Acupuncture for Migraine: A Systematic Review

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ABSTRACT

Background: Migraine is a highly prevalent and often severely disabling disorder. Migraine patients often employ therapies such as acupuncture. To date a systematic review of acupuncture for migraine headache alone has not been published. Given that migraine has a pathophysiology that is distinct from other headaches, it is appropriate and timely that the studies of acupuncture for the treatment of migraine be systematically reviewed. Objectives: To determine whether acupuncture is more effective than no treatment for migraine, more effective than 'sham' or placebo acupuncture for migraine, or as effective as other interventions used to treat and prevent migraine. Selection criteria: Randomised controlled trials of needle acupuncture that breaks the skin for migraine headache. Data collection: The authors used a standardised collection form to abstract data independently. Information on acupuncture protocol, STRICTA criteria, methodological quality (Jadad, IVS) and treatment outcomes were collected. Results: Twenty-five studies with a total of 3004 patients (median = 62; range = 30–794) met the inclusion criteria. Three trials compared acupuncture to waiting list. Eleven trials compared acupuncture to sham acupuncture studies. The results were heterogeneous. Five studies found no significant effects over the sham procedure. Four studies reported a trend in favour of acupuncture. The remaining two small studies reported results in which the acupuncture group did significantly better than those in the sham group. Thirteen studies compared acupuncture to various pharmacotherapies and all found acupuncture to be at least as effective as drug treatment. Conclusion: The current evidence suggests that acupuncture is significantly superior to waiting list, at least as good as sham acupuncture, and of comparable efficiency to several proven drug therapies for the treatment and prevention of migraine.

KEYWORDS acupuncture, migraine, headache.

Introduction

Migraine is a highly prevalent and often severely disabling disorder. As many as 16% of men and 25% of women will experience migraine in their lifetime.[1] Olesen[2] suggests that the total sum of suffering from migraine is greater than for any other kind of headache. Migraine is defined as a moderate to severe recurrent headache lasting between four and 72 hours, usually unilateral and pulsatile in quality. It is often accompanied by nausea or vomiting and is aggravated by routine activities, light and noise.[2] According to Edmeads,[3] up to 48% of migraine sufferers have tried complementary therapies, while only 44% see a medical practitioner. Patients who access complementary therapies are more likely to use them in combination with mainstream treatment.[3] Despite the fact that migraine patients employ therapies such as acupuncture on a regular basis, until recently very little high quality clinical evidence existed to support or refute its efficacy.

A recent Cochrane review of acupuncture for idiopathic headache[4] (including migraine) concluded that, overall, the existing evidence supports the value of acupuncture treatment for this condition, but the quality of evidence is not fully convincing.[4] Since this review was undertaken in 2000, at least nine randomised controlled trials of acupuncture for

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the treatment of migraine headache have been published.[5-13] To date, a systematic review of acupuncture for migraine headache alone has not been published. Given that migraine has a pathophysiology that is distinct from other headaches,[2] it is appropriate and timely that the studies of acupuncture for the treatment of migraine be systematically reviewed.

OBJECTIVES

The objective of this review is to determine whether acupuncture is:

- more effective than no treatment for migraine;
- more effective than 'sham' or placebo acupuncture for migraine; or
- as effective as other interventions used to treat and prevent migraine.

Criteria for considering studies for this review

TYPES OF PARTICIPANTS

Trials which explicitly stated that they were conducted among patients with migraine headaches were considered for inclusion. Criteria such as those of the International Headache Society[14] or those of the Ad Hoc Committee[15] were used to define migraine, but included studies were not limited to these definitions. Studies of patients with tension-type headache, cluster headache, facial pain or imprecisely classified chronic or recurrent primary headache were excluded.

TYPES OF INTERVENTION

Only studies with needle insertion that breaks the skin at acupuncture points, pain points or trigger points were included. Studies which employed only non-invasive interventions, such as acupressure, laser or TENS, were excluded, as were studies in which a substance was injected into the needled point.

Control interventions considered were:

- no treatment,
- sham or placebo acupuncture, or
- other treatment.

TYPES OF OUTCOME MEASURES

Studies were included if they reported at least one clinical outcome related to headache (e.g. pain intensity, global assessment of headache). Trials reporting only physiological or laboratory parameters were excluded.

TYPES OF STUDIES

Only randomised, controlled clinical trials with parallel or cross-over design were considered for inclusion.

SEARCH STRATEGY FOR IDENTIFICATION OF STUDIES

The following sources were searched:

- MEDLINE, 1966 to March 2006;
- EMBASE, 1989 to March 2006;
- CISCOM;
- AMED;
- The database of the Cochrane Field for Complementary Medicine;
- The Cochrane Controlled Trials Register, 3rd quarter, 2005;
- Bibliographies of review articles and included studies;
- Bibliographies of textbooks on acupuncture, pain and headache;
- Attempts were made to contact authors via e-mail for unpublished data.

