Acupuncture for pediatric pain: The trend of evidence-based research

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ABSTRACT

Background and aim: Acupuncture is part of thousand years Traditional Chinese Medicine. There was promising evidence to support the efficacy of acupuncture in reducing postoperative surgery and dental pain, as well as chemotherapy-related nausea and vomiting. The US National Health Statistics Report indicated that there was significant increase in the use of acupuncture. Research on acupuncture has allowed for its integration into common adult pain practice. Acupuncture can also be utilized in pediatric patients.

Experimental procedure: We evaluate the evidence-based acupuncture for pediatric pain research from 2008 to 2017.

Results: and Conclusions: Acupuncture treatment is well supported to be effective treatment for pediatric procedural pain, infantile colic, adolescent pelvic pain, and headaches under specific intervention methods. There is increasing interest in using acupuncture and related techniques for pediatric pain management. However, the evidence-based randomized controlled trials using acupuncture for pediatric pain management is very limited. Further randomized controlled trial research in pediatric pain is urgently needed.

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1. Introduction

Acupuncture is part of Traditional Chinese Medicine (TCM) that has been practiced for over 2000 years. Clinicians specialized in TCM have been referenced to appear between 481 BCE and 403 BCE during the Warring States. The United States National Institutes of Health issued a Consensus Statement of Acupuncture, declaring there was promising evidence to support the efficacy of acupuncture in reducing postoperative surgery and dental pain, as well as chemotherapy-related nausea and vomiting.1 The panel also cited other pain conditions for which acupuncture may be effective, which included headache, menstrual cramps, tennis elbow, fibromyalgia, myofascial pain, osteoarthritis, lower back pain, and carpal tunnel syndrome. The National Health Statistics Report indicated that there was used by 1.5% of adults in 2012; and a small but significant linear increase in the use of acupuncture.2 Research on acupuncture has allowed for its integration into common adult pain practice. Acupuncture can also be useful in the care of pediatric patients less than 18-year-old. We evaluate evidence-based randomized controlled trials (RCT) acupuncture for pediatric pain research during a ten-year period from 2008 to 2017.

2. Methods

The following data base was searched: the electronic database of PubMed including Medline, The Cochrane Library, EMBASE, PsyclINFO (EBSCOhost), and Science Citation Index Expanded (Web of Science). We adopted a sensitive search strategy using the following combination of keywords: “Pediatrics”, “Children”, “Child”, “Adolescent”, “Pain”, “Pain Management”, “Acupuncture”, “Moxibustion”, and “Cupping.”

In addition, to avoid missing relevant articles, the references of all selected articles were screened for additional potentially eligible publications. All searches were performed up to from 2008 to 2017. The final selection of studies was based on specific inclusion and exclusion criteria. Studies were included for review if they were (1) prospective, (2) used a randomized study design, (3) there was access to the full report, (4) the study was related to pain, (5) valid and reliable measures were used, (7) subjects were followed over time, and (8) the article was published between 2008 and 2017.

Studies were excluded if: (1) the data were collected retrospectively, (2) the goal of the study was other than to determine the
effect of the treatment (3) only specific patient groups were targeted (e.g., neonate, adolescents, patients less than 18 years old), (4) the studies were not in English, or (5) the reference was related to a letter or meeting abstract. Thus, we excluded nonrandomized comparative studies, uncontrolled before-after studies, and descriptive time-series studies. Those references that were repeated or judged to be based on the same study were also excluded.

3. Results

A total of \( n = 598 \) unfiltered records were initially found through database searching (Fig. 1). \( n = 413 \) records were remaining after duplicate records were excluded. \( n = 285 \) records were excluded through preliminary screening, resulting in \( n = 128 \) records for review. The full-text articles were accessed and additionally screened for required criteria until \( n = 22 \) articles remained (Table 1).

Most of the selected research addressed procedure related pediatric pain (55%), infant colic pain (23%), adolescent pelvic pain (18%), and headache (5%). The majority of the research techniques utilized filiform needle for acupuncture treatment (50%), while the other techniques also included acupressure (23%), auricular acupuncture (23%), laser acupuncture (14%), magnetic acupressure, and electro stimulation of the acupuncture points. Eighteen out of twenty-two trials (82%) in pediatric pain management had positive results. Four out of twenty-two trials (18%) did not conclude acupuncture as a statically significant or effective comparative treatment. The four studies that found acupuncture ineffective included two studies on heel lancing in newborns and two studies on colic in infants.

