Review Article

Adverse Events of Acupuncture: A Systematic Review of Case Reports

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Acupuncture, moxibustion, and cupping, important in traditional Eastern medicine, are increasingly used in the West. Their widening acceptance demands continual safety assessment. This review, a sequel to one our team published 10 years ago, is an evaluation of the frequency and severity of adverse events (AEs) reported for acupuncture, moxibustion, and cupping between 2000 and 2011. Relevant English-language reports in six databases were identified and assessed by two reviewers. During this 12-year period, 117 reports of 308 AEs from 25 countries and regions were associated with acupuncture (294 cases), moxibustion (4 cases), or cupping (10 cases). Country of occurrence, patient’s sex and age, and outcome were extracted. Infections, mycobacterial, staphylococcal, and others, were the main complication of acupuncture. In the previous review, we found the main source of infection to be hepatitis, caused by reusable needles. In this review, we found the majority of infections to be bacterial, caused by skin contact at acupoint sites; we found no cases of hepatitis. Although the route of infection had changed, infections were still the major complication of acupuncture. Clearly, guidelines such as Clean Needle Technique must be followed in order to minimize acupuncture AEs.

1. Introduction

Traditional acupuncture, which is defined as needling insertion, moxibustion thermal stimulation, and cupping techniques at acupuncture points [1], has become popular in the United States and the rest of the world in recent decades. Data released by the National Institutes of Health (NIH) in 2008 reported that 3.1 million American adults and 150,000 children used acupuncture in 2007. Adult use of acupuncture increased by approximately a million people in the five years from 2002 to 2007 [2]. This increased use brings attention to the safety and quality of the modality.

A number of large surveys on the safety of acupuncture have been conducted, mainly in Europe. Most reported incidents have been fairly minor, and incidence rates were low. For example, in a prospective survey of 34,000 treatments by traditional acupuncturists, MacPherson et al. [3] found no serious adverse events (AEs) and 43 minor ones, a rate of 1.3 per 1000 treatments. In another prospective survey, Melchart et al. [4] found 7.1% minor AEs and 5 serious ones among 97,733 acupuncture patients. The authors of these studies concluded that serious AEs seem to be rare and that acupuncture is generally a safe intervention.

More than a decade since our last review [5], we have conducted this systematic follow-up review of case reports published between 2000 and 2011 on AEs and complications associated with acupuncture. Our purpose is to (1) estimate the trend of occurrences of the AEs associated with acupuncture over the past 11 years, (2) identify risk factors in acupuncture practice in order to minimize such events, and
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(3) recommend safe acupuncture practices based on these reported incidents in order to enhance professional standards of practice.

2. Materials and Methods

2.1. Search Strategy. We searched six databases in an attempt to locate any and all existing English-language case reports on acupuncture AEs published between 2000 and 2011 in electronic form. PubMed, Medline, the Central Information System of Complementary Medicine (CISCOM), Excerpta Medica (EMBASE), Citations in Nursing and Allied Health Literature (CINAHL), and the Complementary and Alternative Medicine for Pain (CAMPAIN) were searched. Search terms were “acupuncture, acupuncture anesthesia, acupuncture analgesia, electroacupuncture, acupuncture points, auricular acupuncture, moxibustion, needling, and cupping.” These terms were combined with “safe, safety, adverse event, adverse reaction, side effects, complications, and risk.”

2.2. Inclusion and Exclusion Criteria. Only original case reports of complications or AEs of acupuncture, moxibustion, and cupping published from 2000 to 2011 were included in this review. Two authors independently screened the titles and abstracts of all papers found from the initial search. Disagreements between the two authors were resolved through discussion.

We excluded multiple inclusions and analyses of the same AE as well as irrelevant studies. An irrelevant study was defined as a non-case report, such as a review, commentary, or clinical trial.

AEs reporting infection, internal organ or tissue injury, and other severe consequences are categorized as “complications,” defined as an added difficulty; a complex state; a disease or accident superimposed upon another without being specifically related. Peripheral or secondary effects such as syncope, nausea, or immune reactions are classified as “adverse reactions” [5].

2.3. Data Extraction. A total of 1613 papers were found; 117 were relevant (Figure 1). When provided, we extracted author, year of publication, country of occurrence, number of patients affected, disease originally treated, preexisting conditions that might have contributed to the AE, the needling site, the reported AE and its outcome, the practitioner’s training, and the patient’s status at followup. The majority of the reports did not give the date of the AEs. The data were extracted by two independent coauthors, double checked to ensure matching, and organized by whether the AEs were (1) complications or (2) adverse reactions.
3. Results

For the years 2000–2011, a total of 117 reports containing 308 AEs associated with acupuncture (294 cases), moxibustion (4 cases), and cupping (10 cases) were identified from 25 countries and regions (Table 1).

3.1. Acupuncture Complications: Infections. A total of 239 reported cases were infections associated with acupuncture. These include 48 individual isolated cases reported in 45 papers (Table 2) and 191 cases reported in five outbreaks (Table 3). Incidents were reported in 17 countries and regions. Korea reported 162 cases, Canada 33, Hong Kong 7, Australia 8, Japan 5, Taiwan 5, UK 4, USA 6, Spain 1, Ireland 1, France 1, Malaysia 1, Croatia 1, Scotland 1, Venezuela 1, Brazil 1, and Thailand 1. Most of the papers did not report the practitioner’s training, but 4 cases were treated by individuals with no medical training or license [6, 7]. One patient with a knee infection died due to renal failure [8]. All other cases recovered after the infection was treated.