The search terms used for the electronic databases were '(acupuncture AND (headache OR migraine))'. Translators were accessed for all identified non-English language publications. However, publication bias is possible as no foreign language databases were searched. An update to this article is planned following review of any non-English language articles identified (languages to be searched include Chinese, French, Italian, German, Spanish, Swedish and Russian).

Methods of critical review of the literature

ELIGIBILITY

All references identified by the literature search were screened by the authors. The first step was to identify all articles on acupuncture treatment of migraine headaches that reported original data. Of the 162 studies so identified, 72 were excluded because they did not mention a valid control condition. The eligibility of the remaining 90 studies was then assessed in detail. Thirty-six were excluded because the subjects suffered from a headache other than migraine. A further 12 were eliminated because the intervention did not involve needle insertion that breaks the skin and 13 because they did not report a relevant clinical outcome. Four studies were excluded due to insufficient information regarding randomisation. A total of 25 studies met the inclusion criteria and were analysed. The characteristics of the included studies are summarised in Table 1 (pp. 8–11).

DATA EXTRACTION

Data were extracted independently by the authors using a standardised collection form. Information on patients, methods, interventions, outcomes and results was extracted using a standardised form similar to that of Melchart and colleagues.[4] Trials were categorised by headache type: migraine and migrainous disorders or mixed (patients with different

types of headache, including migraine), and by the type of control intervention used (no treatment, sham acupuncture, other treatment).

ASSESSMENT OF QUALITY

Quality was assessed by each author independently using both the Jadad Scale[16] and the Internal Validity Scale (IVS), which has been used in several systematic reviews of complementary medicine[4,17,18] to assess the methodological quality of included trials.

The Standards for Reporting Intervention in Controlled Trials of Acupuncture (STRICTA)[19] checklist was used by the authors to ascertain the type and quality of acupuncture treatment for each of the studies. The quality of acupuncture was assessed by the authors who have each undertaken a minimum of five years of full-time undergraduate and postgraduate training in acupuncture and have been in clinical practice for a minimum of seven years. Disagreements between reviewers regarding inclusion/exclusion, methodological quality or quality of acupuncture treatment were resolved by discussion.

Descriptions of included studies according to STRICTA criteria are summarised together with Jadad and IVS scores in Table 1.

However, STRICTA does not offer a scale to make a critical evaluation of studies. Therefore the scale used by Melchart and colleagues[4] was adopted with adaptations. The current authors decided independently, based on their clinical experience and review of the acupuncture literature, whether they would treat the patients in a given study 'exactly or almost exactly the same way', 'similarly', 'differently', 'completely differently', or 'could not assess' due to insufficient information (based on STRICTA criteria). Individualised treatment was considered most reflective of clinical acupuncture practice, followed by formula acupuncture, trigger points, etc.

The authors then rated the degree of confidence that acupuncture was applied in an appropriate manner, with 0% = complete absence of evidence that the acupuncture was appropriate and 100% = total certainty that the acupuncture was appropriate.[4] These ratings are included along with Jadad and IVS scores in Table 1.

SUMMARISING THE RESULTS

The pre-defined main outcome measure for quantitative analysis was the number of days with headache per month in the last follow-up period. Other pre-planned outcomes included intensity of pain, duration and frequency of headache attacks and medication use. However, when the data were extracted the type and timing of outcome measures were so inconsistent and the presentation of results so often insufficient that it was not possible to calculate effective size estimates for the majority of the trials. No power analysis was carried out.

Data on global response to treatment or frequency of headache was extracted. Response was defined as at least 33% improvement from baseline. The relative risk was then calculated with 95% confidence intervals by the proportion of responders in the acupuncture group and proportion of responders in the control group, using the Toronto University EBM Stats Calculator.[20]

Methodological Assessment

Twenty-five studies with a total of 3004 patients (median = 60; range = 30–794) met the inclusion criteria.[5-13,21-36] The majority of the trials had methodological and/or reporting shortcomings. Allocation concealment was described in only seven trials.[6,7,9,11-13,22] The mean Jadad Score was 2.3 (range = 1–5) from a possible maximum score of 5, and the mean Internal Validity Score was 3 (range = 0.5–6) from a possible maximum score of 6.

Overall the reporting of the complex headache data was poor but has improved significantly since the systematic review of acupuncture for idiopathic headache by Melchart and colleagues.[4] The authors were unable to assess the quality of acupuncture in four trials due to insufficient information.[11,22-24] Relevant details according to the STRICTA criteria were lacking for most studies (see Table 1). In seven trials the authors would have treated in a different or completely different manner, in thirteen trials similarly, and in one trial in exactly the same way.[5,9,21,31,33,35,36] The degree of confidence that acupuncture was applied appropriately ranged from 10% to 95% (see Table 1).