4. Discussions

Most of the pediatric acupuncture related studies addressed procedure related pediatric pain, infant colic pain, adolescent pelvic pain, and headache. This report evaluates research in pediatric acupuncture and pain management, in which approximately 55% of the selected articles were related to procedural pediatric pain management. The procedural studies included infant heel lancing, tonsillectomy and dental-related, myringotomy tube surgery, kidney biopsy, ventipuncture, and endoscopic pre-procedural anxiety. Collectively, these studies researched how acupuncture could lead to the reduction of post-operative pain, emergence irritation, procedural time, and infantile crying.

The studies that considered the effectiveness of acupuncture treatment prior to heel lancing procedures of infants used either the Premature Infant Pain Profile (PIPP) or the Neonatal Infant Pain Score (NIPS) to measure the physiological, behavioral, or contextual effects on infants. The selected studies for acupuncture related to heel lancing in infants have found acupuncture of the EX-HN3 (Yinyang) points to decrease the pain scores and the time of crying, acupressure of the BL60 (Kunlun) and KI3 (Taiji) points to decrease the time of the procedure and crying, and acupuncture of the Cingulate Gyrus, Thalamus, Omega 2, Point Zero, and HT7 (Shenmen) auricular points to reduce pain scores. The selected studies that did not find acupuncture treatment effective for procedural pain related to heel lancing of infants have found acupuncture of EX-HN3 to be less effective than oral sucrose, and acupuncture of ST36, SP6, BL60, and KI3 to be less-effective than sucrose yet safe. A study of acupuncture treatment prior to tonsillectomies and adenoectomy concluded that the bilateral HT7 acupoints can prevent emergence agitation (retching, laryngospasm, and vomiting), lower pain scales, and shortened recovery time. A similar study of intraoperative tonsillectomies found acupuncture of LI4 (Hegu), ST36 (Zusanli), P6 (Neiguan), SJ5 (Waiguan), KI6 (Zhaoohai), HT7 (Shenmen), and acupuncture of Cingulate, Master Cerebral, and Tonsil acupuncture points to reduce post-operative pain and lead to earlier oral intake.

The selected articles that researched pediatric tonsillectomies and dental procedures reached a consensus that acupuncture can be an effective treatment in children between the ages of 2–12 years old. A study focused on pre-operative needle acupuncture before local anesthesia dental procedures of the bilateral LI4 acupuncture points resulted in lower pain scores, lower heart rates, and increased satisfaction of patients and family members.

Heel lancing and tonsillectomies with dental procedures are the most common topics in pain management procedures in the selected random controlled trials in pediatric acupuncture, however there are several other independent topics that have found acupuncture to be effective for procedural pediatric pain. Pre-procedural anxiety related to endoscopic procedures has been shown to be reduced in ages 8–17 years old by EX-HN3 (Yintang), or “Extra-1”. Post-operative pain and emergence agitation have been shown to be reduced without adverse side effects in ages 1–6 years old with acupuncture performed bilaterally to LI4 (Hegu) and HT7 (Shenmen) prior to bilateral myringotomy tympanostomy tube insertion. Post-procedural pain in ages 7–26 years old has shown to be reduced in percutaneous kidney biopsies with acupuncture of GB25, BL52, BL51, BL22, and BL 23 bilaterally performed pre-operatively. Acupressure of EX-HN3 and P8 (Laogong) in ages 6–12 years old has been shown to effectively lower pain comparable to topical anesthesia cream.

4.1. Infantile colic

Our report evaluates RCT studies in pediatric acupuncture and
pain management, in which approximately 23% of the selected articles are related to infantile colic. In this ten-year period of research, there is a mixed consensus of the effectiveness of acupuncture treatment for infantile colic. The studies that have found acupuncture significant in treating colic have used acupuncture of the LI4 acupuncture point. These study interventions involved inserting the needles for 2–30 s intervals with 4–6 treatment over 2–3 weeks. Through diaries and questionnaires completed by the infants' parents, these treatments were found to be effective in decreasing the intensity and amount of time infants spent crying with no major side effects. In the opposition, acupuncture of LI4 for 6 treatments over 3 weeks for 2's internals was found to have no major impact on stool, sleep, or eating patterns in infants with colic. This study was unable to rule out minor effects from acupuncture. The other study that did not find acupuncture statistically significant in the treatment of colic had used needle acupuncture bilaterally on acupuncture point ST36 for 30 s without manipulation for 3 days of treatment.

