

# Acupuncture: Does it alleviate pain and are there serious risks? A review of reviews

E. Ernst<sup>a,\*</sup>, Myeong Soo Lee<sup>a,b</sup>, Tae-Young Choi<sup>b</sup>

<sup>a</sup> Complementary Medicine, Peninsula Medical School, Universities of Exeter & Plymouth, Exeter, UK

<sup>b</sup> Division of Standard Research, Korea Institute of Oriental Medicine, Daejeon, South Korea

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

## ARTICLE INFO

### Article history:

Received 17 March 2010

Received in revised form 1 November 2010

Accepted 3 November 2010

### Keywords:

Acupuncture

Risk

Benefit

Systematic review

Alternative medicine

## ABSTRACT

Acupuncture is commonly used for pain control, but doubts about its effectiveness and safety remain. This review was aimed at critically evaluating systematic reviews of acupuncture as a treatment of pain and at summarizing reports of serious adverse effects published since 2000. Literature searches were carried out in 11 databases without language restrictions. Systematic reviews were considered for the evaluation of effectiveness and case series or case reports for summarizing adverse events. Data were extracted according to predefined criteria. Fifty-seven systematic reviews met the inclusion criteria. Four were of excellent methodological quality. Numerous contradictions and caveats emerged. Unanimously positive conclusions from more than one high-quality systematic review existed only for neck pain. Ninety-five cases of severe adverse effects including 5 fatalities were included. Pneumothorax and infections were the most frequently reported adverse effects. In conclusion, numerous systematic reviews have generated little truly convincing evidence that acupuncture is effective in reducing pain. Serious adverse effects continue to be reported.

© 2010 International Association for the Study of Pain. Published by Elsevier B.V. All rights reserved.

## 1. Introduction

Acupuncture is frequently used for pain patients, and theories about its mode of action have been developed [35,164]. Hundreds of clinical trials testing its clinical effectiveness for pain-related syndromes are available. However, the results of trials and systematic reviews are far from uniform. Uncertainty also surrounds acupuncture's safety.

This overview is aimed at critically evaluating all systematic reviews of acupuncture as a treatment of pain and at summarizing reports of serious adverse effects published between 2000 and 2009.

## 2. Methods

### 2.1. Effectiveness

Literature searches were carried out (January 2010) in Medline, Embase, AMED, CINAHL, the Cochrane Library, and 6 Korean and Chinese databases without language restrictions, using terms for acupuncture and pain combined with "systematic review" or "meta-analysis." Departmental files and bibliographies were hand searched. Reviews were defined as systematic if they included an

explicit Methods section describing the search strategy and inclusion/exclusion criteria. Systematic reviews had to focus on the effectiveness of any type of acupuncture for pain. Systematic reviews of complex packages of interventions were excluded. Data were extracted and evaluated [107] independently by 2 authors (EE and MSL) using predefined criteria (Table 1). For the Chinese literature, one author (TYC) did the data extraction.

### 2.2. Serious adverse effects

Embase, Medline, CINAHL, AMED, and the Cochrane Library were searched (October 2009) without language restrictions. Departmental files and bibliographies were hand searched. We included all case reports and case series relating to serious adverse effects, that is, an unwanted clinical outcome that needed medical/surgical attention or led to death. Reports of adverse effects due to injecting drugs into acupuncture points were excluded.

## 3. Results

### 3.1. Effectiveness

Our searches generated 266 hits. Fifty-seven systematic reviews met our inclusions criteria. Key data are summarized in Table 1 [7,16,19,21,25,27,29–34,36–39,42,46,64,65,71–73,75,76,80–84,88–94,110,119,121,125,129,130,133–135,139,145,146,148,157–159,

\* Corresponding author. Address: Complementary Medicine, Peninsula Medical School, Universities of Exeter & Plymouth, 25 Victoria Park Road, Exeter EX2 4NT, UK. Tel.: +44 139 242 4989; fax: +44 139 242 7562.

E-mail address: edzard.ernst@pms.ac.uk (E. Ernst).

**Table 1**  
Systematic reviews (SR) of acupuncture for pain.

First author Year [Ref]	Treatment	Type of pain	No. primary studies	Quality of primary studies	Conclusion (quote)	Quality of SR	Result +/-
Gong [36]China	A	Ankylosing spondylitis	7	Poor	Acupuncture treatment is effective for ankylosing spondylitis	Poor	+
Madsen [89]Denmark	A	Any pain	13 (3 armed trials)	Good	A small analgesic effect of acupuncture was found which seems to lack clinical relevance...	Excellent	+/-
Lee [73]UK	A	Cancer pain	7 (3 RCTs and 4 CCTs)	Mostly poor	The notion that acupuncture is effective ... is not supported by ... rigorous clinical trials	Good	-
Yang [157]China	EA	Cervical spondylosis	5	Mostly poor	Electro-acupuncture is effective for improving the symptoms of cervical spondylosis	Poor	+
Sun [129]USA	A/EA	Chronic headache	25	Variable	Needle acupuncture is superior to sham acupuncture	Good	+
Ezzo, 2000 [29]USA	A	Chronic pain	51	Mostly poor	... inconclusive evidence that acupuncture is more effective than placebo, sham acupuncture or standard care	Good	-
Cho [16]Korea	AP	Dysmenorrhoea	4	Variable	The available data ... suggest that acupressure alleviates menstrual pain.	Good	+
Yang [158]China	A + related therapies	Dysmenorrhoea	32 (30 RCTs and 2 CCTs)	Mostly poor	... there is no convincing evidence.	Good	-
Langhorst [67]	A	Fibromyalgia	7	Variable	acupuncture cannot be recommended for the management of fibromyalgia syndrome	Good	-
Martin-Sanchez [93]Spain	A	Fibromyalgia	6	Mostly poor	... found no evidence of benefit.	Poor	-
Mayhew [94]UK	A	Fibromyalgia	5	Mostly poor	... not supported by the results from rigorous clinical trials.	Good	-
Peng [110]China	A	Frozen shoulder	6	Good	... on frozen shoulder that acupuncture is the safe therapy and effective ...	Moderate	+
Yu [159]China	A	Herpes zoster	10	Poor	Acupuncture ... is effective	Poor	+
Zhao [163]China	A	Herpes zoster	7	Poor	... acupuncture has a certain curative effect on herpes zoster without obvious toxic side effects	Moderate	+
Luo [88]China	A	Intervertebral disk displacement	10	Poor	Acupuncture treatment ... is effective	Moderate	+
Lee [71]UK	A	Labour pain	3	Good	... the evidence for acupuncture as an adjunct to conventional pain control during labour is promising but ...	Good	+/-
Trinh [135]Canada	A	Lateral elbow pain	6	Good	All the studies suggested that acupuncture was effective in the short-term relief...	Good	+
Green [37]Australia	A	Lateral elbow pain	4	Variable	There is insufficient evidence	Good	-
Ee [25]Australia	A	Low back pain in pregnancy	3	Good	... limited evidence supports acupuncture use...	Good	+/-
Yuan [160]UK	A	Low back pain	23	Variable	There is strong evidence that acupuncture can be a useful supplement to other forms of ... therapy...	Good	+
Furlan [34]Canada	A + dry needling	Low back pain	35	Variable	The data do not allow firm conclusions	Good	+/-
Manheimer [92]USA	A	Low back pain	33	Variable	Acupuncture effectively relieves back pain...	Good	+
Zhu [165]China	A	Low back pain	9 (8 RCTs and 1 CCT)	Variable	... might be effective to lower ...	Poor	+
Ernst [27]UK	A	Low back pain	12	Variable	Acupuncture is superior to various control interventions, although there is insufficient evidence to state whether it is superior to placebo	Good	+/-
Henderson [42]USA	A	Low back pain	6	Poor	... did not provide definitive evidence ...	Poor	+/-
Li, 2008 [81]China	EA	Lumbar intervertebral disk herniation	6	Good	EA is effective and safe on treating pain...	Poor	+
Linde [83]Germany	A	Migraine prophylaxis	22	Variable	No evidence for an effect of "true" acupuncture over sham interventions	Excellent	-
Zhang [161]China	A	Migraine	12	Variable	... trials published in China by now cannot evaluate ... accurately.	Poor	-
Griggs [39]UK	A	Migraine	13	Mostly poor	(more research needed)	Poor	+/-
Lee [75]UK	BVA	Musculoskeletal pain	11	Variable	... the total number ... and sample sizes ... were too small to draw definite conclusions	Good	-
Tough [133]UK	A	Myofascial trigger point pain	7	Variable	There is limited evidence derived from 1 study	Good	+/-
Cummings [19]UK	A	Myofascial trigger point pain	23	Variable	Direct needling of myofascial trigger points appears to be an effective treatment	Good	+
Fu [33]USA	A	Neck pain	14	Variable	Confirm short-term effectiveness and efficacy...	Good	+
Trinh [134]Canada	A	Neck pain	10	Variable	... moderate evidence that acupuncture relieves pain better than some sham treatments...	Good	+
Schuller	Laser acup	Orthopaedic diseases	8	Variable	Better ... trials ... are mandatory	Poor	+/-

