heat-sensitive moxibustion may have a comparable curative effect to inhaled salmeterol plus fluticasone on asthma.

Reinhold T et al. Acupuncture in patients suffering from allergic asthma: is it worth additional costs? *J Altern Complement Med.* 2014 Mar;20(3):169-77.

A randomised controlled trial that assessed economic aspects of additional acupuncture treatment in patients with allergic bronchial asthma compared with patients having routine care alone. A total of 306 patients were either allocated to immediate acupuncture or a waiting-list control group. Both groups were free to use routine treatment. The resource consumption, costs and health-related quality of life were evaluated at baseline, and after 3 and 6 months, by using statutory health insurance information and standardised questionnaires. Acupuncture treatment was associated with significantly higher costs compared with patients in the control group (overall costs: €860.76, 95% confidence interval [CI] 705.04 to 1016.47 versus €518.80, 95% CI 356.66 to 680.9, $p=0.003$; asthma-related costs: €517.52, 95% CI 485.63-549.40 versus €144.87, 95% CI 111.70 to 178.05, $p<0.001$). The researcher concluded that these additional costs seem essentially driven by acupuncture costs themselves (€378.40, 95% CI 367.10 to 389.69). However, acupuncture was associated with superior effectiveness in terms of quality-adjusted life years (QALYs). The resulting incremental cost-effective ratio (ICER) lay between €23,231 (overall) and €25,315 (diagnosis-specific) per additional QALY. They concluded that treating patients who have allergic bronchial asthma with acupuncture in addition to routine care resulted in additional costs but better effects in terms of patients' quality of life.

Karlson G(1), Bennicke P. Acupuncture in asthmatic children: a prospective, randomized, controlled clinical trial of efficacy. *Altern Ther Health Med.* 2013 Jul-Aug;19(4):13-9.

A randomised placebo-controlled trial that assessed the efficacy of acupuncture for treating asthma in 122 children aged 6 months to 8 years. Symptom scores and medication use were not different between the groups at 8 months after completion of acupuncture. There were significant reductions in subjective asthma symptoms and in use of inhaled corticosteroids and beta2 agonists in both groups at 3 months. The reduction in asthma symptoms ($p=0.0376$) and use of inhaled corticosteroids ($p=0.0005$) was significantly larger in the intervention group than in the placebo group. The researchers concluded that, although the effect was not sustained beyond the treatment period, the study demonstrated

