



Acupuncture in the Emergency Management of Painful Conditions

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Abstract

Purpose of Review A high percentage of patients present to the emergency department for management of painful conditions. It is in society's interest to provide pain relief without contributing to the ongoing opioid crisis.

Recent Findings Acupuncture is an ancient therapy dating from more than 4000 years. It has not historically been shown in rigorous duplicated studies to be effective in the management of acutely painful conditions. More recent literature has shown its promise in the treatment of a variety of defined and common complaints.

Summary Nonopioid treatment options for management of moderate to severe acute pain in the emergency department are limited. Recent reports and comparative studies utilizing acupuncture show promise for the emergency care of acute painful conditions.

Keywords Opioid crisis · Acupuncture · Pain management · Alternative medicine

Introduction

Acupuncture is well-known as Traditional Chinese Medicine (TCM) practice in which thin needles are inserted in key points of the body to relieve pain. The use of acupuncture dates from approximately 2600 BC, or at least 4000 years ago in China [1], and much of the rest of Asia over 1000 years ago. Sir William Osler recommended its use for low back pain [2]. The father of modern auricular acupuncture, the French physician Dr. Paul Nogier (1908–1996) described an auricular homunculus to explain how acupuncture performed on the external ear could be efficacious for pain in a variety of locations (see Fig. 2). As of 2012, over 1% of the population of the USA had employed acupuncture within the previous year [3].

Both the World Health Organization (WHO) and the National Institute of Health have recognized acupuncture as a safe and effective therapy for treatment of pain and discomfort [4, 5]. In fact, the WHO has listed more than 40 disorders which could benefit from acupuncture treatment [5, 6]. With the scourge of opiate abuse and addiction, alternatives to the use of narcotics for the management of acute and chronic pain have been sought. At the beginning of 2018, the Joint Commission implemented new revised pain management standards for accredited hospitals. This included provision of at least one non-pharmacological pain treatment modality, as well as strategies to decrease opioid use and to minimize risks associated with opioid use [7].

Case 1 A 23-year-old male with prior history of injection drug use, currently on suboxone therapy, presents with severe right knee pain after a fall. He slipped on ice the previous evening. X-rays are negative for fracture, but his knee is contused and he walks with a significant limp. His pain has not been relieved with acetaminophen and ibuprofen. He has a prior history of asthma and prescription opioid and heroin abuse. He consents to acupuncture therapy.

Acupuncture treatment included Battlefield Acupuncture applied to this right ear plus knee point. (Fig. 1) Korean Hand Therapy is performed using silver pellets corresponding to his right knee. Meridian points used: ST 36, ST 34, SP 9, SP 10, GB 34, LR 3, KI 3, with extraordinary meridians Foot Yang Ming, Chong Mo.

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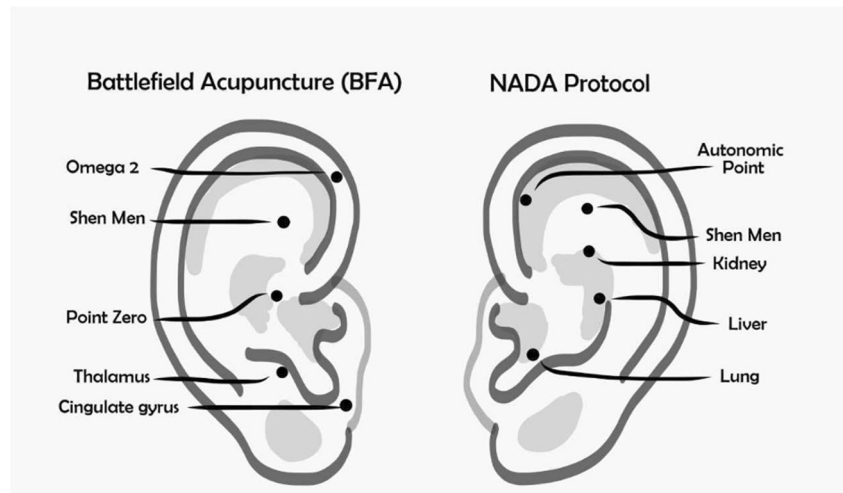
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Fig. 1 Sample points for auricular acupuncture



After treatment, his knee pain was described as 0 out of 10, and he was discharged on naproxen and acetaminophen.

Case 2 A 26-year-old female with prior history of fibromyalgia presented to the ED with complaint of throbbing headache, low back pain, left jaw pain, and sharp right posterior shoulder pain. She has obtained no relief with acetaminophen and cyclobenzaprine.