[119]German Manheimer	A	Osteoarthritis(peripheral joint)	16	Variable	Sham-controlled trials show statistically significant benefit	Excellent	+
[90]USA Selfe [121]USA	A	Osteoarthritis	10	Good	...acupuncture is an effective treatment	Poor	+
Manheimer [91]USA	A	Osteoarthritis (knee)	11	Variable	Sham-controlled trials show clinically irrelevant short-term benefits.	Good	+/-
White [148]UK	A	Osteoarthritis (knee)	13	Variable	...acupuncture is ... significantly superior to sham-acupuncture.	Good	+
Kwon [64]UK	A	Osteoarthritis (peripheral joints)	18	Variable	...acupuncture is an option worthy of consideration	Good	+
Ferrandez Infante [31]Spain	A	Osteoarthritis (knee)	4	Mostly poor	... insufficient evidence ...	Poor	-
Ezzo [30]USA	A	Osteoarthritis (knee)	7	Variable	... play a role in the treatment	Good	+
Stener-Victorin [125]Sweden	EA	Pain during oocyte- retrieval	12	Variable	...no consensus on which method is optimal ... was found.	Poor	+/-
Usichenko [139]Germany	AA	Post-op pain	9	Variable	AA reduces post-op pain is promising but not compelling	Good	+/-
Sun [130]USA	A	Post-op pain	15 (sham controlled RCTs)	Good	Perioperative acupuncture may be a useful adjunct ...	Good	+/-
Li [80]China	A	Rheumatoid arthritis	6	Mostly poor	Of existing clinical evidence shows that acupuncture combined drug therapy more effective than pure rheumatoid arthritis drug	Poor	+
Lee [76]UK	A	Rheumatoid arthritis	8	Variable	...sham-controlled RCTs failed to show specific effects	Good	-
Wang [145]China	A	Rheumatoid arthritis	8	Variable	...conflicting evidence exists	Good	-
Casimiro [7]Canada	A	Rheumatoid arthritis	2	Poor	The conclusions are limited by methodological considerations	Good	-
Wang [146]China	A	Sciatica	6	Poor	Acupuncture treatment is effect for sciatica	Poor	+
Green [38]Australia	A	Shoulder pain	9	Variable	There is little evidence ...	Good	-
Lee [72]UK	A	Surgical pain	19	Variable	Strong evidence exists that real acupuncture is not significantly different for placebo acupuncture.	Good	-
La Touche [65]Spain	A	Temporomandibular joint pain	4	Good	... evidence is limited ...	Poor	-
Fink [32]Germany	A	Temporomandibular joint pain	6	Variable	Acupuncture appears to be a suitable complementary therapy	Poor	+
Linde [84]Germany	A	Tension-type headache	11	Variable	...acupuncture could be a valuable ...	Excellent	+
Davis [21]USA	A	Tension-type headache	8	Good	...acupuncture compared with sham ... has limited efficacy...	Good	-
Jedel [46]Sweden	A	Tension-type headache	6	Variable	... is limited evidence ...	Poor	-
Li [82]China	A	Tension-type headache	13	Variable	...current evidence cannot evaluate ...	Poor	-

+, Overall positive or tentatively positive; -, Fails to show effectiveness; +/-, Unclear; A, acupuncture; EA, electro-acupuncture; BVA, bee venom acupuncture; CCT, controlled clinical trial; RCT, randomized controlled trial.

**Table 2**  
Case reports of infection after acupuncture.

First author(year)	Country	Patient	Reason for acupuncture	Symptoms	Diagnosis	Treatment	Outcome	Causality
Chien [15]	Taiwan	68-year-old man	LBP	Delirium	Epidural abscess caused by <i>Haemophilus aphrophilus</i>	Antibiotics, surgery	Full recovery	Possible
Kuo [62]	Taiwan	57-year-old man	LBP	Fever, pain	Bilateral psoas abscess	Antibiotics	Full recovery	Certain
Ogasawara [104]	Japan	50-year-old woman	LBP	Fever, pain joint-swelling	Polyarticular septic arthritis and bilateral psoas abscess	70 days of antibiotics, drainage of abscess	Full recovery	Probable
Woo [152]	Hong Kong	43-year-old woman	Knee pain	Swelling of knee joint	Methicillin-resistant septic arthritis	i.v. levofloxacin, later i.v. vancomycin	Full recovery	Certain
Wu [155]	China	12-year-old girl	Neurologic sequelae of encephalitis	Swelling, fever	Pott puffy tumour with pseudomonas infection	Surgery, antibiotics	Full recovery	Probable
Hwang [43]	Korea	25-year-old woman	LBP	Fever, right flank pain	Pneumoretroperitoneum	Antibiotics	Full recovery	Certain
Lee [74]	Korea	78-year-old man	LBP	Tetraplegia	Spinal epidural abscess	Antibiotics surgery	Full recovery	Certain
Lee [77]	Korea	79-year-old man	LBP	Fever, abdominal pain	Necrotizing aortitis	i.v. antibiotics, surgery	Full recovery	Certain
Tien [132]	Taiwan	78-year-old man	Rheumatoid arthritis	Swelling and pain in right knee	Septic arthritis	i.v. antibiotics	Full recovery	certain
Tien [132]	Taiwan	78-year-old man	Knee pain	Swelling of knee joint	Septic arthritis	i.v. oxacillin	Full recovery	Probable
Morgan [96]	Lima	16-year-old girl	Weight loss	Pain	Abscess caused by <i>Pseudomonas aeruginosa</i> infection	Oral amoxicillin	Full recovery	Certain
Bang [2]	Korea	64-year-old man	LBP	Paraplegia, loss of consciousness	<i>Escherichia coli</i> sepsis, bilateral psoas abscess	i.v. antibiotics	Patient remained paraplegic	Certain
Seely [120]	US	31-year-old man	Muscle strain, hip pain	Thigh pain, shortness of breath, vomiting, fever	Thigh abscess bacteraemia, diabetic ketoacidosis	Vancomycin, nafcillin	Full recovery	Certain
Chen [12]	Taiwan	44-year-old man	Neck pain	Pain, fever, hemiparesis	Cervical subdural haematoma	Laminectomy, antibiotics	Minor neurological deficits	Certain
Daivajna [20]	UK	48-year-old woman	LBP	Pain	Septic arthritis	i.v. antibiotics, surgery	Full recovery	Certain
Kim [59]	Canada	50-year-old man	LBP	Pain	Spondylodiscitis caused by staphylococcus	i.v. antibiotics	Full recovery	Probable
Saw [118]	Malaysia	55-year-old woman	Osteoarthritis of the knee	Fever, pain, swelling	Necrotizing fasciitis	i.v. antibiotics, surgery	Full recovery	Certain
Studd [126]	Australia	64-year-old woman	Epigastric pain	Abdominal pain	Intra-abdominal abscess	i.v. antibiotics	Full recovery	Certain
Vucicevic [143]	Croatia	53-year-old woman	Shoulder stiffness	Fever, remittent rigors	<i>Staphylococcus aureus</i> sepsis, pleural empyema, polyarthritis, left hand phlegmon	Oxacillin, clindamycin	Full recovery	Probable
Ara [1]	Spain	58-year woman	Weight loss	Subcutaneous nodules on abdomen	<i>Mycobacterium chelonae</i> infection	Oral clarithromycin	Full recovery	Probable
Cho [17]	Korea	56-year-old man	No information	Fever swelling	Retroperitoneal abscess	Surgery, antibiotics	Full recovery	Certain
Kettaneh [55]	France	70-year-old woman	No information	Oedema, fever	Facial erysipelas	i.v. amoxicillin	Full recovery	Probable
Kim [57]	Korea	62-year-old woman	Arthritis	Skin lesions	Syphilis infection	Penicillin i.m.	Full recovery	Probable
Wiwanitkit [150]	Thailand	60-year-old woman	Muscle pain	None	Infection with HIV-virus	None	No information	Probable
Woo [151]	Hong Kong	73-year-old man	LBP	Swelling in back	<i>S. aureus</i> infection	i.v. cloxacillin	Full recovery	Certain
Laing [66]	Ireland	45-year-old woman	Postoperative recovery	Pain swelling	Septic arthritis	Antibiotics, surgery	Full recovery	Certain
Leavy [69]	US	33-year-old man	Hip pain	Pain	<i>S. aureus</i> septicaemia	Oxacillin	Full recovery	Probable
Shah [122]	UK	37-year-old man	Tendonitis	Pain	Infected compartment syndrome	Surgery, antibiotics	Full recovery	Certain
Woo [153]	Hong Kong	79-year-old woman	Chronic pain	Swelling	Mycobacterial infection (right leg)	Antibiotics	Full recovery	Certain
Woo [153]	Hong Kong	21-year-old man	Lupus erythematosus	Swelling	Myobacterial infection (left ankle)	Antibiotics	Full recovery	Certain
Woo [153]	Hong Kong	62-year-old woman	Dizziness	Wrist tenosynovitis	Myobacterial infection (right wrist)	Antibiotics	Full recovery	Certain
Woo [153]	Hong Kong	72-year-old man	Chronic pain	Wrist	Myobacterial infection (left	Antibiotics	Full	Certain