3.2. Mycobacterium Infection. Of the 239 cases of infection, 193 (80.75%; 153 from Korea, 32 from Canada, 5 from Hong Kong, 1 from Venezuela, 1 from Brazil, and 1 from Spain) were associated with mycobacterium.

In 2006, Song et al. reported an outbreak of 40 cases of infection in an Oriental medicine clinic in Republic of Korea. Although disposable acupuncture needles were used, the patients developed skin lesions at two or more sites on the body; infections were confirmed by laboratory culture, clinical signs, and histopathology. All patients recovered after active treatment with antibiotics. Reportedly, these patients received hot-pack therapy and gel massage after acupuncture treatment. No further cases were found in that clinic after equipment sterilization, and regular towel changes were instituted. The authors of the report concluded that the outbreak of infection was due to improper sterilization of equipment applied to the skin after withdrawal of acupuncture needles [52].

In 2006, Tang et al. reported an outbreak of acupuncture-associated bacterial infection in Canada. Between April and December 2002, thirty-two patients developed cutaneous mycobacteriosis after visiting an acupuncture practice in Toronto. Interviews with the patients and acupuncturist revealed that needles were reused and kept in a container of glutaraldehyde disinfectant prior to insertion. The solution was no longer available at the time of the investigation but was probably improperly diluted with tap water [51].

In 2009, Koh et al. reported an outbreak of 109 cases of skin and soft tissue infection in an acupuncture clinic in Republic of Korea. Most patients had at least one skin lesion. Investigators determined that disposable acupuncture needles were used and were unlikely to be the source of infection. Infected patients were all treated by a physical therapy called “interferential current therapy” or “low-frequency therapy.” The authors found that the diluted disinfectant used to sanitize the therapeutic equipment had been prepared several months earlier and was contaminated with Mycobacterium abscessus, the likely source of the outbreak [54].

Woo et al. reported four cases of infection by alcohol-resistant mycobacterium, discovered over a two-year period, in patients with skin lesions who were receiving acupuncture treatment in Hong Kong (Table 3). The patients had clinical and/or radiological lesions at acupuncture points. The acupuncturists’ training and whether disposable acupuncture needles were used were not reported. The authors recommended that proper infection control guidelines for acupuncture should be mandatory and strictly implemented [50].

3.3. Staphylococcus Infection. Nineteen cases from 14 case reports concern staphylococcus infections associated with acupuncture [14, 15, 17, 21, 25, 27, 28, 30, 33, 38, 39, 46, 47, 53]. Of these, nine patients were infected by methicillin-resistant Staphylococcus aureus (MRSA): six from Australia [53], one from Korea [33], one from Taiwan [47], and one from Hong Kong [38].

In the Australian case, Murray et al. reported a 2008 outbreak of eight cases of invasive MRSA, six of them associated with acupuncture (Table 3). After extensive investigation, the authors concluded that the outbreak most likely resulted from a breakdown in sterile technique during the acupuncture procedure and that the MRSA was probably transmitted from the medical practitioner to the patients. At two time points fifteen months apart, that practitioner had been positively colonized with the MRSA strain that caused the infection [53].

3.4. Other Infections. Other infections (31 cases) include septic arthritis [10, 23, 31, 39], necrotizing fasciitis [26, 45, 49], pneumoretroperitoneum [34, 36], facial erysipelas [20],