She denied recent trauma or strenuous physical activity. She agreed to acupuncture therapy.

Acupuncture treatment utilized extraordinary meridians Foot Yang Ming. Battlefield Acupuncture was employed on each ear, with meridian points ST 36, LI 4, LU 7, SP 6, and LR 3. The patient's shoulder, lower back pain, and headache resolved completely after the treatment. She was discharged home on acetaminophen.

Case 3 A 26-year-old female with prior history of migraine headaches presented to the ED with a severe throbbing headache of 48 h duration. She was seen in the ED yesterday and treated with a normal saline bolus, intravenous Toradol, metoclopramide, magnesium, and Benadryl. She underwent a head CT at the time, which was negative. The pain had recurred, over her right temple, eye, and forehead. There is no nuchal rigidity, and no focal neurologic findings. She is afebrile, and obtained minimal relief with Imitrex and Topamax prior to her visit. She agreed to acupuncture treatment.

Acupuncture treatment utilized extraordinary meridians Yang Wei Mo and Hand Jue Yin.

Auricular right ear acupuncture was employed, with corresponding scalp points forehead, temple, plus eye, Shenmen, Point Zero, LR point with gold ASP needles (Fig. 1).

Meridian points included PC 9, LR 3, LR 8, TH 2, GB 14, GV 20, GV 24.5 and Taiyang (an extra point), CV 12, and CV 6.

The patient fell asleep, and when she woke up her headache was gone.

The Importance of Pain Management Itself

Emergency physicians are confronted with a variety of painful conditions, and alleviating pain represents a health care priority and a sacred mission of providers. In the acute setting, analgesia ideally should be simple to administer, safe, rapidly effective, titratable, and relatively free of adverse effects. Non-steroidal anti-inflammatory medications have been associated with gastrointestinal, cardiopulmonary, and renal complications, among others. Acetaminophen has notably been associated with hepatic damage. Systemic administration of opioids carries a high risk of side effects, ranging from addiction to respiratory depression and death. The American College of Emergency Physicians and the American Academy of Emergency Medicine have published recommendations regarding improving pain management, reducing opioid use, and incorporating nonpharmacologic interventions [8, 9]. These alternative therapies include, but are not necessarily limited to: homeopathy, osteopathic manipulation, music therapy, meditation, hypnosis, and breathing therapy. Acupuncture falls into the category of direct intervention for pain, along with TENS and ultrasound.

Evidence for the Efficacy of Acupuncture in the Acute Setting

Acupuncture has been employed in a variety of clinical conditions, many of them chronic: low back pain, tension headache, migraine, neck pain, osteoarthritis, nausea and vomiting, acute pharyngitis, and fibromyalgia, to name a few [10].

One series of case reports demonstrated significant pain relief in a young woman with acute low back pain after heavy lifting, in which ibuprofen was ineffective and the patient declined oxycodone-acetaminophen. The darts were placed by a senior emergency medicine resident who was a novice to the procedure. Another in the series involved a 15-year-old

with low back pain, for whom ibuprofen was ineffective and the mother refused any opioid medication. Battlefield acupuncture inserted by an emergency physician reduced pain to a 4 out of 10, and the patient had minimal pain 1 week later. Two other cases, of carpal tunnel syndrome in a 19-year-old and appendicitis in a 9-year-old respectively, demonstrated significant pain relief. In the latter case, the needles were left in place for 90 min and removed just prior to transfer to the operating suite [11].

A larger study compared morphine sulfate and acupuncture in a series of patients who presented acutely with renal colic. A total of 119 patients were enrolled in the study, comparing pain intensity and timing of pain relief. The dose of morphine used was 0.1 mg/kg every 5 min until their pain score dropped by at least 50% of its baseline value. Analgesia was not only achieved faster in the acupuncture group—14 min versus 28 min for a 50% reduction in the pain score—but acupuncture was associated with a deeper analgesic effect than titrated morphine, with no major side effects. Insertion sites corresponded to the urinary bladder meridian points to the side of the pain. In this study, needles were inserted into the skin to a depth of 1–2 cm, until *de qi*, a feeling of numbness and tingling within the range of the acupuncture point, was achieved [12].

Another study conducted in Tunisia and published recently showed that acupuncture was more effective and faster in relieving pain than was intravenous morphine [13]. In the morphine group, 85 of 150 experienced adverse effects, most frequently dizziness, while 4 of 150 in the acupuncture group experienced minor adverse effects, chiefly needle breakage.