**Table 2** (continued)

First author(year)	Country	Patient	Reason for acupuncture	Symptoms	Diagnosis	Treatment	Outcome	Causality
Ishibe [44]	Kong Japan	13-year-old	No information	tenosynovitis Severe back pain	wrist) Septic arthritis of a lumbar facet joint	Antibiotics	recovery Full	Certain
Nambiar [100]	UK	42-year-old woman	LBP	Fever polyarthritis	Prosthetic valve endocarditis	Surgery, antibiotics	Full recovery	Probable
Woo [154]	China	79-year-old woman	Knee osteoarthritis	Induration of right leg	Soft tissue infection with mycobacterium chelonae	Imipenem, clarithromycin, amikacin	Full recovery	Certain
Castro-Duran [8]	Spain	48-year-old woman	Arthritis	Ulcerative skin lesion	Pyoderma gangrenosum	Antibiotics	Full recovery	Probable
McCartney [95]	UK	52-year-old man	LBP	Swelling of both hands	Bilateral hand oedema	None	Full recovery	Probable
Origuchi [106]	Japan	67-year-old man	No information	High fever, intractable back pain	Infectious aortic aneurysm	i.v. antibiotics	Full recovery	Certain

LBP, low back pain; i.v., intravenous; i.m., intramuscular.

163,165]. They focused on a wide range of pain syndromes (Table 1), and most were published within the last 2 years.

Four systematic reviews were judged to be of excellent methodological quality [83,84,89,90] and 19 were poor [31,32,36,39,42,46,65,80–82,93,119,121,125,146,157,161,165]. None from the rigorous reviews originated from China, while 9 of the poor ones did. Of the 25 reviews with positive conclusions, 11 originated from China.

Twenty-five reviews reached a clearly or tentatively positive conclusion [16,21,27,31,33,34,36–38,64,71,76,83,84,86,88,91,94,

119,121,125,129,134,157,163,165]. In areas where multiple reviews were available, a substantial degree of contradiction emerged.

### 3.2. Serious adverse effects

Ninety-five cases were found and grouped into 3 main categories: infection (Table 2) [1,2,8,12,15,17,20,42,44,55,57,59,62,66,69,74,77,95,96,100,104,106,118,120,122,126,132,143,150–155], trauma (Table 3) [6,9–11,13,18,22,24,41,45,49–51,53,54,56,60,

**Table 3**

Case reports of tissue trauma after acupuncture.

First author(year)	Country	Patient	Reason for acupuncture	Symptoms	Diagnosis	Treatment	Outcome	Causality
Saifelddeen [116]	UK	31-year-old man	Shoulder pain	Dyspnoea	Pneumothorax	None	Full recovery	Certain
Verhelst [141]	Holland	57-year-old woman	Tension headache	Dyspnoea	Bilateral pneumothorax, pneumomediastinum	Symptomatic	Full recovery	Certain
Zhao [162]	China	No information	No information	No information	Tension pneumothorax	No information	Death	Certain
Juss [49]	UK	50-year-old woman	Neck and back pain	Breathlessness, nausea	Pneumothorax	Opiate analgesia	Full recovery	Certain
Lee [70]	Korea	47-year-old man	Abdominal pain	Pain, numbness of left thumb and index finger	Median nerve neuropathy	Physiotherapy, gabapentin	Full recovery	Certain
Nishimura [103]	Japan	81-year-old woman	Stiffness of finger	Swelling and pain in right hand	Haemorrhage in carpal tunnel	Surgery	Full recovery	Certain
Onda [105]	Japan	31-year-old woman	Neck pain	Sensory deficit	Injury of cervical spinal cord	No information	Permanent deficit	Certain
Richter [114]	New Zealand	35-year-old woman	LBP	Dyspnoea	Pneumothorax pleural empyema	Chest drain, antibiotics	Full recovery	Certain
Tsukazaki [136]	Japan	32-year-old woman	Sudden bilateral headache, vomiting	Subarachnoid haemorrhage	No information	No information	No information	No information
Vega-Vega [140]	Spain	26-year-old man	Algodystrophy	Dyspnoea	Pneumothorax	Chest drain	Full recovery	Certain
Liou [86]	Taiwan	29-year-old man	Dizziness	Neck and shoulder pain	Broken-off needle penetrating epidural space at C2 level	Surgery	Full recovery	Certain
Nakanishi [99]	Japan	71-year-old man	Intermittent claudication	Pain and swelling of leg	Popliteal artery pseudoaneurysm	Stent graft	Full recovery	Certain
Rosted [115]	UK	47-year-old man			Temporomandibular joint pain		Numbness in face	Bell's palsy Steroids
Minor deficit Son [124]	Probable Korea	62-year-old man	No information	Dyspnoea	Pneumothorax	No information	No information	Certain
Son [124]	Korea	74-year-old woman	No information	Dyspnoea	Pneumothorax	No information	No information	Certain
Su [127]	Singapore	52-year-old woman	Chronic cough	Breathing difficulties	Bilateral pneumothorax	"Conservative management"	Full recovery	Certain

(continued on next page)

Table 3 (continued)

First author(year)	Country	Patient	Reason for acupuncture	Symptoms	Diagnosis	Treatment	Outcome	Causality
Von Riedenaer [142]	US	25-year-old man	Shoulder pain	Acute dyspnoea, chest pain	Pneumothorax	Video-assisted thoracoscopic removal of migratory needle	Full recovery	Certain
Chauffe [10]	US	27-year-old man	No information	Dyspnoea, chest pain, nonproductive cough	Pneumothorax	Chest drain	Full recovery	Certain
Chen [11]	Taiwan	30-year-old man	Back pain	Numbness of both legs	Epidural haematoma	i.v. steroids, laminectomy	Full recovery	Certain
Karst [53]	Germany	47-year-old woman	Colitis ulcerosa	Pain and swelling of arm	Injury of arteria brachialis, ischemia of hand	Surgery	Amputation below the elbow	Certain
Chang [9]	Korea	68-year-old man	LBP	Abdominal pain, nausea, vomiting, fever, haematemesis	Aorta-duodenal fistula, shock	Cardiopulmonary resuscitation	Death	Certain
Cheng [13]	Taiwan	37-year-old woman	Weight loss	Abdominal pain, nausea, vomiting	Rectus sheath haematoma	“managed conservatively”	Full recovery	Certain
Lee [78]	Hong Kong	36-year-old woman	LBP	Tachypnea	Bilateral pneumothorax	Chest drain	Full recovery	Certain
Park [108]	Korea	49-year-old woman	Shoulder pain	Chest pain	Cardiac tamponade	Operative removal of acupuncture needle	Full recovery	Certain
Patrick [109]	US	63-year-old man	LBP	Leg pain	Broken-off needle tip impinging on posterior root of ganglion of L5 nerve root	Operative removal of needle tip	Full recovery	Certain
Uhm [137]	Korea	42-year-old woman	Dyspepsia	Severe periumbilical pain	Acute traumatic pancreatitis (due to puncture of pancreas by long acupuncture needle)	Fasting, i.v. fluids	Full recovery	Certain
Hama [41]	Japan	70-year-old man	No information	None	Acupuncture needle fragment in medulla oblongata	None	Full recovery	Certain
Kasuda [54]	Japan	71-year-old woman	Shoulder stiffness	Dyspnoea, chest	Bilateral pneumothorax	Resuscitation	Death	Certain
Peuker [111]	Germany	38-year-old woman	Breathing problems, stress	Dyspnoea, pain	Tension pneumothorax	Chest drain	Full recovery	Certain
Cantan [6]	France	25-year-old woman	No information	Haemodynamic shock	Bilateral pneumothorax, cardiac tamponade	Reanimation, surgery	Full recovery	Certain
Iwadata [45]	Japan	72-year-old woman	LBP	Severe dyspnoea	Bilateral tension pneumothorax	Chest drain	Death	Certain
Sato [117]	Japan	62-year-old woman	Sciatica	Pain and numbness in left leg	Peroneal nerve due to fractured acupuncture needle	Surgical removal	Permanent hyperaesthesia	Certain
No author named [87]	Hong Kong	65-year-old man	No information	Dyspnoea	Pneumothorax	No information	Death	Certain
De Kuyper [22]	Holland	32-year-old woman	Asthma	Dyspnoea	Pneumothorax	Chest drain	Full recovery	Certain
Kao [51]	Taiwan	61-year-old woman	Knee osteoarthritis	Enlarging pulsatile mass in left thigh	Pseudo-aneurysm of popliteal artery	Vascular surgery	Full recovery	Certain
Kao [50]	Taiwan	28-year-old woman	LBP	No information	Bilateral pneumothorax	Oxygen, bed rest	Full recovery	Certain
Kim [56]	South Korea	54-year-old man	Abdominal pain	Abdominal pain	Pseudoaneurysm of abdominal aorta	Surgery	Full recovery	Certain
Leung [79]	Hong Kong	70-year-old woman	Asthma	Severe dyspnoea	Left-sided pneumothorax	Chest drain	No information	Certain
Dianjing [24]	China	56-year-old woman	Asthma	Dyspnoea, chest pain	Pneumothorax	Surgery	Full recovery	Certain
Choo [18]	US	44-year-old man	Neck pain	Severe headache, vomiting	Intracranial haemorrhage	Nimodipine, opioids	Full recovery	Certain
Kirchgatterer [60]	Austria	83-year-old woman	No information	Bradycardia, syncope	Cardiac tamponade	Blood transfusion, pericardiocentesis open heart surgery	Full recovery	Certain