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| Table 1: Adverse events associated with acupuncture, moxibustion, and cupping (2000–2011). |
|---------------------------------|-----------------|
| **Adverse events**             | **Number of cases** |
| Acupuncture                     |                  |
| Complications                   |                  |
| Infections                      | 239              |
| Isolated incidents              | 48               |
| Outbreaks                       | 191              |
| Internal organ or tissue injury | 38               |
| Pneumothorax                    | 13               |
| Central nerve system            | 9                |
| Peripheral nerves               | 4                |
| Heart                           | 5                |
| Other injuries                  | 7                |
| Other complications             | 7                |
| Adverse reactions               | 10               |
| Moxibustion                     | 4                |
| Cupping                         | 10               |
| Total                           | 308              |
| First author/year (references) | Country | Cases | Sex | Age/sex | Disease treated | Punctured site | Diagnosis | Practitioner | Follow-up time |
|--------------------------------|---------|-------|-----|---------|----------------|---------------|-----------|--------------|---------------|
| Origuchi 2000 [9] | Japan | 67 | M | Not stated | Infectious aortic aneurysm | Not stated | Acupuncturist | Recovered (≥8d) |
| Ishibe 2001 [10] | Japan | 13 | M | Not stated | Septic arthritis | Not stated | Acupuncturist | Recovered (1wk) |
| Woo 2001 [11] | HK | 79 | F | Knee OA | Mycobacterium chelonae | GB38 (leg) | Recovered (3wk) |
| Nambiar 2001 [12] | UK | 42 | M | Tendonitis | Endocarditis | BL57 (leg) | Recovered (4wk) |
| Leavy 2002 [13] | USA | 37 | M | Hip pain | Staphylococcus aureus | Around thigh | Recovered (6wk) |
| Lang 2002 [14] | Ireland | 45 | F | Postoperative recovery | Left arm | Recovered (6wk) |
| Uchino 2002 [15] | Japan | 47 | F | Earlobe | Infected left atrial myxoma | Not stated | Practitioner | Recovered (after surgery) |
| Woo 2003 [16] | HK | 73 | M | LBP | Staphylococcus | Not stated | Recovered (5wk) |
| Ara 2003 [17] | Spain | 58 | F | Obesity | Mycobacterium chelonae | Abdomen | Recovered (3mo) |
| Cho 2003 [18] | Korea | 56 | M | Right flank discomfort | Klebsiella pneumoniae | Recovered (4wk) |
| Kettaneh 2003 [19] | France | 70 | M | FACIAL erysipelas | Acupuncturist | Recovered (4wk) |
| Ha 2003 [20] | Korea | 69 | F | Hip pain | Mycobacterium chelonae | Low back | Discitis from staphylococcus pleural empyema | Recovered (3wk) |
| Lin 2003 [21] | Australia | 44 | F | Epigastric pain | Staphylococcus | LBP | Recovered (6wk) |
| Daiwasa 2004 [22] | USA | 64 | F | Abdominal abscess | LBP | Acupuncturist | Recovered (3wk) |
| Studd 2004 [23] | Canada | 50 | M | LBP | Abdominal mediastinal abscess | LBP | Recovered (6wk) |
| Kim 2004 [24] | Korea | 55 | M | Right flank pain | LBP | Acupuncturist | Recovered (3wk) |
| Soo 2004 [25] | Korea | 60 | F | Cervical paraspinal and costovertebral region | LBP | Acupuncturist | Recovered (6wk) |
| Bang 2005 [26] | Taiwan | 34 | M | Lumbar paraspinal muscles | LBP | Acupuncturist | Recovered (6wk) |
| Soley 2006 [27] | USA | 64 | M | Hip pain | Pseudomonas aeruginosa | Hip, thigh | Recovered (6wk) |
| Simmons 2006 [28] | Korea | 64 | F | Left arm | Cellulitis and necrotizing fasciitis | LBP | Recovered (6wk) |
| Morgan 2008 [29] | USA | 79 | F | LBP | Staphylococcus aureus | LBP | Recovered (6wk) |
| Lee 2008 [30] | Korea | 25 | F | LBP | Cellulitis and necrotizing fasciitis | LBP | Recovered (6wk) |
| Huang 2008 [31] | Taiwan | 24 | M | Knee | Acupuncture parlor | LBP | Recovered (6wk) |
| Jeong 2009 [32] | Korea | 22 | F | Weight loss | Pseudomonas aeruginosa | LBP | Recovered (6wk) |
| Hwang 2008 [33] | Korea | 25 | F | LBP | Cellulitis and necrotizing fasciitis | LBP | Recovered (6wk) |
| Wu 2009 [34] | Taiwan | 12 | M | Neurological sequelae of encephalitis | LBP | Acupuncturist | Recovered (6wk) |
| Morgan 2008 [35] | USA | 16 | F | Weight loss | Acupuncture parlor | LBP | Recovered (6wk) |
| Huang 2008 [36] | Taiwan | 79 | M | LBP | Cellulitis and necrotizing fasciitis | LBP | Recovered (6wk) |
| Hwang 2008 [37] | Korea | 69 | M | LBP | Necrotizing fasciitis | LBP | Recovered (6wk) |

**Table 2**: Infections associated with acupuncture (48 cases).
| First author/year (references) | Country  | Cases age/sex | Disease treated | Punctured site | Diagnosis | Practitioner | Followup time |
|--------------------------------|----------|---------------|----------------|---------------|-----------|--------------|---------------|
| Woo 2009 [38]                 | HK       | 43/F          | Knee pain      | Knee          | MRSA      | Not specified| Recovered (3 mo) |
| Ogasawara 2009 [39]           | Japan    | 50/F          | LBP            | Lower back    | Septic arthritis (MRSA) | Not specified | Recovered (70 d) |
| Guevara-Patiño 2010 [40]      | Venezuela| 23/F          | Not stated     | Not stated    | NTM       | Not specified| Recovered (6 mo) |
| Nakajima 2010 [41]            | Japan    | 60/F          | Knee pain      | Needles embedded at knee | Enterococcus faecalis knee infection | Not specified | Recovered (1 y) |
| Winter 2010 [42]              | USA      | 21/F          | Obesity        | Auricular     | Auricular cellulitis | Acupuncturist | Recovered (2 d) |
| Kim 2010 [43]                 | Korea    | 53/F          | LBP            | Lower back    | Auricular cellulitis | Acupuncturist | Recovered (1 wk) |
| Cho 2010 [44]                 | Korea    | 77/M          | Not stated     | Back and abdomen | Cutaneous tuberculosis infection | Illegal treatment | Recovered (1 y) |
|                                |          | 75/F          | Not stated     | Back and thigh | Cutaneous tuberculosis infection | Illegal treatment | Recovered (9 mo) |
| Kim 2010 [7]                  | Korea    | 72/F          | Not stated     | Back, shoulder, and right thigh | Cutaneous tuberculosis infection | Illegal treatment | Recovered (9 mo) |
| Macuha 2010 [45]              | USA      | 84/M          | Osteoarthritis | Left groin     | Necrotizing fasciitis | Not specified | Recovered (2 mo) |
| Buckley 2011 [46]             | UK       | 15/M          | Eczema         | Around the knee | Staphylococcus aureus endocarditis | Not specified | Recovered (3 mo) |
| Kuo 2011 [47]                 | Taiwan   | 57/M          | LBP            | Bilateral paraspinal muscles | MRSA | Not specified | Recovered (2 mo) |
| Castro-Silva 2011 [48]        | Brazil   | 59/M          | Ankle pain     | Limb          | Mycobacterium haemophilum infection | Not specified | Recovered (4 mo) |
| Hsieh 2011 [49]               | Taiwan   | 44/F          | Calf pain      | Calf          | Necrotizing fasciitis | TCM doctor | Recovered (21 d) |

MRSA: methicillin-resistant *Staphylococcus aureus* infection.
NTM: nontuberculous mycobacterial skin infection.
*
Acupuncture points.
Table 3: Infectious outbreaks associated with acupuncture (191 cases).