The acupuncture interventions used varied considerably. In seven studies the rationale behind the choice of points was explicitly stated to be Traditional Chinese Medicine.[7,8,10,12,25-27] Diener,[12] Linde[8,9] and Wylie[27] stated the source for their point selection strategy. Ten trials provided some information on the qualification and experience of trial acupuncturists.[5-7,9,11-13,29,30,33] Deqi was reported in ten studies.[5,6,8,9,12,13,22,29,30,34]

The median treatment period was eight weeks (range = 2 hours – 24 weeks) with eight treatment sessions (range = 1–16). Nineteen studies followed up after at least six months.[5,7-13,21-26,29-31,34,35] The median follow-up time was 42 weeks (range = 4–104).

The most commonly reported outcomes were headache frequency and pain intensity, but in many studies results were reported in insufficient detail. Medication use, quality of life, days off work and cost effectiveness were reported in a minority of trials. Nineteen trials used headache diaries for outcome assessment.[5,7-9,11-13,22-24,26-33,36]

TABLE 1 Acupuncture reporting and quality (STRICTA/JADAD/IVS)

Author	Acupuncture rationale	Needling details	Treatment regime
Agró et al.[10]	Formula acupuncture or acupuncture based on TCM principles of syndrome differentiation	Formula: ST8, GB5, GB20, GV14, LU7; or points according to TCM differentiation of syndromes	6 months treatment; 3 sessions; 15 days interruption; no information on number or duration of treatments
Alecrim-Andrande et al.[13]	Semi-standardised acupuncture vs sham acupuncture	Local points: GB12, GB20, GB21, BL10; plus points selected according to location of pain: BL60, SI3: BL22, ST36, GV23, LI4, TE5, GB34, GB8: SI3, GV20, LR3: PC6; Deqi achieved	Treatments twice weekly for 4 weeks then weekly for 8 weeks
Allais et al.[5]	Formula acupuncture. No sources given for treatment protocol	16 0.3 x 52 mm needles inserted bilaterally to a depth of 10–30 mm at SP6, ST36, CV12, LI4, PC6, GB20, GB14, Ex-HN5, GV20 and manipulated with the even method to achieve Deqi	Total of 12 treatment sessions: 1 weekly for 2 months then 1 monthly for 4 months
Baust et al.[28]	Formula acupuncture applied according to location of pain	If pain mainly frontal, GB14, Ex-HN3, LI4; temporal, Ex-HN9, GB20, TE5; occipital, GV15, BL10, BL60; no information on needling or Deqi	Total of 6 treatments at two day intervals
Ceccherelli et al.[32]	Formula acupuncture	Points used: BL2, BL10, BL60, GB3, GB20, GV11, GV20, LR3, CV13, Ex-HN1, ST8; no information on Deqi	Total of 10 weekly treatment sessions
Diener et al.[12]	Semi-standardised point selection based on differentiation of syndromes according to TCM based on Chinese and German texts	10–25 needles, 0.25–0.30 mm x 25–40 mm inserted 2–20 mm; Deqi achieved	1–2 treatments weekly; 10–15 treatments; 30 min duration
Doerr-Proske et al.[33]	Formula acupuncture at local points only; no sources given for protocol	Ex-HN2, GB2, TE5; no information on Deqi	Total of 10 treatment sessions, probably 1 per week
Dowson et al.[22]	Individualised acupuncture according to location of pain; no rationale or sources given	Point selection according to location of pain; Deqi achieved; no information on points, needles or technique	Total of 6 sessions, 1 per week
Gao et al.[25]	Acupuncture based on differentiation of syndromes according to Traditional Chinese Medicine	Filiform needles 0.25–0.30 x 50 mm. Evil-wind: BL60, SI7, GV20, GB20. Liver: LR3, GB43, GV20. Taiyang Kidney: KI3, BL23, ST36. Taiyang Stagntn: GB34, SP10. Ex-HN5, GV20, GB8; no information on Deqi	4–5 sessions per week; 10 treatments per course; 1–3 courses
Henry et al.[21]	Formula-based electroacupuncture; no source given for treatment protocol	Needling with electrostimulation at LI4, ST36, BL2, BL10, LR3, BL60; no information on Deqi	8 sessions of 30 min each; 6 x 1 per week; 2 x 1 per month
Hesse et al.[31]	Trigger-point acupuncture points chosen according to muscle groups and tenderness according to principles of trigger-point therapy	Needling at most tender trigger points plus placebo tablet; needling for few seconds only; no information on Deqi or on exact points or depth of needling	Individualised
Heydenreich et al.[35]	Individualised needle acupuncture or TENS to acupuncture points	Individually selected points from LR3, KI6, SP6, ST36 or 44, BL60 or 62, LU7, PC6, TE5, LI4, SI3 and local tender points; no information on needling or Deqi	12–16 sessions; 1 per week