70,78,79,87,99,103,105,108,109,111,112,114–117,124,127,136,137, 140–142,162], and other adverse effects (Table 4) [3–5,40,47,48, 58,61,97,98,131,138,156]. Five patients died. Patients were from all age groups and most had consulted their acupuncturist for relatively minor problems.

Thirty-eight cases of infections were reported (Table 2) [1,2,8,12,15,17,20,42,44,55,57,59,62,66,69,74,77,95,96,100,104,106,118,120,122,126,132,143,150–155]. Bacterial infections were the most commonly encountered complication. They usually responded well to antibiotics.

**Table 4**  
Other adverse effects after acupuncture.

First author(year)	Country	Patient	Reason for acupuncture	Symptoms	Diagnosis	Treatment	Outcome	Causality
Jeong [48]	Korea	24-year-old woman	Weight loss	Painful skin lesion on both arms	Factitial panniculitis	No information	No information	Certain
Jeong [48]	Korea	22-year-old woman	Weight loss	Painful skin lesion on abdomen	Factitial panniculitis	No information	No information	Certain
Ulloth [138]	US	52-year-old man	LBP	Headache, nausea, vomiting	Cerebrospinal fluid fistula	Surgical removal of acupuncture needles and repair of fistula	Full recovery	Certain
Bradbury [3]	UK	50-year-old woman	Shoulder pain	Feeling unwell and dizzy, inability to walk or stand up	Nystagmus, vertigo, hypotension	None	Full recovery	Probable
Campbell [5]	UK	Woman (no age provided)	Chronic pain in left hallux	Leaking left breast	Galactorrhoea of left breast	None	Full recovery	Probable
Kung [61]	Taiwan	72-year-old man	Pain in right forearm	Dizziness, cold sweats, loss of consciousness	Epileptic fit	None	Full recovery	Probable
Kung [61]	Taiwan	63-year-old woman	Pain in left ankle	Dizziness, nausea, loss of consciousness	Epileptic fit	None	Full recovery	Probable
Ha [40]	Korea	68-year-old woman	LBP	Aggravation of LBP	Granuloma compressing lumbar 4th nerve	Surgical decompression	Full recovery	Probable
Brouard [4]	Switzerland	65-year-old woman	No information	None	Basal cell carcinoma of earlobe (at acupuncture sites)	Surgery	Dysaesthesia at ear lobe	Probable
Jenner [47]	UK	41-year-old women	Cancer pain	Galactorrhoea	None	None	Full recovery	Probable
Kim, 2002 [58]	Korea	37-year-old woman	Abdominal pain	Skin lesions	Pseudolymphoma, gold allergy	Intralesional triamcinolone	Improved	Certain
Murray [98]	UK	35-year-old man	Tennis elbow	Red skin lesions	Behçet disease	No information	No information	Probable
Takeishi [131]	Japan	66-year-old woman	Skin lesions	Arthritis	Argyria	No information	No information	Certain
Morimoto [97]	Japan	65-year-old woman	Shoulder stiffness	Dermatitis, pain	Contact dermatitis, trigeminal neuralgia	Nerve block	No information	Certain
Yanagihara [156]	Japan	55-year-old woman	Musculoskeletal pain	Tumours at site of treatment	Silicone granuloma; suspected sarcoidosis	Observation	No information	Certain

LBP, low back pain.

Forty-two case reports of organ trauma emerged (Table 3) [6,9–11,13,18,22,24,41,45,49–51,53,54,56,60,70,78,79,86,87,99,103,105,108,109,111,112,114–117,124,127,136,137,140–142,162]. The most frequently reported complication was pneumothorax. Most patients recovered fully, but 4 patients died due to a pneumothorax.

A wide range of other adverse effects are summarized in Table 4 [3–5,40,47,48,58,61,97,98,131,138,156]. Most patients made a full recovery after receiving adequate treatment.

#### 4. Discussion

A similar overview, covering 1989 to 2000, included 17 systematic reviews of acupuncture for pain [85]. The interest in acupuncture is evidently increasing. The majority of the early reviews arrived at negative conclusions [85], while the majority of the 57 recent reviews were positive. Yet there are many contradictions and doubts. For instance, there is no plausible reason why acupuncture should reduce pain in some conditions while failing to work in many others.

Multiple reviews exist for a range of conditions, and agreement between them existed for only 4 conditions: fibromyalgia, herpes zoster, neck pain, and postoperative pain. Acupuncture failed to be demonstrably effective for fibromyalgia, but it seemed to be effective for neck pain. For postoperative pain, both reviews re-

flected uncertainty. More primary studies are therefore required. As to herpes zoster, the primary studies and one of the reviews were of poor quality. Thus, we would caution against drawing positive conclusions and advocate more rigorous primary studies.

The majority of the (high-quality) reviews were positive for low back pain and osteoarthritis. For myofascial trigger-point pain, a positive trend existed, with one review being positive and one unclear. For the treatment of migraine, rheumatoid arthritis, and tension headache, the conclusions were largely negative. For dysmenorrhoea and temporomandibular joint pain, the evidence was contradictory, suggesting that more and better primary studies are required.

For indications where only one systematic review was available (Table 1), definitive conclusions were usually prevented by the paucity or poor quality of the primary studies or the poor quality of the reviews: ankylosing spondylitis, cervical spondylosis, frozen shoulder, intervertebral disk displacement, lumbar intervertebral disk herniation, orthopaedic diseases, pain during oocyte retrieval, and sciatica. One systematic review suggested effectiveness for chronic headache. Chronic headache is a broad category, and more specific diagnoses might be more informative (see above). Other single reviews failed to show effectiveness for cancer pain, migraine prophylaxis, musculoskeletal pain, shoulder pain, and surgical pain. All of the remaining single reviews arrived at unclear conclusions.



These findings should be seen in the light of recent results from high-quality randomized controlled trials. Cherkin et al. [14] have shown that, for chronic low back pain, individualized acupuncture is not better in reducing symptoms than formula acupuncture or sham acupuncture with a toothpick that does not penetrate the skin. All 3 forms of acupuncture, however, were more effective than usual care. The authors consider, therefore, that the benefits of acupuncture “resulted from nonspecific effects such as therapist conviction, patient enthusiasm, or receiving a treatment believed to be helpful” [14]. This view was further strengthened by a recent randomized controlled trial in patients with osteoarthritis examining the effects of acupuncturists’ communication style [128]. Real and sham acupuncture were both more effective in reducing pain than no acupuncture at all, but real acupuncture was no better than sham. Moreover, a communication style generating high expectations in patients resulted in improved outcomes compared to a normal style, regardless of the type of acupuncture administered. In the primary studies included in the systematic reviews evaluated above, the risk of bias was often considerable. Adequately controlling for nonspecific effects in future is likely to demonstrate that acupuncture has no or few specific effects on pain [89].