| First author/year (references) | Country | Cases | Diagnosis                          | Practitioner                  | Followup time |
|--------------------------------|---------|-------|------------------------------------|-------------------------------|---------------|
| Woo 2002 [50]                 | HK      | 4     | Alcohol-resistant mycobacteria     | Not specified                 | Recovered     |
| Tang 2006 [51]                | Canada  | 32    | Mycobacteriosis                    | Acupuncturist                 | Recovered     |
| Song 2006 [52]                | Korea   | 40    | Mycobacteriosis                    | Oriental medical clinic       | Recovered     |
| Murray 2008 [53]              | Australia | 6    | MRSA                               | Acupuncturist                 | Recovered     |
| Koh 2010 [54]                 | Korea   | 109   | Mycobacteriosis                    | Acupuncturist                 | Recovered     |

Table 4: Pneumothoraxes associated with acupuncture (13 cases).

| First author /year (reference) | Country | Cases age/sex | Disease treated                  | Punctured site                  | Practitioner                      | Followup |
|--------------------------------|---------|---------------|----------------------------------|---------------------------------|-----------------------------------|----------|
| Kao [58]                       | Taiwan  | 28/F          | Back pain                        | Thoracic spine bilaterally      | Not specified                     | Recovered (2d) |
| Leung 2002 [59]                | HK      | 70/F          | Asthma                           | Thoracic spine bilaterally      | Acupuncturist                     | Not stated |
| Iwadate 2003 [60]              | Japan   | 72/F          | Stiff neck                       | Thoracic cavity                 | Acupuncture clinic                | Death    |
| Peuker 2004 [61]               | Germany | 38/F          | Breathing problem                | Points at chest and upper back (LU1 and BL13) | Medical acupuncturist | Recovered (1 wk) |
| Saifelddeen 2004 [62]          | UK      | 31/M          | Shoulder pain                    | Right scapular region           | Not specified                     | Recovered (1 wk) |
| Lee 2005 [63]                  | HK      | 36/F          | Back pain                        | Upper back                      | Registered TCM practitioner       | Recovered (5 d) |
| Chaufe 2006 [64]               | USA     | 27/M          | Upper back pain                  | Upper back (T2-8 levels)        | Not specified                     | Recovered (2 d) |
| Su 2007 [65]                   | Singapore | 52/F   | Chronic bronchitis               | Upper back (T3)                 | Not specified                     | Recovered (2 d) |
| Von Riedenauer 2007 [66]       | USA     | 25/M          | Shoulder pain                    | Migration of embedded needles   | Not specified                     | Recovered (1 wk) |
| Juss 2008 [67]                 | UK      | 50/F          | Neck and back pain               | Acupoints at upper back (BL13, BL14, BL15, and BL16) | Physiotherapist | Recovered (2 d) |
| Richter 2008 [68]              | New Zealand | 35/F | Back pain                        | Back region                     | Physiotherapist                   | Recovered (10 d) |
| Kennedy 2010 [69]              | USA     | 54/F          | Musculoskeletal pain             | Left side chest                 | Not specified                     | Recovered (?) |
| Inayama 2011 [70]              | Japan   | 37/F          | Not stated                       | Neck and upper back             | Acupuncturist                     | Recovered (12 d) |

HIV [6], *Listeria monocytogenes*-caused arthritis [31], and infections by *Enterococcus faecalis* [41] and *Pseudomonas* [32, 37]. Although most of the reports did not state possible cause of the infections, reusable needles were used in a few cases.

3.5. Acupuncture Complications: Organ and Tissue Injuries. Of 38 cases of organ or tissue injuries, 13 were pneumothoraces (Table 4); 9 were central nerve system injuries (Table 5); 4 were peripheral nerve injuries (Table 6); 5 were heart injuries (Table 7); 7 were other organ and tissue injuries (Table 8). The cases were distributed among ten countries: 10 from South Korea, 6 from the USA, 6 from Taiwan, 5 from Japan, 3 from the UK, 2 from Germany, 2 from Hong Kong, 1 from Austria, 1 from Iran, 1 from Singapore, and 1 from New Zealand. Although most papers did not report the training background of the practitioner, 3 cases were reportedly treated by individuals with no medical training or license [55–57].

3.6. Pneumothorax (Table 4). Of 13 cases of pneumothorax [58–70] associated with acupuncture, the USA reported 3, the UK 2, Hong Kong 2, Japan 2, Singapore 1, Germany 1, Taiwan 1, and New Zealand 1. Most of these were reported by emergency room physicians. The major patient complaints were dyspnea and chest pain; pneumothorax was confirmed by X-ray. All but one of the 13 patients recovered. A 72-year-old woman died 90 minutes after an acupuncture treatment; autopsy confirmed that the cause was needle penetration of the thoracic cavity [60].

3.7. Central Nervous System Injury (Table 5). There were nine cases of central nervous system injury, including five spinal cord injuries [55, 73–75, 77] and four of brain injury [56, 71, 72, 76].

Two of the spinal injuries were caused by migrating broken needles [55, 75]; the others were probably the result of needling too deeply. All patients recovered after treatment.