Co-intervention	Practitioner background	Control interventions	Quality
No information	No information	Formula acupuncture vs acupuncture according to TCM differentiation of syndromes vs various pharmacotherapy	Jadad: 1-0-0-0-0 IVS: 1-0-1-0-0-0 Acu: similarly 70%
Rescue medications only; patients on prophylactic drugs were excluded	'Medical acupuncture specialist'	Minimal acupuncture with no manipulation to the following points bilaterally: Ex-B1, TE17, TE20, SP7, ST37, LU5	Jadad: 1-1-1-1-1 IVS: 1-1-1-1-1-1 Acu: similarly 50%
No limitation was placed on concurrent use of medications but these were recorded and used as an outcome measure	'3 experienced and qualified acupuncturists.' No information on duration of training or clinical experience	Control group received flunarizine, a well-documented drug for migraine prophylaxis; no attempt at blinding	Jadad: 1-1-0-0-1 IVS: 1-0-1-0-1-1 Acu: differently 50%
No information	No information	Sham points 2–3 cm distant from true points. No attempt at blinding; patients probably not completely informed that they might receive sham	Jadad: 1-0-1-1-0 IVS: 1-0-0-1-1-0 Acu: similarly 75%
No information	No information	Complex procedure without real needling suggesting anaesthesia to the patient; no source to validate sham intervention; patients blind	Jadad: 1-0-0-0-0 IVS: 1-0-0.5-1-0-1 Acu: similarly 70%
Acute medications recorded and allowed in all groups	>140 hours of acupuncture training; >2 years clinical experience (median = 8.5 years)	Sham acupuncture at non-acupoints on arm, back and thigh; 3 mm insertion; no stimulation	Jadad: 1-1-1-1-1 IVS: 1-1-1-1-1-1 Acu: similarly 75%
No limitation on concurrent use of medications, but these were recorded as an outcome measure	Anaesthetist trained in acupuncture; no information on duration of training or experience	Waiting list and bio-behavioral treatment program; no attempt at blinding	Jadad: 1-0-0-0-0 IVS: 1-0-0-0-0-0 Acu: completely differently 20%
No information	No information	Mock TENS; patients blinded, but likely ineffectively	Jadad: 1-1-0-0-0 IVS: 1-0.5-0.5-0.5- 0.5-0.5 Acu: insufficient data
Control group received ergotamine for acute attacks but other co-interventions not reported	No information	A traditional Chinese herbal preparation (*Zheng tian wan*), 1 bd plus ergotamine for acute attacks; no attempt at blinding	Jadad: 1-0-0-0-0 IVS: 1-0-0-0-0-0 Acu: similarly 85%
Medications recorded and used as outcome measure, but diary not employed	No information	Dry needling 1 cm away from points used in acupuncture group; patient and evaluator blind	Jadad: 1-0-1-1-0 IVS: 1-0-1-1-1-0 Acu: completely differently 40%
Medications and other co-interventions not mentioned	No information	Metroprolol and placebo stimulation (touch with blunt end of the needle); patients and evaluators blind; unusual acupuncture technique as sham distinguishable	Jadad: 1-0-1-0-1 IVS: 1-0-1-0.5-1-0.5 Acu: completely differently 50%
Medications recorded and used as outcome measure but method of measurement unclear (?diary)	No information	TENS or medication (iprazochrom and dihydroergotocin mesylate); no attempt at blinding	Jadad: 1-0-0-0-0 IVS: 1-0-1-0-0-0 Acu: differently 70%

TABLE 1 Continued

Author	Acupuncture rationale	Needling details	Treatment regime
Kubiena et al.[23]	Individualised acupuncture applied according to the Vienna school	4–5 local and 4–5 distal points; Vienna school points not given; no information on technique or Deqi	10–15 sessions; 1 per week
Lehmann et al.[24]	Needle acupuncture or electroacupuncture; no information on points, protocol or source	No information on points, needling or Deqi	12 sessions; 1 per week
Linde et al.[8]	Formula acupuncture based on earlier studies, manuals and personal advice from the University of TCM, Shanghai	15 x 0.25 mm or 30 x 0.30 mm needles inserted 10–30 mm at: GB8, GB20, LI4, LR3, SP6 and GB14 or Ex-HN5 or BL10; Deqi achieved	Needling on 8th, 5th and 3rd day before menstruation for 3 months; 9 sessions total
Linde et al.[9]	Semi-standardised formula acupuncture	Basic points GB20, 40, or 41 or 42, GV20, LR3, TE3 or 5 bilaterally, plus additional individual points; Deqi achieved	12 x 30 min sessions over 8 weeks
Loh et al.[36]	Brief acupuncture with strong stimulation; no information on rationale or source	Brief, strong needling at local points in neck and temporal region, e.g. GB20, GB21; distal points usually LI4 and LR3; 6 needles minimum	No information
Melchart et al.[6]	Individualised acupuncture; no information on rationale or source	0.3 x 4.0 mm or 0.25 x 2.5 mm needles inserted bilaterally, mainly at GB14, GB15, GB10, GB8, GB21, GB41, LI4, LR3, TE5, CV20, Ex-HN5, according to individual symptoms; Deqi achieved.	At the onset of an acute attack, 1–2 treatments within 2 hours
Melchart et al.[7]	Individualised acupuncture according to the principles of TCM	Example of individual treatment given for up stirring of wind heat with phlegm-damp and blood stasis: GB20, GB14, Ex-HN5, LI4, LI20, GV20, LR3	12 treatments over 4 weeks as TCM hospital inpatient
Vickers et al.[11]	Individualised acupuncture; no specification of type, rationale or source	No information	6–11 weekly sessions
Vincent[26]	Individualised acupuncture points selected on the basis of tenderness according to TCM text	8 points (4 bilateral) inserted 1–2 cm, chosen from LR3, GB20, GB21, BL10, BL11, TE15, SI14, SI15, Ex-HN5; no information on Deqi	6 sessions of 15 min; 1 per week
Weinschutz et al.[29]	Individualised acupuncture points chosen according to pain localisation and modalities	Up to 10 points chosen according to pain localisation and modalities with stimulation to achieve Deqi; no information on needling technique	8 sessions of 15 min; 1 per week
Weinschutz et al.[30]	Individualised acupuncture points chosen according to pain localisation and modalities	Up to 10 points chosen according to pain localisation and modalities with stimulation to achieve Deqi; no information on needling technique	8 sessions of 15 min; 1 per week
Wylie et al.[27]	Individualised acupuncture applied according to TCM	Points selected from CV20, GB20, SP6, BL2, ST36, ST40, GB41, KI3, GB14, LI4, TE5, PC6, Ex-HN5, Ex-HN3, Ah-shi; no information on needling or Deqi	6 sessions with unclear frequency