Serious complications after acupuncture continue to be reported. Many are not intrinsic to acupuncture, but caused by malpractice of acupuncturists. This might explain why surveys of adequately trained therapists failed to yield such complications [28,147,149]. Most of the case reports originated from Asia (Tables 2–4), possibly reflecting the fact that, in Asia, acupuncture is more widely practised than elsewhere. Alternatively, it might be due to more Asian therapists being poorly trained [113]. Tables 2–4 also disclose many serious adverse events from developed countries, including Australia, Austria, Canada, Croatia, France, Germany, Holland, Ireland, New Zealand, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The number of adverse effects reported from the United Kingdom seems particularly remarkable, possibly indicating less under-reporting in the United Kingdom than elsewhere.

The most frequent complications included pneumothorax, and bacterial and viral infections. Viral infections are rarely published as case reports, but other types of investigations suggest that they are relatively frequent [23,26,52,63,68,101,102,123,144].

One might argue that, in view of the popularity of acupuncture, the number of serious adverse effects is minute. We would counter, however, that even one avoidable adverse event is one too many. The key to making progress would be to train all acupuncturists to a high level of competency.

In many of the case reports, causality was uncertain (Tables 2–4), not least because of a lack of sufficient detail. Yet, most of the authors seemed confident about causality. In future, authors and editors should ensure that the quality of case reports increases.

In conclusion, many systematic reviews of acupuncture for pain management are available. Yet they only support few indications, and contradictions abound. Acupuncture remains associated with serious adverse effects. In order to minimize the risk, all acupuncturists should be trained adequately.

## Acknowledgment

MSL and TYC were supported by KIOM (K10251). The authors have no conflicts of interest to declare.

## References

- [1] Ara M, de Santamaria CS, Zaballos P, Yus C, Lezciano MA. *Mycobacterium chelonae* infection with multiple cutaneous lesions after treatment with acupuncture. *Int J Dermatol* 2003;42:642–4.
- [2] Bang MS, Lim SH. Paraplegia caused by spinal infection after acupuncture. *Spinal Cord* 2006;44:258–9.
- [3] Bradbury A, Botancor J, White A. Nystagmus following acupuncture—case report. *Acupunct Med* 2006;24:33–4.
- [4] Brouard M, Kaya G, Vecchiotti G, Chavaz P, Harms M. Basal cell carcinoma of the earlobe after auricular acupuncture. *Dermatology* 2002;204:142–4.
- [5] Campbell A, Macglashan J. Acupuncture-induced galactorrhoea—a case report. *Acupunct Med* 2005;23:146.
- [6] Cantan R, Milesi-Defrance N, Hardenberg K, Vernet M, Messant I, Freysz M. Pneumothorax bilatéral et tamponnade après acupuncture [French]. *Presse Med* 2003;32:311–2.
- [7] Casimiro L, Barnsley L, Brosseau L, Milne S, Robinson VA, Tugwell P, Wells G. Acupuncture and electroacupuncture for the treatment of rheumatoid arthritis. *Cochrane Database Syst Rev* 2005;CD003788.
- [8] Castro-Duran J, Martin-Amanda M, Jimenez-Alonso J. *Pyoderma gangrenosum* induced by acupuncture in a patient with ulcerative colitis. *Arch Intern Med* 2000;160:2394.
- [9] Chang SA, Kim YJ, Sohn DW, Park YB, Choi YS. Aortoduodenal fistula complicated by acupuncture. *Int J Cardiol* 2005;104:241–2.
- [10] Chauffe RJ, Duskin AL. Pneumothorax secondary to acupuncture therapy. *South Med J* 2006;99:1297–9.
- [11] Chen JC, Chen Y, Lin SM, Yang HJ, Su CF, Tseng SH. Acute spinal epidural hematoma after acupuncture. *J Trauma* 2006;60:414–6.
- [12] Chen MH, Chen MH, Huang JS. Cervical subdural empyema following acupuncture. *J Clin Neurosci* 2004;11:909–11.
- [13] Cheng SP, Liu CL. Rectus sheath hematoma after acupuncture. *J Emerg Med* 2005;29:101–2.
- [14] Cherkin DC, Sherman KJ, Avins AL, Erro JH, Ichikawa L, Barlow WE, Delaney K, Hawkes R, Hamilton L, Pressman A, Khalsa PS, Deyo RA. A randomized trial comparing acupuncture, simulated acupuncture, and usual care for chronic low back pain. *Arch Intern Med* 2009;169:858–66.
- [15] Chien JT, Lin CH, Chen YC, Lay CJ, Wang CL, Tsai CC. Epidural abscess caused by *Haemophilus aphrophilus* misidentified as *Pasteurella* species. *Intern Med* 2009;48:853–8.
- [16] Cho SH, Hwang EW. Acupressure for primary dysmenorrhoea: a systematic review. *Complement Ther Med* 2010;18:49–56.
- [17] Cho YP, Jang HJ, Kim JS, Kim YH, Han MS, Lee SG. Retroperitoneal abscess complicated by acupuncture: case report. *J Korean Med Sci* 2003;18:756–7.
- [18] Choo DC, Yue G. Acute intracranial hemorrhage caused by acupuncture. *Headache* 2000;40:397–8.
- [19] Cummings TM, White AR. Needling therapies in the management of myofascial trigger point pain: a systematic review. *Arch Phys Med Rehabil* 2001;82:986–92.
- [20] Daivajna S, Jones A, O'Malley M, Mehdian H. Unilateral septic arthritis of a lumbar facet joint secondary to acupuncture treatment—a case report. *Acupunct Med* 2004;22:152–5.
- [21] Davis MA, Kononowech RW, Rolin SA, Spierings EL. Acupuncture for tension-type headache: a meta-analysis of randomized, controlled trials. *J Pain* 2008;9:667–77.
- [22] de Kuyper RD, van Hezik EJ. Bilateral pneumothorax in a young woman after acupuncture [Dutch]. *Ned Tijdschr Geneesk* 2002;146:1158.
- [23] Dev A, Sundarajan V, Sievert V. Ethnic and cultural determinants influence risk assessment for hepatitis C acquisition. *J Gastroenterol Hepatol* 2004;19:792–8.
- [24] Shen D, Zhang M. A case of pneumothorax caused by acupuncture. *Int J Clin Acupunct* 2001;12:79.
- [25] Ee CC, Manheimer E, Pirota MV, White AR. Acupuncture for pelvic and back pain in pregnancy: a systematic review. *Am J Obstet Gynecol* 2008;198:254–9.
- [26] Ernst E, Sherman KJ. Is acupuncture a risk factor for hepatitis? Systematic review of epidemiological studies. *J Gastroenterol Hepatol* 2003;18:1231–6.
- [27] Ernst E, White AR, Wider B. Acupuncture of back pain: meta-analysis of randomised controlled trials and an update with data from the most recent studies [German]. *Schmerz* 2002;16:129–39.
- [28] Ernst E, White AR. Prospective studies of the safety of acupuncture: a systematic review. *Am J Med* 2001;110:481–5.
- [29] Ezzo J, Berman B, Hadhazy VA, Jadad AR, Lao L, Sing BB. Is acupuncture effective for the treatment of chronic pain? A systematic review. *Pain* 2000;86:217–25.
- [30] Ezzo J, Hadhazy V, Birch S, Lao L, Kaplan G, Hochberg M, Berman B. Acupuncture for osteoarthritis of the knee. *Arthritis Rheum* 2001;44:819–25.
- [31] Ferrandez Infante A, Garcia Olmos L, Gonzalez Gamarra A, Meis Meis MJ, Sanchez Rodriguez BM. Effectiveness of acupuncture in the treatment of pain from osteoarthritis of the knee [Spanish]. *Aten Primaria* 2002;30:602–8.
- [32] Fink M, Rosted P, Bernateck M, Stiesch-Scholz M, Karst M. Acupuncture in the treatment of painful dysfunction of the temporomandibular joint—a review of the literature. *Forsch Komplementmed* 2006;13:109–15.
- [33] Fu LM, Li JT, Wu WS. Randomized controlled trials of acupuncture for neck pain: systematic review and meta-analysis. *J Altern Complement Med* 2009;15:133–45.
- [34] Furlan AD, van Tulder M, Cherkin D, Tsukayama H, Lao L, Koes B, Berman B. Acupuncture and dry-needling for low back pain: an updated systematic review within the framework of the Cochrane collaboration. *Spine* 2005;30:944–63.
- [35] Goldman N, Chen M, Fujita T, Xu Q, Peng W, Liu W, Jensen TK, Pei Y, Want F, Han X, Chen JF, Schnermann J, Takano T, Bekar L, Tieu K, Nedergaard M.