### 4.2. Adolescent pelvic pain

There is evidence-based research through RCTs that supports acupuncture can be effective in the treatment of adolescent pelvic pain related to endometriosis and dysmenorrhea. Acupuncture with sixteen treatments over eight weeks with 8–12 acupoints focused on Extraordinary and Divergent acupuncture channels

### Table 1

| Authors            | Age Range | No. | Diagnosis           | Study Type | Conclusions                                                                 |
|--------------------|-----------|-----|---------------------|------------|-----------------------------------------------------------------------------|
| Hulth et al., 2008 | Mean age = 6 weeks | 40  | Colic pain         | Two-arm RCT | Four treatments with light needling on LI4 acupuncture points may alleviate crying and pain related behavior without any noted side effects. |
| Wayne et al., 2008 | Adolescents | 18  | Endometriosis      | Two-arm RCT | Acupuncture may be an effective, safe, and well-tolerated adjunct therapy for endometriosis-related pelvic pain in adolescents. |
| Wang et al., 2008  | 8–17 year old | 42  | Procedure anxiety  | Two-arm RCT | Acupuncture head treatment at Extra-1 acupoint reduces pre-procedural anxiety in children. |
| Gottschling et al., 2008 | Mean age = 12.3 years | 43  | Headache          | Two-arm RCT | Active laser acupuncture is better than placebo and can provide a significant benefit for children with headache. |
| Lin et al., 2009   | 1–6 year old | 60  | Myringotomy tube surgery | Two-arm RCT | Acupuncture treatment may be effective in diminishing both pain and emergence agitation in children after bilateral myringotomy tube insertion without adverse effects. |
| Chen et al., 2010  | Adolescents | 134 | Menstrual distress | Four-arm RCT | Acupuncture is an effective and safe non-pharmacologic strategy for the treatment of primary dysmenorrhea. |
| Landgren et al., 2010 | 2–8 weeks | 81  | Colic pain        | Two-arm RCT | Minimal acupuncture at LI4 acupuncture points shortened the duration and reduced the intensity of crying in infants with colic. |
| Ecevit et al., 2011 | Preterm babies | 10  | Heel pricks       | Randomized crossover | Acupuncture is an effective method for the treatment of pain in neonates. |
| Landgren et al., 2011 | 2–8 weeks | 90  | Colic pain        | Two-arm RCT | Minimal acupuncture had no major effect on feeding, stooling and sleep, although a minor effect on stooling and sleep cannot be ruled out. |
| Acar et al., 2011  | 2–8 year old | 50  | Emergence agitation after tonsillectomy and/or adenoidectomy | Two-arm RCT | Application of capiscum plasters on HT7 acupoints offers a valuable choice in the prevention of EA in children. |
| Skjeie et al., 2013 | Infants | 90  | Colic pain        | Two-arm RCT | Acupuncture treatment at ST36 acupuncture points for infantile colic showed no statistically significant or clinically relevant effect. |
| Yeh et al., 2013   | Adolescents | 113 | Dysmenorrhea      | Two-arm RCT | Auricular acupuncture relieves menstrual pain and distress in adolescents. |
| Abbasoglu et al., 2015 | Term newborns | 42  | Heel lancing      | Two-arm RCT | Laser acupuncture at the Yintang acupuncture point before heel lancing is less effective than oral sucrose for reducing the discomfort of this procedure. |
| Abbasoglu et al., 2015 | Preterm infants | 32  | Heel lancing      | Two-arm RCT | Applying acupuncture at the BL60 and KI3 acupuncture points before heel lancing was associated with shorter procedural time and shorter duration of crying in preterm infants. |
| Tsao et al., 2015  | 3–12 year old | 59  | Post-Tonsillectomy pain | Two-arm RCT | Acupuncture group has significant improvements in pain control postoperatively and earlier oral intake. |
| Cha et al., 2016   | Adolescents | 91  | Dysmenorrhea      | Two-arm RCT | Auricular acupuncture therapy was an effective treatment for alleviating abdominal pain, back pain, and primary dysmenorrhea of female adolescents. |
| Mitchell et al., 2016 | Term neonates | 162 | Heel lancing      | Four-arm RCT | Noninvasive electrical stimulation at acupuncture points at 3.5 mA, 10 Hz is not effective in relieving pain during heel sticks in neonates. |
| Usichenko et al., 2016 | Mean age = 10 year old | 49  | Dental procedure  | Two-arm RCT | Acupuncture at LI4 acupuncture points reduces pain and autonomic distress in children during local anesthetic injection in dental procedures. |
| Chen et al., 2017  | Preterm infants | 40  | Heel pricks       | Two-arm RCT | Auricular noninvasive magnetic acupuncture is feasible in neonates and may reduce Premature Infant Pain Profile scores during heel pricks. |
| Landgren et al., 2017 | Infants | 147 | Colic pain        | Three-arm RCT | Acupuncture at LI4 acupuncture point appears to reduce crying in infants with colic safely. |
| Oates et al., 2017  | 7–26 year old | 69  | Procedure pain in kidney biopsy | Two-arm RCT | Adjunctive laser acupuncture significantly improved pain after pediatric percutaneous kidney biopsies. |
| Pour et al., 2017   | 6–12 year old | 120 | Venipuncture pain | Three-arm RCT | Acupressure at the Extra-1 (Yintang) and the PC8 (Laogong) was as effective as topical anesthesia cream in alleviating children's venipuncture pain. |
with electrical stimulation of auricular points has shown may be effective in treating endometriosis-related pelvic pain in adolescents. There is also evidence that different techniques of acupuncture can relieve dysmenorrhea and menstrual distress. Auricular acupressure of the Shenmen, Kidney, Liver, Internal Genitals, Central Rim, and Endocrine acupoints has been shown to be significantly more effective in relieving menstrual pain and distress than by sham acupressure. Additionally, acupressure on the acupoints Jagung, Sinmum, Gyogom, and Naebunbi has lowered adolescent abdominal pain, back pain, and primary dysmenorrhea.