Co-intervention	Practitioner background	Control interventions	Quality
Medications recorded and used as outcome measure but data uninterruptible due to loss to follow-up	No information	Sham acupuncture at points 1.5–2 cm away from acu points; patients blind	Jadad: 1-1-1-0-0 IVS: 1-0-0-1-0.5-0 Acu: insufficient data
Medications recorded in diary and used as outcome measure	No information	Propanolol 75–150 mg/d; no attempt at blinding	Jadad: 1-0-0-0-0 IVS: 1-0-0-0-0-0 Acu: insufficient data
Medications recorded in diary and used as outcome measure	Experienced physiotherapist; no information on acupuncture training or experience	Varied pharmacotherapy; no attempt at blinding	Jadad: 1-0-1-1-1 IVS: 1-0-1-1-0.5 Acu: similarly 90%
Medications recorded in diary and used as outcome measure	Physicians trained (>140 hours) and experienced (c. 10 years) in acupuncture	At least 10 minimally inserted needles at non-acupoints; no stimulation; waiting list	Jadad: 1-1-1-1-1 IVS: 1-1-1-1-1-1 Acu: differently 75%
No prophylactic medication allowed; medications recorded in diary. Included as part of a global outcome measure	No information	Individualised medications usually propranolol; no attempt at blinding	Jadad: 1-0-0-0-0 IVS: 1-0-0-0-0-0.5 Acu: completely differently 25%
No other interventions allowed	Experienced Chinese acupuncturist trained at Beijing University of TCM	Sumatriptan or placebo injection; patients blind to injection content but not to acupuncture	Jadad: 1-1-0-0-1 IVS: 1-1-1-0-0-1 Acu: similarly 80%
Individualised Chinese herbal preparations	'Specifically trained and highly experienced Chinese physicians'	Waiting list	Jadad: 1-1-0-0-1 IVS: 1-1-1-0-0-1 Acu: exactly the same 95%
All treatments for headache recorded in diary and used in outcome measure	Physiotherapists with 250 hours of acupuncture training and median 12 years experience	Standard GP care; no attempt at blinding	Jadad: 1-1-0-0-1 IVS: 1-1-1-0-0-1 Acu: insufficient data
Medications recorded in diary and used as outcome measure	No information	Superficial needling 2–3 cm from classical points; patients blind	Jadad: 1-0-1-0-0 IVS: 1-0-1-1-0-0 Acu: similarly 60%
Not reported	1 experienced and qualified acupuncturist	Sham acupuncture; superficial needling 2–3 cm from true points; patients blind	Jadad: 1-0-0-0-0 IVS: 1-0-0.5-0.5-0-0 Acu: similarly 75%
Not reported	1 experienced and qualified acupuncturist	Sham acupuncture; superficial needling 2–3 cm from true points; patients blind	Jadad: 1-0-0-0-0 IVS: 1-0-0.5-0.5-0-0 Acu: similarly 75%
Acupuncture group received lifestyle counselling; other co-interventions not recorded	No information	Massage and relaxation	Jadad: 1-0-0-0-0 IVS: 1-0-0-0-0-0 Acu: similarly 80%

Results

Relative risk calculations for high quality studies where dichotomous responder rates were reported are presented in Table 2. These calculations must be interpreted with caution due to the differing outcome measures of various studies.

ACUPUNCTURE VS SHAM CONTROLLED TRIALS

Eleven trials (N = 1324) compared acupuncture to sham acupuncture among patients with migraine.[8,9,12,13,21,23,26,28-30,32] Two compared acupuncture to other sham procedures.[6,22] Melchart[6] compared acupuncture to placebo injection while Dowson[22] compared acupuncture to mock TENS. Two studies comparing acupuncture to sham were not analysed due to poor methodological quality or reporting flaws.[29,30] The study by Melchart[6] is analysed separately below because the outcomes relate solely to relief of acute migraine attacks.