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| | <p>that acupuncture had an effect on asthma in preschool children for the duration of treatment as assessed by subjective parameters and use of medication.</p> |
| <p>Han J. Observation on effect of acupuncture at Yuji (LU 10) on the pulmonary function of patients with bronchial asthma and immediate efficacy of relieving asthma. Zhongguo Zhen Jiu. 2012 Oct;32(10):891-4.</p> | <p>A randomised controlled trial that compared acupuncture (at LU 10) and salbutamol for the immediate relief of an acute asthma attack in 577 patients. All the patients were also given oxygen and azithromycin. The indices of the pulmonary function and symptom scores all significantly improved immediately after acupuncture and 5 minutes after salbutamol inhalation (all $p < 0.05$), with the results in the inhalation group being superior to those in the acupuncture group (all $p < 0.05$). The indices did improve significantly after the acupuncture needles were left in place for more than 30 minutes compared with the indices immediately after the needles had been inserted (all $p < 0.05$), and were similar to the indices after salbutamol inhalation (all $p > 0.05$). The researchers concluded that acupuncture at LU 10 can relieve an acute attack of bronchial asthma, and that it achieves an immediate effect quickly, with the best effect being after the needle has been in place for 30 minutes of needle retaining, an effect that is equal to salbutamol inhalation.</p> |
| <p>Song NC et al. Comparative study on effect of acupoint heat-sensitive moxibustion and Seretide on the symptoms of bronchial asthma at chronic persistent stage. Zhongguo Zhen Jiu. 2012 Jul;32(7):593-6.</p> | <p>A randomised controlled trial that compared acupoint heat-sensitive moxibustion with inhaled salmeterol plus fluticasone for the relief of symptoms in 64 patients with chronic bronchial asthma. After 3 months of treatment, asthma symptom scores had all improved in patients in both treatment groups (both $p < 0.05$). During 6 months of follow-up visits, asthma symptom scores in the heat-sensitive moxibustion group were stable, but those in the medication group were reduced, and there was significant difference between the two groups in favour of heat-sensitive moxibustion ($p < 0.05$). The researchers concluded that acupoint heat-sensitive moxibustion effectively relieves the clinical symptoms of chronic bronchial asthma with a similar immediate efficacy to that of inhaled salmeterol plus fluticasone but better long-term efficacy.</p> |
| <p>Ouyang BS et al. Impact of acupoint heat-sensitive moxibustion on lung function and life quality of patients with chronic persistent bronchial asthma: a randomized controlled study. Zhongguo Zhen Jiu. 2011 Nov;31(11):965-70.</p> | <p>A randomised controlled trial that assessed the impact of heat-sensitive moxibustion on lung function in chronic persistent bronchial asthma and on quality of life compared with inhaled salmeterol plus fluticasone in 57 patients. Lung function (measured using FEV1) improved in both groups ($p < 0.05$, $p < 0.01$). Improvement in symptoms and quality of life were similar in both groups (all $p > 0.05$). But improvement in general health, chills, fever and sweating was greater in the heat-sensitive moxibustion group than the medication group (both $p < 0.05$), while improvement in respiratory symptoms was better in the medication group ($p < 0.05$). The researchers concluded that heat-sensitive moxibustion improves lung function, relieves clinical symptoms and benefits life quality for patients with chronic persistent bronchial asthma, with a similar efficacy to inhaled salmeterol plus fluticasone.</p> |
| <p>Scheewe S et al. Acupuncture in children and adolescents with bronchial asthma: a randomised controlled study. Complement Ther</p> | <p>A randomised controlled trial that evaluated the immediate effects of acupuncture as an add-on therapy in in-patient rehabilitation of 93 children and adolescents with bronchial asthma. With acupuncture, the peak expiratory flow variability was significantly</p> |

Med. 2011 Oct;19(5):239-46.

better ($p < 0.01$) than that of patients in the control group. Moreover, rehabilitation response at the time of discharge concerning perceived anxiety was significantly better in the acupuncture group. There were no differences in quality of life and lung function tests between the groups. The researchers concluded that additional acupuncture can improve peak expiratory flow variability and anxiety, without any difference in objective lung function tests and quality of life.

Liang C et al. Comparative observation on therapeutic effect of chronic persistent bronchial asthma treated with heat-sensitive moxibustion and medication. Zhongguo Zhen Jiu. 2010 Nov;30(11):886-90.

A randomised controlled trial that compared heat-sensitive moxibustion with inhaled salmeterol plus fluticasone in 36 patients with chronic persistent asthma. After treatment, the effective rate of 88.2% (15/17) in the heat-sensitive moxibustion group was superior to that of 47.4% (9/19) in the medication group ($p < 0.05$); the clinical symptom scores and pulmonary ventilation function improved in both groups, with the heat-sensitive moxibustion group being superior to the medication group (all $p < 0.05$). The researchers concluded that, for chronic persistent bronchial asthma, heat-sensitive moxibustion can improve clinical symptoms and pulmonary ventilation function, and that it is more effective than inhaled salmeterol plus fluticasone.

Lin CH et al. Effects of acupuncture-like transcutaneous electrical nerve stimulation on children with asthma. J Asthma. 2010 Dec;47(10):1116-22.

A controlled study that evaluated the effects of acupuncture-like transcutaneous electrical nerve stimulation (AL-TENS) in 43 children with asthma. Children were either given AL-TENS or no AL-TENS. After 8 weeks of AL-TENS, there were no significant differences on forced vital capacity (FVC), FEV1/FVC, and peak expiratory flows (PEFs) between the two groups. The heart rate turbulence (HRT) is the physiological, biphasic response of the sinus node to premature ventricular contractions. In the experimental group, the mean HRT was statistically significant between pre-test and post-test. The heart rate variability (HRV) and the pediatric asthma quality of life questionnaire (PAQLQ) showed no difference, but in the experimental group, the subscale of the PAQLQ (particularly activity) improved significantly more than the pre-test scores. Furthermore, there were no differences in PFTs and HRV after 8 weeks of AL-TENS between the two groups. The researchers concluded that the PAQLQ activities of the experimental group improved significantly more than those of the control group.