Lastly, a comparative acupressure study of LI4 (Hegu) and SP6 (Sanyinjiao) matched points versus LI4 (Hegu) and ST36 (Zusanli) single points provides meaningful insight in choosing the most effective acupoint for treating menstrual distress. Chen et al. found acupressure resulted in LI4 and SP6 matched points effectively relieved pain, distress, and anxiety of menstruating adolescents. Alternatively, this study also found that single acupressure on the LI4 point resulted only in the relief of pain, and single acupressure on the ST36 acupoints resulted in no significant relief of menstrual symptoms.

4.3. Headache

There is a significant need for more random controlled studies in acupuncture for the treatment for headaches. One of the 22 qualifying research papers in this study focused on the treatment of pediatric headaches. Focused on children with an average age of 12.3 ± 2.6 years old, laser acupuncture was found to provide significant benefit for migraine and tension-type headaches. This research pursued different acupuncture points depending on the presenting headache symptoms. Frontal headaches lead to points LI4 (Hegu) and ST36 (Zusanli), lateral headaches lead to SJ6 (Zhi-gou) and GB34 (Yung Ling Quan), occipital headaches lead to SI3 (Hou Xi), BL60 (Kunlun), and holoccephalic pain lead to GV20 (Bai Hui). Body and auricular points were additionally pursued individually. This research found acupuncture to be safe, noninvasive, and lowered the severity and frequency of headaches.

5. Conclusions

Acupuncture treatment is well supported to be effective treatment for pediatric procedural pain, infantile colic, adolescent pelvic pain, and headaches under specific intervention methods. Because the studies reviewed were clinically heterogeneous in terms of treatment types, and outcome measures, pooling of the results was not possible. As a result, our analysis was generally qualitative rather than quantitative. It is the difference in application of acupuncture that will result in the variability of treatment effectiveness; not the intervention of acupuncture itself. However, studies that use similar intervention methods for the same conditions display consistency in results. Non-consensus in the effectiveness of acupuncture treatment can be traced to a difference in method.

Acupuncture has become an increasingly evident part of health delivering system in the Western medical society. There is increasing interest in using acupuncture and related techniques for pediatric pain management. However, this report indicates that the evidence-based RCT using acupuncture for pediatric pain management is very limited. Further extensive research to evaluate the value of integrating acupuncture in pediatric pain management is urgently needed and strongly encouraged.

Disclosures

Name: Yuan-Chi Lin, MD, MPH.

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Appendix A. Supplementary data

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