- Adenosine A1 receptors mediate local anti-nociceptive effects of acupuncture. *Nat Neurosci* 2010;13:883–8.
- [36] Gong XM, Ren K. Acupuncture therapy in the rehabilitative treatment of ankylosing spondylitis: a systematic review. *Chinese J Rehabil Med* 2007;22:537.
- [37] Green S, Buchbinder R, Barnsley L, Hall S, White M, Smidt N, Assendelft W. Acupuncture for lateral elbow pain. *Cochrane Database Syst Rev* 2002;CD003527.
- [38] Green S, Buchbinder R, Hetrick S. Acupuncture for shoulder pain. *Cochrane Database Syst Rev* 2005;CD005319.
- [39] Griggs C, Jensen J. Effectiveness of acupuncture for migraine: critical literature review. *J Adv Nurs* 2006;54:491–501.
- [40] Ha KY, Kim YH. Chronic inflammatory granuloma mimics clinical manifestations of lumbar spinal stenosis after acupuncture: a case report. *Spine [Phila Pa 1976]* 2003;28:E217–20.
- [41] Hama Y, Kaji T. A migrated acupuncture needle in the medulla oblongata. *Arch Neurol* 2004;61:1608.
- [42] Henderson H. Acupuncture: evidence for its use in chronic low back pain. *Br J Nurs* 2002;11:1395–403.
- [43] Hwang JK, Kim J, Lee BJ, Park JJ, Kim JS, Bak YT. Pneumoretroperitoneum following acupuncture. *J Altern Complement Med* 2008;14:1299–301.
- [44] Ishibe M, Inoue M, Saitou K. Septic arthritis of a lumbar facet joint due to pyonex. *Arch Orthop Trauma Surg* 2001;121:90–2.
- [45] Iwadate K, Ito H, Katsumura S, Matsuyama N, Sato K, Yonemura I, Ito Y. An autopsy case of bilateral tension pneumothorax after acupuncture. *Leg Med [Tokyo]* 2003;5:170–4.
- [46] Jedel E, Carlsson J. Acupuncture in the management of tension-type headache. *Phys Ther Rev* 2005;10:131–9.
- [47] Jenner C, Filshie J. Galactorrhoea following acupuncture. *Acupunct Med* 2002;20:107–8.
- [48] Jeong KH, Lee MH. Two cases of factitial panniculitis induced by electroacupuncture. *Clin Exp Dermatol* 2008;34:e170–3.
- [49] Juss JK, Speed CA, Warrington J, Mahadeva R. Acupuncture induced pneumothorax—a case report. *Acupunct Med* 2008;26:193–6.
- [50] Kao CL, Chang JP. Bilateral pneumothorax after acupuncture. *J Emerg Med* 2002;22:101–2.
- [51] Kao CL, Chang JP. Pseudoaneurysm of the popliteal artery: a rare sequela of acupuncture. *Tex Heart Inst J* 2002;29:126–9.
- [52] Karmochkine M, Carrat F, Dos Santos O, Cacoub P, Raguin G, GERMIVIC Study Group. A case-control study of risk factors for hepatitis C infection in patients with unexplained routes of infection. *J Viral Hepat* 2006;13:775–82.
- [53] Karst M, Fink M, Molsberger A. Above elbow amputation due to acupuncture treatment? [German]. *Versicherungsmedizin* 2006;58:88–90.
- [54] Kasuda S, Morimura Y, Kudo R, Sageshima N, Sanefuji N, Ishitani A, Fukudome A, Hatake K. A case of sudden death due to bilateral tension pneumothorax after acupuncture. *J Nara Med Assoc* 2004;55:331–5.
- [55] Kettaneh A, Ozan N, Stirnemann J, Fain O, Thomas M. Facial erysipelas after receiving acupuncture treatment. *Scand J Infect Dis* 2003;35:911–2.
- [56] Kim DI, Huh SH, Lee BB, Kim DK, Do YS. Pseudoaneurysm of the abdominal aorta caused by acupuncture therapy. *Surg Today* 2002;32:942–3.
- [57] Kim JW, Kim KJ, Lee CJ. A case of secondary syphilis showing clinical features of annular pustular psoriasis following the acupuncture and venous drainage in a herb clinic. *Korean J Dermatol* 2003;41:1525–9.
- [58] Kim KJ, Lee MW, Choi JH, Sung KJ, Moon KC, Koh JK. CD30-positive T-cell-rich pseudolymphoma induced by gold acupuncture. *Br J Dermatol* 2002;146:882–4.
- [59] Kim PS, Hsu W. Discitis in an adult following acupuncture treatment: a case report. *J Can Chiropr Assoc* 2004;48:132–6.
- [60] Kirchgatterer A, Schwarz CD, Höller E, Punzengruber C, Hartl P, Eber B. Cardiac tamponade following acupuncture. *Chest* 2000;117:1510–1.
- [61] Kung YY, Chen FP, Hwang SJ, Hsieh JC, Lin YY. Convulsive syncope: an unusual complication of acupuncture treatment in older patients. *J Altern Complement Med* 2005;11:535–7.
- [62] Kuo CM, Wu CK, Lien WC. Bilateral psoas abscess formation after acupuncture. *J Emerg Med* 2009 [Epub ahead of print]. doi:10.1016/j.jemermed.2009.02.030.
- [63] Kweon SS, Shin MH, Song HJ, Jeon DY, Choi JS. Seroprevalence and risk factors for hepatitis C virus infection among female commercial sex workers in South Korea who are not intravenous drug users. *Am J Trop Med Hyg* 2006;74:1117–21.
- [64] Kwon YD, Pittler MH, Ernst E. Acupuncture for peripheral joint osteoarthritis: a systematic review and meta-analysis. *Rheumatology [Oxford]* 2006;45:1331–7.
- [65] La Touche R, Angulo-Diaz-Parreno S, de-la-Hoz JL, Fernandez-Carnero J, Ge HY, Linares MT, Mesa J, Sanchez-Gutierrez J. Effectiveness of acupuncture in treatment of temporomandibular disorders of muscular origin: a systematic review of the last decade. *J Altern Complement Med* 2010;16:107–12.
- [66] Laing AJ, Mullett H, Gilmore MF. Acupuncture-associated arthritis in a joint with an orthopaedic implant. *J Infect* 2002;44:43–4.
- [67] Langhorst J, Klose P, Musial F, Irnich D, Hauser W. Efficacy of acupuncture in fibromyalgia syndrome—a systematic review with a meta-analysis of controlled clinical trials. *Rheumatol* 2010;49:778–88.
- [68] Lasher LE, Elm JL, Hoang Q, Nekomoto TS, Cashman TM, Miller FD, Effler PV. A case control investigation of hepatitis C risk factors in Hawaii. *Hawaii Med J* 2005;64:296–304.
- [69] Leavy BR. Apparent adverse outcome of acupuncture. *J Am Board Fam Pract* 2002;15:246–8.