Five studies[8,9,13,22,28] found no significant effects over the sham procedure (RR 0.973 95%CI [0.74–1.17]). Three studies[12,21,23] reported a trend in favour of acupuncture (RR 1.18 95%CI [0.93–1.50]). The remaining two small studies[26,32] reported results in which the acupuncture group did significantly better than those in the sham group (RR 1.82 95%CI [1.1–3.1].

Diener[12] conducted the largest study to date (n = 794), which compared true acupuncture, sham acupuncture and standard migraine prophylaxis. It was methodologically rigorous but suffered from a large dropout rate. The strengths of the study were its large sample size, comparison to sham and established pharmacotherapy, valid outcome measures and an acupuncture protocol similar to clinical practice. All three arms improved significantly over baseline and there was no consistent difference in outcomes between groups. However, an explorative analysis favours true acupuncture over sham acupuncture, particularly for mean reduction in headache days (true = 2.3 days 95%CI [1.9–2.7]; sham = 1.5 days 95%CI [1.1–2.0]).

TRIALS COMPARING ACUPUNCTURE TO WAITING LIST

Three trials (N = 434) compared acupuncture to waiting list.[7,9,33] The data from the study by Doerr-Proske[33] was not analysed due to poor methodological quality.

Melchart[7] was the only study of inpatient management of migraine with acupuncture and co-interventions including Chinese herbal medicine and Qigong. Patients were randomised to four weeks of inpatient treatment in a German Traditional Chinese Medicine hospital or waiting list. Patients receiving acupuncture had significantly better outcomes compared to controls (>50% decrease in headache days RR 3.35[1.61–6.99]).

The study by Linde[9] is large and methodologically rigorous. It compared formula acupuncture, sham acupuncture and waiting list. Both formula acupuncture and sham acupuncture were significantly superior to waiting list (RR 3.53 95%CI [2.00–6.23]), but formula acupuncture was not superior to sham.

The combined results of the 404 patients in both of the well-designed trials[7,9] strongly suggest that acupuncture is significantly superior to waiting list (RR 3.17 95%CI [2.00–5.00]).

TRIALS COMPARING ACUPUNCTURE WITH ANOTHER TREATMENT

Thirteen trials (N = 2243) comparing acupuncture to another treatment were analysed.[5,6,10-12,24,25,27,31,33-36] Two studies compared acupuncture to other non-pharmacological therapies but due to poor methodological quality and inadequate reporting, no meaningful data could be extracted.[27,33] In studies comparing acupuncture to pharmacotherapy, all showed results for the acupuncture group that were as good as or better than the pharmacotherapy group.[5,6,10-12,24,25,31,34-36] Five studies were of high methodological quality, had larger sample sizes and were more clearly reported.[5,6,11,12,31] The remaining six studies were of low methodological quality and suffered significant reporting deficits, which prevented extraction of meaningful data.[10,24,25,34-36]

Hesse[31] compared trigger-point acupuncture and a placebo tablet with metoprolol and sham acupuncture. The strength of this study was that it attempted to blind both patients and evaluators, but it is likely that the sham intervention (touching with the blunt end of the needle) was discernable from true needling. The authors claimed that intervention and control were equally effective. However, metoprolol also had more side effects. Both groups showed significant improvements in migraine frequency and intensity but responder rates were not recorded and as such the data cannot be pooled with the other studies.

Allais[5] compared acupuncture with the calcium channel blocker flunarizine for women with migraine headache. Flunarizine has been unequivocally demonstrated to be effective and well tolerated in almost 20 placebo controlled trials. Allais[5] found that both acupuncture and flunarizine were effective in migraine prophylaxis (RR 1.31 95%CI [0.52–3.25]). Acupuncture was more effective in the first four months and more effective in reducing intensity and analgesic use with fewer side effects.

Vickers[11] randomised 401 patients to either 'use acupuncture' or 'avoid acupuncture' in addition to 'standard' therapy. Their findings suggested that a policy of 'use acupuncture' in addition to 'standard' therapy resulted in a significant and cost-effective reduction in migraine frequency and intensity compared to 'standard' therapy and a policy of 'avoid acupuncture' (RR 2.03

TABLE 2 Results: Acupuncture for Migraine Prophylaxis[a]