The brain injuries were an acute intracranial hemorrhage [71], an injury to the medulla oblongata [72], a subarachnoid hemorrhage [76], and an intracranial hemorrhage with cerebellar infarction [56]. Three were due to needle insertion; the medulla injury was caused by a broken needle. Three
### Table 5: Central nervous system injuries associated with acupuncture (9 cases).

| First author/year (reference) | Country | Cases age/sex | Disease treated | Punctured site | Complication | Onset after acupuncture | Practitioner | Followup |
|-------------------------------|---------|----------------|-----------------|----------------|--------------|--------------------------|-------------|----------|
| Choo 2000 [71] USA 44/M Neck pain | GV16 (neck) | Acute intracranial hemorrhage | Immediately | Not specified | Recovered (10 d) |
| Hama 2004 [72] Japan 70/M Not stated | Lumbar region | Medulla oblongata injury, left facial paresthesia | 3 wk | Not specified | Recovered (1 y) |
| Eftekhari 2005 [73] Iran 74/M LBP | | Epidural hematoma | Shortly | Not specified | Recovered (after surgery) |
| Chen 2006 [74] Taiwan 30/M Back pain | Upper back | Epidural haematoma | 1 h | Acupuncturist | Recovered (after surgery) |
| Ulloth 2007 [75] USA 52/M LBP | L1, L2, and L3 Vertebrae (embedded needles) | Cerebrospinal fluid fistula | 14 mo | Acupuncturist | Recovered (after surgery) |
| Liou 2007 [55] Taiwan 29/M Stiffness of neck | Epidural space at C2 level (a broken needle) | Spinal Cord Injury | 3 y | "Nonmedical practitioner" | Recovered (after surgery) |
| Tsukazaki 2008 [76] Japan 32/F Not stated | GV16 (neck) | Subarachnoid hemorrhage | 1 d | Oriental medicine clinic | Not stated |
| Lee 2011 [77] Korea 58/F Quadri- paesis neck pain | Neck | Cervical epidural hematoma | 1 h | Family physician | Recovered (8 wk) |
| Heo 2011 [56] Korea 65/M Not stated | Posterior neck | Intracranial hemorrhage and cerebellar infarction | 3 d | Unauthorized acupuncturist | Recovered (1 mo) |

### Table 6: Peripheral nerve injuries associated with acupuncture (4 cases).

| First author/year (reference) | Country | Cases age/sex | Disease treated | Punctured site | Complication | Onset after acupuncture | Practitioner | Followup |
|-------------------------------|---------|----------------|-----------------|----------------|--------------|--------------------------|-------------|----------|
| Sato 2003 [78] Japan 62/F Sciatica | Anterior of the leg | Peroneal nerve palsy | 1 d | Not specified | Recovered (4 mo) |
| Patrick 2005 [79] USA 63/F LBP | Low back | Injury of the L5 nerve root | 28 y | Not specified | Recovered (after surgery) |
| Rosted 2007 [80] UK 47/M TMD | ST6, ST7 (face) | Bell’s Palsy | 1 d | Not specified | Recovered (2 wk) |
| Lee 2008 [81] Korea 47/M Abdominal discomfort | PC5 & PC6 (forearm) | Median nerve neuropathy | Shortly | Oriental medicine practitioner | Recovered (1 y) |

### Table 7: Heart injuries associated with acupuncture (5 cases).

| First author/year (reference) | Country | Cases age/sex | Disease treated | Punctured site | Complication | Onset after acupuncture | Practitioner | Followup |
|-------------------------------|---------|----------------|-----------------|----------------|--------------|--------------------------|-------------|----------|
| Kirchgatterer 2000 [82] Austria 83/F Not stated | Sternum | Cardiac tamponade | 20 min | Experienced acupuncturist | Recovered (2 wk) |
| Park 2004 [83] Korea 49/F Shoulder pain | Shoulders and upper back | Cardiac tamponade | 2 h | Not specified | Recovered (after surgery) |
| Kim 2006 [84] Korea 70/M Chronic lung disease | Neck, chest, and abdomen (embed needles) | Right ventricular embolism | 1 y | Not specified | Not stated |
| Song 2010 [85] Korea 69/F Pain | Shoulders and neck (implanted needles) | Myocardium injury | 10 y | Traditional medicine practitioner | Unknown |
| Kim 2011 [57] Korea 54/f Myalgia and dyspepsia | Chest, abdomen | Hemopericardium | 30 min | Unauthorized acupuncturist | Recovered (6 d) |
patients recovered after treatment; outcome was not given for the fourth (Table 5).

3.8. Peripheral Nerve Injury (Table 6). Four reported cases of peripheral nerve injury were associated with acupuncture treatment [78–81], one each in Japan, Korea, the USA, and the UK. The injured nerves were the peroneal nerve via acupuncture point GB34 the median nerve via PC5 and PC6, the facial nerve via ST7 and ST8, and the L5 nerve root via a broken needle in the lumbar region. All patients recovered.

3.9. Heart Injury (Table 7). Five cases of heart injury include two of cardiac tamponade [82, 83], one of the hemopericardium [57], one ventricular embolism [84], and one myocardial injury [85]. Of these, two were due to the migration of embedded needles [83, 84] and two were due to needle insertion [57, 82]. Two were caused by an acupuncturist or TCM practitioner, and one by an “unauthorized acupuncturist” [57]. The status of two practitioners was unreported. Three patients recovered; outcome was not reported in the other two cases.

3.10. Other Organ and Tissue Injuries (Table 8). Seven cases of other organ and tissue injuries were found: a pseudoaneurysm of the abdominal aorta [86], a pseudoaneurysm of the popliteal artery [87], acute traumatic pancreatitis [88], an aortoduodenal fistula causing direct communication between the aorta and the GI tract [89], a rectus sheath hematoma [90], ear hematomas [91], and a popliteal arteriovenous fistula [92]. The patient with acute traumatic pancreatitis had been treated with 13 cm needles placed at three sites on the anterior abdominal wall. Abdominal computed tomography revealed small multiple gold acupuncture needles on the anterior abdominal wall and back muscles. The patient’s condition quickly improved with fasting and intravenous fluids [88]. One patient died [89].