Choi JY et al. A randomized pilot study of acupuncture as an adjunct therapy in adult asthmatic patients. J Asthma. 2010 Sep;47(7):774-80. doi: 10.3109/02770903.2010.485665.

A randomised controlled trial that looked at the feasibility of estimating the effectiveness of acupuncture in 45 patients with asthma being managed with conventional medicine. They were allocated to an active acupuncture group, a sham acupuncture group, or a waiting list group and were told to continue using their asthma medicines. No significant differences in the between- or within-group values of weekly average PEF (recorded daily in the morning) and FEV1 were found. For the quality of life questionnaire for adult Korean asthmatics and the transition dyspnea index, the active acupuncture group showed a significant improvement compared with the waiting list group at 2, 4, and 6 weeks after randomisation. The researchers concluded that acupuncture as an adjunct therapy to conventional medical care does not seem to affect pulmonary function in asthmatic patients.

However, it showed a favourable effect on the quality of life in adult asthmatic patients.

Chu K.-A. et al. Acupuncture therapy results in immediate bronchodilating effect in asthma patients. *Journal of the Chinese Medical Association* 2007; 70(7): 265-8.

A randomised controlled study that compared 'real' acupuncture with sham acupuncture in 18 patients with asthma (bronchodilator response >20% improvement of forced expiratory volume over 1 second [FEV1]). Spirometry was recorded before and after treatment. The mean FEV1 values before and after real acupuncture were 1.52L and 1.67L, respectively ($p < 0.001$). The mean FEV1 values before and after sham acupuncture were 1.49L and 1.49L, respectively ($p = 0.838$). The percentage change in FEV1 values after real acupuncture was better than after sham acupuncture (11.57% vs. 0.32%; $p = 0.003$). The researchers concluded that, in asthma patients, acupuncture treatment may result in immediate improvement of FEV1.

Mehi-Madrona L et al. The Impact of Acupuncture and Craniosacral Therapy Interventions on Clinical Outcomes in Adults With Asthma. *The Journal of Science and Healing* 2007; 3(1): 28-36.

A randomised controlled trial that assessed the effects of acupuncture and craniosacral therapy on lung function, quality of life, anxiety, depression, and medication usage in people with asthma. Patients were allocated to one of five groups: acupuncture, craniosacral therapy, acupuncture plus craniosacral, attention control, and waiting list control. Quality of life improved more in patients given acupuncture and/or craniosacral therapy than in those in the control groups. However, depression, medication use and lung function remained the same. The combination of acupuncture plus craniosacral treatment was not superior to each therapy alone. The researchers concluded that acupuncture and/or craniosacral therapy are potentially useful adjuncts to the conventional care of adults with asthma.

Zhang WP. Effects of acupuncture on the pulmonary function and heart rate variability in different state of bronchial asthma. [Chinese] *Chen Tzu Yen Chiu Acupuncture Research* 2007; 32(1): 42-8.

A randomised controlled trial involving 71 patients with asthma that compared the effects of 12 days of acupuncture treatment with a control group taking anti-asthma drugs (e.g. sodium cromoglicate, albuterol, fenoterol). After the treatment, FEV1 forced expiratory flow, and peak expiratory flow in the acupuncture group had increased significantly ($p < 0.05$), and more so than in the control group ($p < 0.05$). The researchers concluded that acupuncture is significantly superior to medication in improving lung function in asthma patients, which is related to its function in regulating activities of the autonomic nervous system.

Maa S-H et al. Effect of Acupuncture or Acupressure on Quality of Life of Patients with Chronic Obstructive Asthma: A Pilot Study. *Journal of Alternative and Complementary Medicine* 2003; 9(5): 659-70.