Study	Acu[b] (n_R/n_P)	Control (n_R/n_P)	Relative risk (95% CI)	Weight (%)	Relative risk (95% CI)
Acupuncture vs sham procedure			0.1 Favours control 1 Favours acupuncture 10		
Baust et al.[28]	14/23	14/21		4.1%	0.91[0.58–1.43]
Alecrim-Andrande et al.[13]	6/12	3/12		2.2%	2.00[0.65–6.20]
Diener et al.[12]	87/290	84/317		55.9%	1.13[0.88–1.46]
Dowson et al.[22]	11/25	13/23		4.6%	0.78[0.44–1.38]
Henry et al.[21]	11/20	3/10		2.7%	1.83[0.66–5.12]
Kubiena et al.[23]	3/7	4/11		1.6%	1.18[0.37–3.76]
Linde et al.[8]	2/13	2/13		2.6%	0.77[0.15–3.91]
Linde et al.[9]	66/145	42/81		21.0%	0.88[0.67–1.16]
Vincent[26]	7/15	6/15		2.7%	1.17[0.51–2.66]
All acupuncture vs sham procedure trials	220/565	177/520		100%	1.14[0.98–1.34]
Acupuncture vs waiting list					
Melchart et al.[7]	24/46	7/45		29.2%	3.35[1.61–6.99]
Linde et al.[9]	66/145	11/76		70.8%	3.53[2.00–6.23]
All acupuncture vs waiting list	90/191	18/121		100%	3.17[2.00–5.00]
Acupuncture vs pharmacotherapy					
Allais et al.[5]	10/77	7/73		18.0%	1.31[0.52–3.25]
Diener et al.[12] (True acupuncture arm)	87/257	45/128		46.0%	0.96[0.72–1.29]
Diener et al.[12] (Sham acupuncture arm)	84/275	45/128		N/A	0.87[0.65–1.17]
Vickers et al.[11]	49/161	21/140		36.0%	2.03[1.28–3.21]
All acupuncture vs pharmacotherapy trials	146/495	73/341		100%	1.38[1.08–1.76]

[a] High quality trials only (Jadad or IVS ≥3); n_R/n_P = number of responders/number of participants. [b] Acu = acupuncture

95%CI [1.28–3.21]). The pragmatic trial design does not test the effects of a therapy but those of a policy. Consequently, the claims based on this study cannot be made regarding acupuncture itself, but only the policy of recommending it to migraine sufferers.

A unique study by Melchart[6] compared acupuncture, sumatriptan and placebo to treat acute migraine headache. The acupuncture and sumatriptan groups showed similar response rates (21/60 vs 21/58; RR 0.97 95%CI [0.59–1.58]) and were significantly better than placebo in aborting acute migraine attacks (primary outcome) (RR 1.94 95%CI [1.03–3.67]). However, a second dose of sumatriptan was significantly better than a second application of acupuncture at interrupting an established attack after failure of the initial treatment (4/31 vs 11/31) (Table 3).

Diener,[12] as discussed above, compared both true acupuncture and sham acupuncture to standard migraine prophylaxis with beta-blockers, calcium channel blockers or anti-epileptics. All three arms improved significantly over baseline and there was no consistent difference in outcomes between groups (acupuncture vs pharmacotherapy RR 0.96 95%CI [0.72–1.29]; sham vs pharmacotherapy RR 0.87 95%CI [0.65–1.17]).

Discussion

The current evidence suggests that acupuncture is significantly superior to waiting list, at least as good as sham acupuncture and of comparable efficacy to several proven drug therapies for the treatment and prevention of migraine. It is interesting to note the positive results for sham acupuncture in two of the largest trials indicating that sham acupuncture is likely to be an active placebo.

This systematic review builds on the results of the previous review by Melchart,[4] which supported the value of acupuncture in the treatment of idiopathic headache but found the quality

and amount of evidence lacking. The methodological quality of acupuncture research has improved substantially, largely as a result of the work by Melchart,[4] who has led many of the recent large-scale trials.

The size of trials has increased dramatically over the past five years. In the Cochrane review,[4] only two migraine studies[34,35] had more than 100 participants, whereas seven[5-7,9-12] of the eight[5-12] most recent studies have over 100 patients and three have over 300 patients.[9,11,12] This is particularly important because it provides the statistical power needed to draw firmer conclusions.

Three studies[9,11,12] since 2000 stand out for their methodological quality and large sample size. Their results are substantially homogeneous with respect to the efficacy of true acupuncture compared to pharmacotherapy, but differ in their findings with regards to the relative activity of sham acupuncture. Bearing in mind that the conventional pharmaceuticals used for the treatment of migraine have shown unequivocal superiority to inert placebos in hundreds of randomised controlled trials, it seems reasonable to hypothesise that sham acupuncture that breaks the skin is not therapeutically inert.

The fact that sham acupuncture is likely to be an active placebo is particularly relevant when analysing the results of the study by Linde,[9] which found no significant difference between true acupuncture and sham. It is likely that sham acupuncture activates endogenous antinociceptive mechanisms.