- [70] Lee CH, Hyun JK, Lee SJ. Isolated median sensory neuropathy after acupuncture. *Arch Phys Med Rehabil* 2008;89:2379–81.
- [71] Lee H, Ernst E. Acupuncture for labor pain: a systematic review. *Am J Obstet Gynecol* 2004;191:1573–9.
- [72] Lee H, Ernst E. Acupuncture analgesia during surgery: a systematic review. *Pain* 2005;114:511–7.
- [73] Lee H, Schmidt K, Ernst E. Acupuncture for the relief of cancer-related pain—a systematic review. *Eur J Pain* 2005;9:437–44.
- [74] Lee KW, Han SJ, Kim DJ, Lee M. Spinal epidural abscess associated with moxibustion-related infection of the finger. *J Spinal Cord Med* 2008;31:319–23.
- [75] Lee MS, Pittler MH, Shin BC, Kong JC, Ernst E. Bee venom acupuncture for musculoskeletal pain: a systematic review. *J Pain* 2008;9:289–97.
- [76] Lee MS, Shin BC, Ernst E. Acupuncture for rheumatoid arthritis: a systematic review. *Rheumatology [Oxford]* 2008;47:1747–53.
- [77] Lee S, Lim SH, Kim DK, Joo HC. Acupuncture induced necrotizing aortitis with infected pseudoaneurysm formation. *Yonsei Med J* 2008;49:322–4.
- [78] Lee WM, Leung HB, Wong WC. Iatrogenic bilateral pneumothorax arising from acupuncture: a case report. *J Orthop Surg [Hong Kong]* 2005;13:300–2.
- [79] Leung JS. Complementary medicine, acupuncture, and pneumothorax. *Hong Kong Med J* 2002;8:225–6.
- [80] Li K, Wang YF, Tian JW, Yang KH. Systematic review of acupuncture and moxibustion treatment of rheumatoid arthritis. *Gansu Sci Technol* 2008;24:144–6.
- [81] Li QY, Peng WN, Mu Y. The system evaluation of electroacupuncture for lumbar intervertebral disc herniation. *J Integrated Trad Chin Western Med* 2008;17:325–30.
- [82] Li Y, Luo C. Acupuncture for tension-type headache: a systematic review. *Chin J Evid Based Med* 2005;5:117–24.
- [83] Linde K, Allais G, Brinkhaus B, Manheimer E, Vickers A, White AR. Acupuncture for migraine prophylaxis. *Cochrane Database Syst Rev* 2009;6:CD001218.
- [84] Linde K, Allais G, Brinkhaus B, Manheimer E, Vickers A, White AR. Acupuncture for tension-type headache. *Cochrane Database Syst Rev* 2009;6:CD007587.
- [85] Linde K, Vickers A, Hondras M, ter Riet G, Thormählen J, Berman B, Melchart D. Systematic reviews of complementary therapies – an annotated bibliography. Part 1: acupuncture. *BMC Complement Altern Med* 2001;1:3.
- [86] Liou JT, Liu FC, Hsin ST, Sum DC, Lui PW. Broken needle in the cervical spine: a previously unreported complication of Xiaozendao acupuncture therapy. *J Altern Complement Med* 2007;13:129–32.
- [87] Lung patient dies after acupuncture. *South China Morning Post* 2002; Jan 29. p 2.
- [88] Luo S, Luo SW. Systematic review of acupuncture for treating intervertebral disk displacement. *J Clin Acupunct Moxibust* 2005;21:10–4.
- [89] Madsen MV, Gotsche PC, Hrobjartsson A. Acupuncture treatment for pain: systematic review of randomised clinical trials with acupuncture, placebo acupuncture, and no acupuncture groups. *BMJ* 2009;338:a3115.
- [90] Manheimer E, Cheng K, Linde K, Lao L, Yoo J, Wieland S, van der Windt DA, Berman BM, Bouter LM. Acupuncture for peripheral joint osteoarthritis. *Cochrane Database of Syst Rev* 2010;1:CD001977.
- [91] Manheimer E, Linde K, Lao L, Bouter LM, Berman BM. Meta-analysis: acupuncture for osteoarthritis of the knee. *Ann Intern Med* 2007;146:868–77.
- [92] Manheimer E, White A, Berman B, Forsys K, Ernst E. Meta-analysis: acupuncture for low back pain. *Ann Intern Med* 2004;142:651–63.
- [93] Martin-Sanchez E, Torralba E, Diaz-Dominguez E, Barriga A, Martin JL. Efficacy of acupuncture for the treatment of fibromyalgia: systematic review and meta-analysis of randomized trials. *Open Rheumatol J* 2009;3:25–9.
- [94] Mayhew E, Ernst E. Acupuncture for fibromyalgia—a systematic review of randomized clinical trials. *Rheumatology [Oxford]* 2009;48:801–4.
- [95] McCartney CJ, Herriot R, Chambers WA. Bilateral hand oedema related to acupuncture. *Pain* 2000;84:429–30.
- [96] Morgan AE. *Pseudomonas aeruginosa* infection due to acupunctural ear stapling. *Am J Infect Control* 2008;36:602.
- [97] Morimoto M, Kawata K, Tsuchiya N, Murakami H, Kura M, Koga Y. A case of acupuncture needle dermatitis [Japanese]. *Masui* 2000;49:887–9.
- [98] Murray PI, Aboteen N. Complication of acupuncture in a patient with Behcet's disease. *Br J Ophthalmol* 2002;86:476–7.
- [99] Nakanishi N, Matsuo A, Matsuo K, Shiono Y, Yamaguchi S, Nishibori Y, Inoue K, Tanaka T, Fujita H, Kitamura M, Inoue N. Successful deployment of a stent graft in the popliteal artery for pseudoaneurysm after acupuncture: a case report [Japanese]. *J Cardiol* 2007;50:213–8.
- [100] Nambiar P, Ratnatunga C. Prosthetic valve endocarditis in a patient with Marfan's Syndrome following acupuncture. *J Heart Valve Dis* 2001;10:689–90.
- [101] Ngo Y, Maugat S, Duong QT, Nguyen TN, Astagneau P. Risk of hepatitis C related to traditional medicine: a case control study in Ho Chi Minh City, Vietnam [French]. *Rev Epidemiol Sante Publique* 2007;55:107–12.
- [102] Nguyen VT, McLaws ML, Dore GJ. Highly endemic hepatitis B infection in rural Vietnam. *J Gastroenterol Hepatol* 2007;22:2093–100.
- [103] Nishimura T, Hirata H, Uchida A. Acute carpal tunnel syndrome induced by hemorrhage during acupuncture therapy. *Med Acupunct* 2008;20:63–5.
- [104] Ogasawara M, Oda K, Yamaji K, Takasaki Y. Polyarticular septic arthritis with bilateral psoas abscesses following acupuncture. *Acupunct Med* 2009;27:81–2.