3.11. Other Complications of Acupuncture. Seven other complications associated with acupuncture were reported (Table 9): bilateral hand edema [93], epithelioid granuloma at needling sites [94], pseudolymphoma [95], localized argyria [96], pustules [97], pancytopenia [98], and scars at needling sites [99]. The localized argyria and pancytopenia were caused by needles embedded 20 and 17 years earlier, respectively [96, 98], in a type of Japanese acupuncture reported in our previous review [5]. The epithelioid granulomas were caused by silicone coating on the needles [94]. The scars were due to a hot needle technique in which the needles were heated in fire before insertion [99].

3.12. Adverse Reactions Associated with Acupuncture. Ten cases of adverse reactions from acupuncture were found (Table 10): three of syncope from two reports [100, 101]; two of galactorrhea (spontaneous milk flow) [102, 103]; one of bilateral nystagmus [104]; one of pyoderma gangrenosum due to immune reaction, in which the tissue became necrotic and deep ulcers formed [105]; one of hepatotoxicity [106]; one of eruptive lichen planus [107]; one of spontaneous needle migration [108]. These unusual cases are uncommonly seen in regular acupuncture practice. The case report authors postulated that these AEs were likely caused by a rare physiological reaction to the acupuncture needle. For example, the case report of spontaneous needle movement involved the acupuncture needles having “spontaneously moved deeper as far as the hilt, travelling an extra depth of 5-10 mm,” which was observed repeatedly on the same patient. Although there was no resulting complicating in this case, the authors cautioned that this could have caused serious complications if the needles had been placed near a vital organ [108].

The syncope cases occurred immediately or several minutes after a first acupuncture treatment; the patients were sitting or semirecumbent during treatment [100, 101].

3.13. Complications Associated with Moxibustion. Four AEs associated with moxibustion were found (Table 11): bruising [109], burns and cellulitis [110], spinal epidural abscess [111], and large superficial basal cell carcinoma [112]. Of these, two were self-administered [111, 112]. An “untrained individual” performed the third [110]; there was no information on the fourth [109].

3.14. AEs Associated with Cupping. Ten AEs associated with cupping were found (Table 12): four from Turkey, three from Korea, two from Taiwan, and one from the UK. Most were minor: keloid scarring [113], burns [114, 115], and bullae [116, 117]. Several were serious: acquired hemophilia A [118], stroke 14 hours after cupping on the back and neck [119], factitious panniculitis [120], reversible cardiac hypertrophy [121], and iron deficiency anemia [122]. These last two cases involved cupping with bleeding [121, 122]. In six cases, there was no information on practitioner training; in the other four, treatment was self-administered.

4. Discussion

Our primary objective in reviewing case reports of AEs associated with acupuncture has been to identify individual cases and outbreaks of AEs and to analyze their possible causes, in order to minimize future acupuncture AEs and enhance safe practice within the profession. How do the objectives and results of this review fit in the context of other available literatures on the safety of acupuncture? Incidence rates for major AEs of acupuncture are best estimated from large prospective surveys of practitioners. Four recent surveys of acupuncture safety among regulated, qualified practitioners, two conducted in Germany [4, 123] and two in the United Kingdom [3, 124], confirm that serious adverse events after acupuncture are uncommon. Indeed, of these surveys, covering more than 3 million acupuncture treatments all together, there were no deaths or permanent disabilities, and all those with AEs fully recovered [125]. Thus, it can be concluded that acupuncture has a very low rate of AEs, when conducted among licensed, qualified practitioners in the West. Recent systematic reviews of RCTs of acupuncture [126–128], in which the acupuncture procedure is also
Table 8: Other organ or tissue injuries associated with acupuncture (7 cases).

| First author/year (reference) | Country | Cases age/sex | Disease treated | Punctured site | Complication | Onset after acupuncture | Practitioner | Followup |
|-------------------------------|---------|---------------|----------------|----------------|---------------|------------------------|--------------|---------|
| Kim 2002 [86] | Korea | 54/M | Abdominal pain | Back | Pseudoaneurysm of abdominal aorta | Immediately | OMD | Recovered (8 d) |
| Kao 2002 [87] | Taiwan | 61/F | Osteoarthritis | Knee | Pseudoaneurysm of the popliteal artery | 6 mo | Not specified | Recovered (in 1 y) |
| Uhm 2005 [88] | Korea | 42/F | Dyspepsia | Abdomen | Acute traumatic pancreatitis | 5 h | Acupuncture clinic | Recovered (4 d) |
| Chang 2005 [89] | Korea | 68/F | LBP | Abdomen | Aortoduodenal fistula | 2 wk | Not specified | Dead |
| Cheng 2005 [90] | Taiwan | 37/F | Weight loss | Abdomen | Rectus sheath hematoma | 4 h | Not specified | Recovered (1 mo) |
| Usichenko 2006 [91] | Germany | 78/M | Postoperative pain | Ear lobe (embedded needles) | Ear hematomas | 4 d | Not specified | Recovered with discoloration |
| Kuo 2010 [92] | Taiwan | 39/F | Knee soreness | Popliteal fossa | Popliteal arteriovenous fistula | Several years | Not specified | Discharged |

Table 9: Other complications associated with acupuncture (7 cases).