A randomised controlled pilot study that assessed the effects of acupuncture or acupressure when added to standard care for chronic obstructive asthma. Forty-one patients were assigned to receive acupuncture plus standard care, self-administered acupressure plus standard care, or standard care alone. Six-minute walking, the Dyspnea Visual Analogue Scale, the modified Borg scale, St. George's Respiratory Questionnaire (SGRQ), and the Bronchitis Emphysema Symptom Checklist (BESC) were used at the beginning and end of the 8 weeks of treatment. The total SGRQ score of acupuncture subjects showed an average 18.5-fold improvement (95% CI 1.54 to 211.48, $p = 0.02$); the improvement for the acupressure subjects was 6.57-fold (95% CI 0.98 to 44.00, $p = 0.05$). The other variables did not differ from those of the controls. The researchers concluded that patients with stable,

chronic obstructive asthma experienced clinically significant improvements in quality of life when their standard care was supplemented with acupuncture or acupressure.

Physiological studies

Yang YQ et al. Considerations for use of acupuncture as supplemental therapy for patients with allergic asthma. *Clin Rev Allergy Immunol.* 2013 Jun;44(3):254-61

A study that examined the immunomodulatory effects of acupuncture in the treatment of patients with allergic asthma. After treatment, the concentrations of secretory immunoglobulin A (IgA) and total IgA in the saliva ($p < 0.01$, $p < 0.02$) and nasal secretions ($p < 0.02$, $p < 0.02$) were significantly decreased. The levels of total IgE in sera ($p < 0.001$), the counts of interleukin-2R and T lymphocytes ($p < 0.001$), and the absolute and differential numbers of eosinophils ($p < 0.01$, $p < 0.01$) in the peripheral blood were also significantly decreased. The numbers of CD3+, CD4+, and CD8+ T lymphocytes in the peripheral blood were significantly ($p < 0.001$, $p < 0.01$, and $p < 0.001$, respectively). The concentration of cortisol in the plasma did not change significantly ($p > 0.05$). The researchers concluded that acupuncture has regulatory effects on mucosal and cellular immunity in patients with allergic asthma.

Mo L et al. Effects of acupoint injection of autoblood on expression of pulmonary transcription factor GATA 3 and T-bet proteins and genes in asthma rats. *Zhen Ci Yan Jiu.* 2012 Oct;37(5):357-62.

An animal study that found autoblood acupoint injection to be comparable to dexamethasone intraperitoneal injection in down-regulating asthma-induced increase of pulmonary GATA 3 protein and mRNA expression as well as the ratio of GATA 3 mRNA/T-bet mRNA, and in up-regulating asthma-induced decrease of T-bet mRNA expression in rats with asthma. The researchers concluded that this may contribute to its effects in relieving asthma.

Xu YD et al. Proteomic analysis reveals the deregulation of inflammation-related proteins in acupuncture-treated rats with asthma onset. *Evid Based Complement Alternat Med.* 2012;2012:850512.

An animal study that analysed changes in the lung proteome of acupuncture-treated rats with asthma using two-dimensional gel electrophoresis (2DE) and mass-spectrometry (MS). Acupuncture appeared to improve respiratory function and reduce the total number of leukocytes and eosinophils in bronchoalveolar lavage fluid. Image analysis of 2DE gels revealed 32 differentially expressed acupuncture-specific protein spots in asthma onset, 30 of which were identified as 28 unique proteins. Analyses showed that these altered proteins are most likely involved in inflammation-related biological functions resulting in an inflammation signalling pathway. The researchers suggested that acupuncture affects the pathway at different levels by down-regulating pro-inflammatory proteins and up-regulating anti-inflammatory proteins. These deregulated inflammation-related proteins may mediate, at least in part, the anti-asthmatic effect of acupuncture.

Wang Y et al. Influence of acupuncture on expression of T-type calcium channel protein in airway smooth muscle cell in airway remodeling rats with asthma]. *Zhongguo Zhen Jiu.* 2012 Jun;32(6):534-40.