- [105] Onda K, Honda H, Arai H, Uchiyama S. Dissociated sensory loss caused by acupuncture injury to the cervical spinal cord [Japanese]. *Brain Nerve* 2008;60:1187–90.
- [106] Origuchi N, Komiya T, Ohyama K, Wakabayashi T, Shigematsu H. Infectious aneurysm formation after depot acupuncture. *Eur J Vasc Endovasc Surg* 2000;20:211–3.
- [107] Oxman AD, Guyatt GH. Validation of an index of the quality of review articles. *J Clin Epidemiol* 1991;44:1271–8.
- [108] Park JH, Shin HJ, Choo SJ, Song JK, Kim JJ. Successful removal of migrated acupuncture needles in a patient with cardiac tamponade by means of intraoperative transesophageal echocardiographic assistance. *J Thorac Cardiovasc Surg* 2005;130:210–2.
- [109] Patrick BS. Acupuncture complication—a case report. *J Miss State Med Assoc* 2005;46:195–7.
- [110] Peng WN, Wang Y, Lin BY, Mao M. Review of acupuncture for frozen shoulder. *World J Acupunct Moxibust* 2007;17:1–15.
- [111] Peuker E. Case report of tension pneumothorax related to acupuncture. *Acupunct Med* 2004;22:40–3.
- [112] Ramnarain D, Braams R. Bilateral pneumothorax in a young woman after acupuncture [Dutch]. *Ned Tijdschr Geneesk* 2002;146:172–5.
- [113] Reynolds L, McKee M. Possible risks of transmission of bloodborne infection via acupuncture needles in Guizhou province, southwest China. *J Altern Complement Med* 2008;14:1281–5.
- [114] Richter JC, Kamali W, O'Connor P. Pneumothorax and pleural empyema after acupuncture. *Intern Med J* 2008;38:678–80.
- [115] Rosted P, Woolley DR. Bell's Palsy following acupuncture treatment—a case report. *Acupunct Med* 2007;25:47–8.
- [116] Saifelddeen K, Evans M. Acupuncture associated pneumothorax. *Emerg Med J* 2004;21:398.
- [117] Sato M, Katsumoto H, Kawamura K, Sugiyama H, Takahashi T. Peroneal nerve palsy following acupuncture treatment. *J Bone Joint Surg AM* 2003;85-A:916–8.
- [118] Saw A, Kwan MK, Sengupta S. Necrotising fasciitis: a life-threatening complication of acupuncture in a patient with diabetes mellitus. *Singapore Med J* 2004;45:180–2.
- [119] Schuller BK, Neugebauer EA. Evidence for laser acupuncture in cases of orthopedic diseases: a systematic review [German]. *Schmerz* 2008;22:9–15.
- [120] Seely EJ, Chambers HF. Diabetic ketoacidosis precipitated by *Staphylococcus aureus* abscess and bacteremia due to acupuncture: case report and review of the literature. *Clin Infect Dis* 2006;43:e6–8.
- [121] Selife TK, Taylor AG. Acupuncture and osteoarthritis of the knee: a review of randomized, controlled trials. *Fam Community Health* 2008;31:247–54.
- [122] Shah N, Hing C, Tucker K, Crawford R. Infected compartment syndrome after acupuncture. *Acupunct Med* 2002;20:105–6.
- [123] Shin HR. Epidemiology of hepatitis C virus in Korea. *Intervirology* 2006;49:18–22.
- [124] Son JG, Oh JJ, Jeong JP, Kim SO, Ju JY, Lim JH, Cho GJ, Chae DR, Kim KS, Kim YI, Lim SC, Kim YC. Two cases of iatrogenic pneumothorax after Intra-Muscular Stimulation (IMS) therapy. *Tuberc Respir Dis* 2007;63:444–8.
- [125] Stener-Victorin E. The pain-relieving effect of electro-acupuncture and conventional medical analgesic methods during oocyte retrieval: a systematic review of randomized controlled trials. *Hum Reprod* 2005;20:339–49.
- [126] Studd RC, Stewart PJ. Images in clinical medicine. Intraabdominal abscess after acupuncture. *N Engl J Med* 2004;17:1763.
- [127] Su JW, Lim CH, Chua YL. Bilateral pneumothoraces as a complication of acupuncture. *Singapore Med J* 2007;48:e32–3.
- [128] Suarez-Almazor ME, Looney C, Liu Y, Cox V, Pietz K, Marcus DM, Street Jr RL. A randomized controlled trial of acupuncture for osteoarthritis of the knee: effects of patient-provider communication. *Arthritis Care Res [Hoboken]* 2010;62:1229–36.
- [129] Sun Y, Gan TJ. Acupuncture for the management of chronic headache: a systematic review. *Anesth Analg* 2008;107:2038–47.
- [130] Sun Y, Gan TJ, Dubose JW, Habib AS. Acupuncture and related techniques for postoperative pain: a systematic review of randomized controlled trials. *Br J Anaesth* 2008;101:151–60.
- [131] Takeishi E, Hirose R, Hamasaki Y, Katayama I. Localized argyria 20-years after embedding of acupuncture needles. *Eur J Dermatol* 2002;12:609–11.
- [132] Tien CH, Huang GS, Chang CC, Chang DM, Lai JH. Acupuncture-associated listeria monocytogenes arthritis in a patient with rheumatoid arthritis. *Joint Bone Spine* 2008;75:502–3.
- [133] Tough EA, White AR, Cummings TM, Richards SH, Campbell JL. Acupuncture and dry needling in the management of myofascial trigger point pain: a systematic review and meta-analysis of randomised controlled trials. *Eur J Pain* 2009;13:3–10.
- [134] Trinh K, Graham N, Gross A, Goldsmith C, Wang E, Cameron I, Kay T. Acupuncture for neck disorders. *Spine [Phila Pa 1976]* 2007;32:236–43.
- [135] Trinh KV, Phillips SD, Ho E, Damsma K. Acupuncture for the alleviation of lateral epicondyle pain: a systematic review. *Rheumatology [Oxford]* 2004;43:1085–90.
- [136] Tsukazaki Y, Inagaki T, Yamanouchi Y, Kawamoto K, Oka N. Traumatic subarachnoid hemorrhage associated with acupuncture. *Headache* 2008;48:1240–1.
- [137] Uhm MS, Kim YS, Suh SC, Kim I, Ryu SH, Lee JW, Moon JS. Acute pancreatitis induced by traditional acupuncture therapy. *Eur J Gastroenterol Hepatol* 2005;17:675–7.
- [138] Ulloth JE, Haines SJ. Acupuncture needles causing lumbar cerebrospinal fluid fistula. Case report. *J Neurosurg Spine* 2007;6:567–9.
- [139] Usichenko TI, Dinse M, Hermsen M, Witstuck T, Pavlovic D, Lehmann C. Auricular acupuncture for pain relief after total hip arthroplasty—a randomised controlled study. *Pain* 2005;114:320–7.
- [140] Vega-Vega CC, Cardona-Llorens A, López-Aranda MA. Nexo causal de neumotórax asociado con acupuntura. A propósito de un caso [Spanish]. *Rehabilitacion* 2008;42:252–5.
- [141] Verhelst X, Carlier A, Elzo Kraemer X, Taelman P. A rare cause of pneumothorax and pneumomediastinum [Dutch]. *Tijdschrift voor Geneeskunde* 2009;65:367–9.
- [142] von Riedenauer WB, Baker MK, Brewer RJ. Video-assisted thorascopic removal of migratory acupuncture needle causing pneumothorax. *Chest* 2007;131:899–901.
- [143] Vucicevic Z, Sharma M, Miklic S, Ferencic Z. Multiloculated pleural emphyema following acupuncture. *Infection* 2004;33:297–8.
- [144] Walsh B, Maguire H, Carrington D. Outbreak of hepatitis B in an acupuncture clinic. *Commun Dis Public Health* 1999;2:137–40.
- [145] Wang C, De Pablo P, Schmid X, McAlindon C, Chen T. Acupuncture for pain relief in patients with rheumatoid arthritis: a systematic review. *Arthritis Rheum* 2008;9:1249–56.
- [146] Wang F, Zhang D, Liu Y. Systematic review of acupuncture and moxibustion treatment of sciatica. *World Chinese Med* 2007;2:354–5.
- [147] White A. The safety of acupuncture—evidence from the UK. *Acupunct Med* 2006;24:S3–7.
- [148] White A, Foster NE, Cummings M, Barlas P. Acupuncture treatment for chronic knee pain: a systematic review. *Rheumatology [Oxford]* 2007;46:384–90.
- [149] White AR, Ernst E. Survey of adverse events following acupuncture [SAFA]. *Forsch Komplementarmed* 2000;7:29–58.
- [150] Wiwanitkit V. HIV infection after Chinese traditional acupuncture treatment. *Complement Ther Med* 2003;11:272.
- [151] Woo PC, Lau SK, Wong SS, Yuen KY. *Staphylococcus aureus* subcutaneous abscess complicating acupuncture: need for implementation of proper infection control guidelines. *New Microbiol* 2003;26:169–74.
- [152] Woo PC, Lau SK, Yuen KY. First report of methicillin-resistant *Staphylococcus aureus* septic arthritis complicating acupuncture: simple procedure resulting in the most devastating outcome. *Diagn Microbiol Infect Dis* 2009;63:92–5.
- [153] Woo PC, Leung KW, Wong SS, Chong KT, Cheung EY, Yuen KY. Relatively alcohol-resistant mycobacteria are emerging pathogens in patients receiving acupuncture treatment. *J Clin Microbiol* 2002;40:1219–24.
- [154] Woo PC, Li JH, Tang W, Yuen K. Acupuncture mycobacteriosis. *N Engl J Med* 2001;345:842–3.
- [155] Wu CT, Huang JL, Hsia SH, Lee HY, Lin JJ. Pott's puffy tumor after acupuncture therapy. *Eur J Pediatr* 2009;168:1147–9.
- [156] Yanagihara M, Fujii T, Wakamatu N, Ishizaki H, Takehara T, Nawate K. Silicone granuloma on the entry points of acupuncture, venepuncture and surgical needles. *J Cutan Pathol* 2000;27:301–5.
- [157] Yang G, Wang XQ. Systematic review of efficacy of electro-acupuncture treatment of cervical disease. *Beijing J Trad Chinese Med* 2006;25:433–5.
- [158] Yang H, Liu CZ, Chen X, Ma LX, Xie JP, Guo NN, Ma ZB, Zheng YY, Zhu J, Liu JP. Systematic review of clinical trials of acupuncture-related therapies for primary dysmenorrhea. *Acta Obstet Gynecol Scand* 2008;87:1114–22.
- [159] Yu XM, Zhu GM, Chen YL, Fang M, Chen YN. Systematic assessment of acupuncture for treatment of herpes zoster in domestic clinical studies [Chinese]. *Zhongguo Zhen Jiu* 2007;27:536–40.
- [160] Yuan J, Purepong N, Kerr DP, Park J, Bradbury I, McDonough S. Effectiveness of acupuncture for low back pain: a systematic review. *Spine [Phila Pa 1976]* 2008;33:E887–900.
- [161] Zhang Y, Lin HL, Wang LP. Evaluation of the quality of reports on acupuncture for migraine prophylaxis. *Chin J Evid Based Med* 2008;8:461–5.
- [162] Zhao DY, Zhang GL. Clinical analysis on 38 cases of pneumothorax induced by acupuncture or acupoint injection [Chinese]. *Zhongguo Zhen Jiu* 2009;29:239–42.
- [163] Zhao DY, Wang LP. Systematic assessment of randomized controlled trials of acupuncture-moxibustion treatment of herpes zoster. *Shanghai J Acupunct Moxibust* 2007;26:30–3.
- [164] Zhao ZQ. Neural mechanism underlying acupuncture analgesia. *Prog Neurobiol* 2008;84:355–75.
- [165] Zhu Y, Origasa H, Wang Q. Meta-analysis of acupuncture therapy for relieving low back pain on the visual analog scale. *Yakur to chiryo* 2002;30:997–1002.