| First author/year (reference) | Country | Case age/sex | Disease treated | Puncture site | Complication | Followup time | Remarks |
|-------------------------------|---------|--------------|----------------|---------------|---------------|--------------|---------|
| McCartney 2000 [93] | UK | 52/M | LPB | L14 (Hand) | Bilateral hand edema | Recovered (in 8 wk) | No lab evidence of inflammation |
| Yanagihara 2000 [94] | Japan | 55/F | Shoulder pain and lumbago | Back, hip, neck, legs and arms | Epithelioid granuloma at needling sites | Improved | Caused by silicone coating on needles |
| Kim 2002 [95] | Korea | 37/F | Abdominal discomfort | Not state | Pseudolymphoma | Improved | CD-30 positive |
| Takeishi 2002 [96] | Japan | 66/F | Arthralgia | Extremities | Localized argyria | Not stated | Embedded silver needles 20 y earlier |
| Murray 2002 [97] | UK | 35/M | Tennis elbow | Arm | Pustules | Not stated | Pt has Behcet disease |
| Vassiou 2003 [98] | Greece | 67/F | LBP | Chest & abdomen | Pancytopenia | Not stated | Embedded needles 17 y earlier |
| Pigatto 2004 [99] | Italy | 36/F | Hyperthyroidism | St10 (neck) | Scars atneedling site | No improvement | “Hot needle” used |

Conducted under well-controlled conditions, also found no serious AEs associated with acupuncture [128], although one of these systematic reviews of RCTs separately examined case reports of AEs associated with acupuncture and had findings comparable to ours. However, any medical intervention has the potential to cause damage, particularly when administered by an untrained or unqualified practitioner, or in an unregulated setting. Our objective was thus to identify signals that might suggest the potential for AEs of acupuncture, when administered in specific settings, or when using specific acupuncture styles, and also to compare the patterns of AEs in the past 12 years with the patterns identified in the 35-year period covered by our first review. Comparing the new data with that of the previous review shows the emergence of some important new patterns, which may be relevant for future regulation and policy making. Although the majority of the AEs are still infections, the routes of infection have changed. Our present findings include 239 AEs from infection; 191 occurred in five outbreaks of bacterial infection caused by skin contact with unsterilized equipment and dirty towels, in unhygienic clinical settings. In our previous findings, hepatitis cross-infections from patient to patient due to reused needles (94 cases reported in four outbreaks) were the most frequent source of infection. Since the introduction of disposable needles, hepatitis infections have rarely been reported, which is an important achievement that has resulted from the greater regulation of acupuncture practice, particularly the requirement for disposable needle...
Table 10: Adverse reactions associated with acupuncture (10 cases).

| First author/year (reference) | Country | Case age/sex | Disease treated | Puncture sites | Adverse reactions | Remarks |
|------------------------------|---------|--------------|----------------|---------------|------------------|---------|
| Castro-Durán 2000 [105]      | Spain   | 48/F         | Arthralgia      | Not stated    | Pyoderma gangrenosum | Immune response |
| Jenner 2002 [102]            | UK      | 41/F         | Cancer pain     | Points at upper back | Galactorrhoea | Breast cancer |
| Cole 2002 [100]              | USA     | 25/M         | Healthy volunteer for a clinical study | ST36 (bilateral) | Convulsive syncope | Pt was sitting |
| Campbell 2005 [103]          | UK      | 32/F         | Foot pain       | Local points at foot | Galactorrhoea (left side) | Pt had no lactation prior to the tx |
| Kung 2005 [101]              | Taiwan  | 72/M         | Arm pain        | L11, TB5 (arm) | Syncope | Pt was sitting |
| Bradbury 2006 [104]          | UK      | 63/F         | Ankle pain      | GB34, B40 (leg & ankle) | Syncope | Pt was sitting |
| Smyth 2007 [108]             | Scotland| 55/M         | Back pain       | Back | Spontaneous needle movement | No complication |
| Hong 2008 [106]              | China   | 52/F         | Leg weakness    | ST36 (leg) | Hepatotoxicity | Pt was in menopause |
| Fleming 2011 [107]           | UK      | 41/F         | Back pain       | Lower back | Eruptive lichen planus | Immune response |

Table 11: Adverse events associated with moxibustion (4 cases).

| First author/year (reference) | Country | Case age/sex | Disease treated | Moxibustion site | Adverse events | Practitioner | Remarks |
|------------------------------|---------|--------------|----------------|------------------|----------------|--------------|---------|
| Fisman 2002 [109]            | Canada  | 38/M         | Not stated      | Abdomen          | Ecchymoses     | Not specified | Pt had a hx of liver disease | Recovered |
| Chau 2006 [110]              | USA     | 53/F         | Headache        | Leg and feet     | Cellulitis     | Untrained individual |         |
| Lee 2008 [111]               | Korea   | 78/F         | Pain            | Fingers          | Infection caused spinal epidural abscess | Self | Pt had diabetes |
| Yun 2009 [112]               | Korea   | 58/M         | Abdominal pain  | Abdomen          | Basal cell carcinoma | Self | Pt. self-treated for 10 y |

use. However, in recent years, bacterial infections, including MRSA and mycobacterium, have become pervasive in healthcare settings in general [129]. Such infections, a pressing concern for all medical practitioners, including acupuncturists, result from poor hygiene. Hygienic clinical settings, sterilized equipment, and clean supplies are critical for preventing future such infections.

Pneumothorax is still the most common organ and tissue injury. There were also cases of spinal cord injuries due to short, small needles embedded laterally along the spine in the Japanese practice known as okibari. The putative mechanism responsible for this AE is that the imbedded needles used in the Japanese okibari acupuncture technique could spontaneously migrate within the tissue, with some of them migrating to the spinal cord to cause spinal cord injury [130]. However, this AE has significantly decreased since our previous review, in which 11 cases due to this practice were found. In the present review, we found organ injuries mainly to be associated with faulty needle insertion. Heart injuries can be fatal, although no death was reported in the five cases we found. Acupuncture training programs must enhance student knowledge of anatomy at each acupuncture point. Supervised clinical internships must provide rigorous training in needle direction, depth of insertion with attention to the size of the patient, and methods of manipulation.