A randomised controlled animal study that looked at the anti-remodelling effect of acupuncture on asthma and the role of T-type calcium channel protein in airway smooth muscle cell in this remodelling. Rats were allocated to a normal group (not handled), a model group (no treatment), an acupuncture group and a sham acupuncture group. Airway resistance in the model group was higher than that in the normal and acupuncture groups (both $p < 0.05$), and lower in the acupuncture group than the sham acupuncture group ($p < 0.05$). (2) The ratios of airway wall thickness to basement membrane perimeter and airway outer perimeter to

airway internal perimeter were higher in the model group than in the normal and acupuncture groups (all $p < 0.05$), and lower in the acupuncture group than the sham acupuncture group (both $p < 0.05$). The average opticals of calcium (v) 3.1 and calcium (v) 3.2 in airway smooth muscle cell were higher in the model group than the normal and acupuncture groups (both $p < 0.05$). The average optical of calcium (v) 3.3 in airway smooth muscle in the model group was higher than in the normal group ($p < 0.05$) and lower than in the sham acupuncture group ($p < 0.05$). The researchers concluded that acupuncture can inhibit airway remodelling and fission of cells in airway smooth muscle and can reduce airway resistance, and that this may be related to the inhibition of T-type calcium channel protein in airway smooth muscle cells.

Yan XK et al. Effect of acupuncture on SP-A expression in bronchoalveolar lavage fluid of asthmatic rats. *Zhongguo Zhen Jiu*. 2010 Aug;30(8):665-8.

A randomised controlled animal study that investigated the possible mechanisms of acupuncture in asthma prevention and treatment. Rats were allocated to a blank control group, a normal saline control group (NS control group), an asthma model group, an asthma model with acupuncture group (asthma-acupuncture group) and an asthma model with binding group (asthma binding group). Airway resistance in the asthma model group was significantly higher than in the blank control and NS control groups from 36 minutes after asthma provocation (all $p < 0.01$). Western-Blot detection showed that SP-A expression in bronchoalveolar lavage fluid in the asthma model group was significantly lower than in blank control and NS control groups (both $p < 0.05$), and was significantly higher in the asthma-acupuncture group than in the asthma model group ($p < 0.05$). The researchers concluded that the mechanism of prevention and treatment of acupuncture for allergic asthma may be related to regulation of SP-A expression in the airways.

Carneiro ER et al. Electroacupuncture promotes a decrease in inflammatory response associated with Th1/Th2 cytokines, nitric oxide and leukotriene B4 modulation in experimental asthma. *Cytokine*. 2010 Jun;50(3):335-40.

A controlled animal study that aimed to verify the effects of electroacupuncture (EA) on the asthma mediators Th2 cytokines, leukotriene B4 (LTB4) and nitric oxide (NO). Rats were divided into control, immobilised, sham acupuncture and EA groups. EA increased interleukin (IL)-1 and interferon (IFN)-gamma and decreased IL-4, IL-10, NO and LTB4 compared with control and sham acupuncture. The presence of eosinophils in the BAL negatively correlated with IL-1 and IFN-gamma production and positively correlated with IL-4 and IL-10 production. The researchers concluded that results show that the beneficial anti-inflammatory action of EA on asthma is related to the balance of the Th1/Th2 response and the reduction of LTB4 and NO.

Hui KK et al. Acupuncture, the limbic system, and the anticorrelated networks of the brain. *Auton Neurosci*. 2010; 157(1-2): 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