Non-specific needling effects may also account for the results of a recent small study by Alecrim-Andrande[13] who found true acupuncture equivalent to a sham procedure. These effects are likely to be compounded by the fact that real acupoints were needled in the so-called sham group. Alecrim-Andrande[13] clearly states that the points chosen as sham are not specifically indicated for headache in the Traditional Chinese Medicine literature. However, the use of points on the head and neck is likely to activate segmental antinociceptive mechanisms.[38]

Sham acupuncture often involves insertion of needles into non-acupoints. This methodology allows the examination of specific point related effects but adds the confounding factor of non-specific needling effects. In fact, the minimally inserted needle technique used in many studies as sham acupuncture is very similar to true acupuncture as practised by members of the Japanese Meridian Therapy, Keiraku Chiryo and Toyohari schools.[39] Furthermore, finding a neutral point is problematic because all points on the body are considered to be connected to the meridian system from the surface of the skin (cutaneous regions) through to the deep pathways of the primary and divergent channels.[40] This is also true from a neurobiological perspective, as any needle that breaks the skin causes a neurochemical response, which may lead to long-term changes in nociceptive processing.[38]

Placebo acupuncture with non-inserted needles has also been used and has the advantage of resembling real acupuncture and eliminating non-specific effects of needling in the control group. However, with placebo acupuncture it is difficult to maintain blinding in long-term studies and may only be effective for acupuncture-naive patients.

Alternatively, acupuncture can be compared to standard medical care. This has the advantage of allowing comparisons of effects and adverse events. However, it is often impossible to achieve adequate blinding and increases the risk of type II error. Ten trials have compared acupuncture to various types of pharmacotherapy and have all shown the results of acupuncture to be as good as or better than the control treatment.[5,6,10-12,24,25,31] In particular, the pragmatic trial by Vickers[11] comparing acupuncture with standard care indicates that acupuncture is beneficial and cost-effective under real-life conditions.

According to Vickers[11] standard care plus acupuncture resulted in persisting, clinically relevant benefits for migraine sufferers compared with controls treated with standard pharmacotherapy. However, because the study had no placebo control it is possible that the benefits in the acupuncture group were part

TABLE 3 Results: Acupuncture for Acute Migraine[a]

Study	Acupunct. (n_R/n_P)	Control (n_R/n_P)	Relative risk (95% CI)	Weight (%)	Relative risk (95% CI)
			0.1 Favours control 1 Favours acupuncture 10		
Acupuncture vs sham procedure (Melchart et al.[6])	21/60	11/61			1.94[1.03–3.67]
Acupuncture vs pharmacotherapy (Melchart et al.[6])	21/60	21/58			0.97[0.59–1.58]

[a] High quality trials only (Jadad or IVS ≥3); n_R/n_P = number of responders/number of participants.

of a placebo effect. Nonetheless, Vickers[11] states that the overall cost of managing migraine headache is reduced by the addition of acupuncture. As such, he called for the inclusion of acupuncture in addition to standard pharmacological treatment for migraine within the National Health Service in the United Kingdom.

IMPLICATIONS FOR RESEARCH

It seems likely that acupuncture has a place in the treatment of migraine, but several questions remain unanswered. The variety of acupuncture techniques examined in the literature and used in clinical practice makes it difficult to recommend specific acupuncture treatment strategies. Indeed, the work of Linde[9] calls into question the importance of point selection, location and needling technique in the treatment of migraine. Studies comparing true acupuncture, sham acupuncture and placebo needling would help to clarify the relative contribution of non-specific needling effects and placebo to the positive results of acupuncture for migraine.

It would also be informative to study the effects of true acupuncture and placebo pill against placebo needling and placebo pill, against a third arm of standard pharmacotherapy and placebo needling. This would help to clarify the relative contribution of placebo effects to the positive results of acupuncture.

Finally, it must be asked how much more evidence is necessary before acupuncture can be recommended to migraine sufferers. Diener[12] states that the efficacy of the treatment may be more important than unequivocal knowledge of its mechanism of action. The majority of pharmacotherapies used for migraine are clearly effective but have unclear mechanisms. Perhaps research efforts directed at maximising the therapeutic effects of acupuncture alone or in combination with drug treatment would be a more productive use of research funding.

IMPLICATIONS FOR CLINICAL PRACTICE

Advising migraine patients to use acupuncture is likely to reduce frequency of migraine headache, both in combination with or independent of medication. These benefits are associated with minimal side effects,[42,43] but the mechanism of action is unclear. The optimal acupuncture protocol has not been established by clinical trials. However, both shallow and deep needling techniques at a variety of points have been shown to significantly improve clinical outcomes.

Conclusion

The current evidence suggests that acupuncture is significantly superior to waiting list, at least as good as sham acupuncture and of comparable efficacy to several proven drug therapies for the treatment and prevention of migraine. Recent high quality evidence suggests that the addition of acupuncture to standard care is cost effective and improves outcomes in migraine headache. It is still unclear as to whether this is due to the specific effects of needling at acupuncture points or to the non-specific effects of needling and a potent placebo effect. Large scale, randomised, controlled trials comparing acupuncture with proven pharmacotherapies are warranted to assess the place of acupuncture in the management of migraine headache. The recent study by Vickers[11] indicates that it can be beneficially combined with standard therapy to improve outcomes. However, the variety of acupuncture techniques examined in the literature and used in clinical practice makes it difficult to recommend specific acupuncture treatment strategies.

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