Three cases reported deaths attributed to acupuncture [8, 60, 89]. Two were due to organ injuries [60, 89], and one was due to infection [8]. Of the organ injury deaths, one case from Japan [60] reported that a 72-year-old woman died after bilateral tension pneumothorax following acupuncture. The finding of the autopsy also suggested the patient that may have been injured by the insertion of the needles into the lungs during the previous acupuncture treatments. The second organ injury death, from Korea, reported that a 68-year-old woman died of massive hematemesis resulting from aortoduodenal fistula. The autopsy showed an injury to the
### Table 12: Adverse events associated with cupping (10 cases).

| First author/year (reference) | Country | Case age/sex | Disease treated | Cupping site | Adverse events | Practitioner | Remarks |
|-------------------------------|---------|--------------|----------------|--------------|----------------|--------------|---------|
| Birol 2005 [113]              | Turkey  | 36/F         | Cough          | Back         | Keloid scar    | Not specified| Recovered (several days) |
| Kose 2006 [114]               | Turkey  | 30/M         | Back pain      | Back         | 10% burns at shoulder and back | Self | Recovered (11 d) |
| Tuncez 2006 [116]             | Turkey  | 57/F         | LBP            | Low Back     | Suction bullae | Not stated | Diabetic; cupping lasted 40 min |
| Weng 2008 [118]               | Taiwan  | 58/F         | Not stated     | Thigh        | Acquired hemophilia A | Not stated | Improved (1 wk) |
| Sohn 2008 [121]               | Korea   | 66/F         | Pain           | Not specified| Reversible cardiac hypertrophy | Self | Bloodletting with cupping >10 y, recovered (3 mo) |
| Lee 2008 [122]                | Korea   | 39/M         | Musculoskeletal pain | Back | Iron deficiency anemia | Not stated | Bloodletting with cupping Pt. fully recovered |
| Lin 2009 [117]                | Taiwan  | 55/M         | Not stated     | Back         | Bullae         | Not stated | Recovered (several wk) |
| Blunt 2010 [119]              | UK      | 55/M         | Not stated     | Back and neck| Hemorrhagic stroke (14 h later) | Not stated | May be due to stimulation of baroreceptor, neck area |
| Kulahci 2011 [115]            | Turkey  | 32/M         | Back pain      | Back         | Burns on back and shoulder | Mother | Recovered |
| Moon 2011 [120]               | Korea   | 56/F         | Neck and shoulder | Not stated | Factitious panniculitis | Self | Recovered (3 mo) |

Abdominal aorta, caused by a deep insertion with a 15 cm long acupuncture needle into the abdomen [89]. The third case was reported from Scotland in which a 69-year-old man died from an infection after acupuncture treatment at the thigh [8]. The patient was later found to have a preexisting pancytopenia (i.e., low white blood cell count), resulting in an increased susceptibility to infection. The case report author, who is also the practitioner, admitted that the patient’s skin at the acupuncture point was not cleaned prior to the needle insertion and later found local muscle infection which led to sepsicaemia. The patient died a few weeks later from a multiorgan failure. These three unfortunate death cases suggest that biomedical knowledge such as anatomy and microbiology is needed in order avoid organ injury and infection. Skin cleansing should also be required, particularly for those patients with immune compromised condition.

There were only a handful of cases reported by practitioners who performed the acupuncture [8, 100, 101, 103, 104, 108] including a death report [8]. The rest of the cases were reported by investigators who were not the acupuncturists who performed the treatment. Most cases of AEs did not report the qualification of the practitioner. We would suggest that future report on AEs of acupuncture should include the information on the training qualification of the practitioners and the procedure used for the treatment, such as whether or not clean needle techniques were used.

Acupuncture safety practice guidance or guidelines such as Clean Needle Technique (CNT) appear to have played a critical role in minimizing the number of AEs associated with acupuncture practice [129]. In the United States, CNT was first addressed by the National Certification Commission for Acupuncture and Oriental Medicine in 1984. This course is designed to train professional acupuncturists on safe practice procedures. Course content includes training on microbiology, infection control, skills of adequately setting up a sterile practice area (e.g., adequate use of disinfectant and sterile equipment), adequate needle insertion, and adequate handling of AEs associated with acupuncture [130]. CNT courses are now offered by the US Council of Colleges of Acupuncture and Oriental Medicine and required by the acupuncture licensing boards of each state; as a result, reported acupuncture AE incidents have significantly decreased in the United States.

In our previous review, about half of the 202 cases of AE that we identified were from the USA. However, as our present review shows, AE cases reported from the USA are now rare. Of the 308 cases we found, only 13 were from the United States, and out of 239 cases of infection, only 5 are from the United States. It should be noted that there were very few case reports of AEs from China included in this review, although acupuncture is widely practiced in China. We are aware that cases of AEs associated with acupuncture performed in China are likely to be reported in Chinese
language case reports, which are not reflected in the present review due to language limitation. We are currently preparing a separate review on AEs reported in China. In conclusion, although serious AEs associated with acupuncture are rare, acupuncture practice is not risk-free. Adequate regulation can even further minimize any risk. We recommend that not only adequate training in biomedical knowledge, such as anatomy and microbiology, but also safe and clean practice guidelines are necessary requirements and should continue to be enforced in countries such as the United States where they exist, and that countries without such guidelines should consider developing them in order to minimize acupuncture AEs.

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