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| | <p>painful sensations can attenuate or even reverse the desired effects. Their results suggest that acupuncture mobilizes 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.</p> |
| <p>Yin LM et al. Use of serial analysis of gene expression to reveal the specific regulation of gene expression profile in asthmatic rats treated by acupuncture. <i>Journal of Biomedical Science</i> 2009; 16(1): 46.</p> | <p>A study that systematically analysed and compared the gene expression profiles of the asthmatic and acupuncture-treated asthmatic rat lung, to try and gain insight into the molecular mechanism underlying the early airway response phase of asthma treated by acupuncture. The researchers found that the gene expression profile of this phase of asthma could be effectively and specifically regulated by acupuncture, which suggests that the gene expression of immune response and steroid hormone may play an important role in asthma treatment.</p> |
| <p>Kavoussi B, Ross BE. The neuroimmune basis of anti-inflammatory acupuncture. <i>Integr Cancer Ther</i> 2007; 6: 251-7.</p> | <p>A review article that suggests the anti-inflammatory actions of traditional and electro-acupuncture are mediated by efferent vagus nerve activation and inflammatory macrophage deactivation.</p> |
| <p>Carneiro ER et al. Effect of electroacupuncture on bronchial asthma induced by ovalbumin in rats. <i>Journal of Alternative and Complementary Medicine</i> 2005; 11(1): 127-34.</p> | <p>A study using a rat pulmonary hypersensitivity experimental model that mimics human asthma to investigate whether electroacupuncture treatment can reduce the inflammatory process. Histopathological analyses showed that peribronchial and perivascular inflammatory cell infiltrates were significantly lower with electroacupuncture than with sham acupuncture and control groups. Furthermore, bronchoalveolar lavage total cell count and percentage of polymorphonuclears (as well as the differential counts of neutrophils and eosinophils) were significantly reduced with electroacupuncture. Taken together, these results show that electroacupuncture diminishes bronchial immune-mediated inflammation induced in rats.</p> |
| <p>Zijlstra FJ et al. Anti-inflammatory actions of acupuncture. <i>Mediators Inflamm</i> 2003; 12(2):59-69.</p> | <p>An article that suggests a hypothesis for the anti-inflammatory action of acupuncture: Insertion of acupuncture needles initially stimulates production of beta-endorphins, calcitonin gene-related peptide (CGRP) and substance P, leading to further stimulation of cytokines and (nitric oxide) NO. While high levels of CGRP have been shown to be pro-inflammatory, CGRP in low concentrations exerts potent anti-inflammatory actions. Therefore, a frequently applied 'low-dose' treatment of acupuncture could provoke a sustained release of CGRP with anti-inflammatory activity, without stimulation of pro-inflammatory cells.</p> |
| <p>Jeong HJ et al. Regulatory effect of cytokine production in asthma patients by SOOJI CHIM (Koryo Hand Acupuncture Therapy). <i>Immunopharmacology and Immunotoxicology</i> 2002; 24(2): 265-4.</p> | <p>A study that investigated the regulatory effects of hand acupuncture on cytokine production in peripheral blood of patients with asthma. Plasma interferon-gamma and interleukin-2 levels derived from T helper 1 cells and interleukin-4 and -6 levels derived from T helper 2 cells were elevated with hand acupuncture. These results suggest that the effects of hand acupuncture as an asthma treatment may be due to the regulation of cytokine production.</p> |

Joos S et al. Immunomodulatory effects of acupuncture in the treatment of allergic asthma: a randomized controlled study. *J Altern Complement Med* 2000; 6(6): 519-25.

A randomised, controlled study that compared the immunological effects of Chinese acupuncture with sham acupuncture in 38 patients with allergic asthma. All patients were treated 12 times for 30 minutes over a time period of 4 weeks. Patients' general well-being and several peripheral blood parameters (eosinophils, lymphocyte subpopulations, cytokines, in vitro lymphocyte proliferation) were determined before and after treatment. In the Chinese acupuncture group, significantly more patients indicated an improvement in general well-being (79% vs. 47% in the control group, $p = 0.049$). The following changes were found in the Chinese acupuncture group: within the lymphocyte subpopulations the CD3+ cells ($p = 0.005$) and CD4+ cells ($p = 0.014$) increased significantly. There were also significant changes in cytokine concentrations: interleukin (IL)-6 ($p = 0.026$) and IL-10 ($p = 0.001$) decreased whereas IL-8 ($p = 0.050$) rose. Additionally, the in vitro lymphocyte proliferation rate increased significantly ($p = 0.035$), while the number of eosinophils decreased from 4.4% to 3.3% ($p > 0.05$). The control group, however, showed no significant changes apart from an increase in the CD4+ cells ($p = 0.012$). The researchers concluded that their results imply that asthma patients benefit from acupuncture treatment given in addition to conventional therapy, and that Chinese acupuncture showed significant immune-modulating effects.