It has been used in the emergency department for low back pain, migraine, and ankle sprain, as noted in one randomized study of 270 participants in Australia. The primary outcome was pain at 1 h (T1). Acupuncture was compared with pharmacologic therapy, including the following drugs: tramadol, dextropropoxyphene, paracetamol (acetaminophen), diazepam, metoclopramide, ibuprofen, and paracetamol with codeine. Acupuncture was provided by either a registered Chinese medicine practitioner or an ED physician with medical acupuncture qualifications. In this report, acupuncture provided analgesia comparable to that of pharmacotherapy for back pain and ankle sprains, but not for migraine [14]. Notably, patients in the acupuncture group were at least as satisfied after 48 h than were those receiving pharmacotherapy.

Acupuncture was demonstrated to be effective in relieving pain during delivery and reduced the need for pain medication in another report [15]. Randomized controlled trials have noted acupuncture to be effective for neck pain, osteoarthritis, and headache [16]. Acupuncture for sickle cell painful occlusive crisis has been reported [17].

One recent meta-analysis from Australia reviewed the status of acupuncture in the emergency setting. Currently in Australia, acupuncture is delivered in the ED occasionally

by doctors and nurses whose level of training varies. Outcomes in this meta-analysis included measures of acupuncture versus sham treatment, acupuncture versus standard analgesia, and acupuncture as adjunct to standard care. Complicating the analysis was the fact that some reports utilized ear acupuncture, while some employed body acupuncture. There were 14 randomized controlled trials in the meta-analysis, comprising 1210 patients from 1991 to 2016. The most commonly studied conditions included limb fractures, migraine, mixed pain conditions, back/spinal pain, and renal colic. All scores favored acupuncture over sham therapy. Acupuncture was found to be non-inferior to standard analgesic care as regards pain outcomes and patient satisfaction. Two trials reported a reduction in analgesic use at 24 and 48 h; two did not. Between 52.5 and 99.2% of patients said that they would be happy to receive acupuncture again [18].

Another recent review and meta-analysis evaluated a variety of nonpharmacologic pain interventions and their efficacy in reducing pain in the emergency setting. Studies analyzing acupuncture efficacy included the following countries: Tunisia, the USA, Australia, Brazil, Taiwan, and Turkey. Overall, acupuncture was found to decrease pain immediately until ED discharge, and improve nausea and anxiety [19].

Implementation of Acupuncture in the Emergency Department: One Model

Studies dating from over 10 years ago have assessed the safety and effectiveness of acupuncture in the emergency setting [20, 21]. Armed with this data, and after integration of complementary therapies elsewhere in the hospital, one hospital in Minneapolis chose to implement acupuncture in the emergency setting by scheduling an acupuncturist for 15–30 h per week in the ED. The acupuncturist first started by shadowing providers, funded by a grant and by a philanthropic donor. Acupuncture referrals in the electronic health record were required to be entered by clinical providers. An acupuncturist licensed by the Minnesota Board of Medical Practice delivered the procedure. The acupuncturist was free to determine the acupuncture points, depth of needles, and needle stimulation for each patient. Of 279 patients approached by the acupuncturist, 248 received services. Sessions lasted on average 23 min. Mean pain scores decreased from 6.80 to approximately 4.3, on a scale from 0 to 10, a significant difference. Anxiety also was significantly diminished. This was a feasibility study which demonstrated a significant decline in pain and anxiety following acupuncture therapy [22]. One report cited a mean time for acupuncture administration to be only 6 min in 3 randomized control trials, although body acupuncture may delay usual emergency care by up to 30 min [18].

Acupuncture has been shown to reduce pain significantly in another pilot study conducted in the emergency setting, as

well as to diminish anxiety and stress. In this study, most treatments lasted 20–30 min, using from 8 to 15 needles. For this report, it was employed largely for headache, abdominal, and back pain [23].

Battlefield acupuncture (BFA) has been described as an auricular acupuncture, using up to 5 auricular acupuncture points per ear in sequence. (see Fig. 1) It was developed in 2001 to provide a rapid and safe pain relief for military men and women suffering from acute or chronic pain. After placing each needle, the patient is encouraged to move, ambulate, or at least to move their upper extremities. If the pain level is not significantly reduced, the BFA protocol is started in the other ear. The protocol has been taught to emergency physicians in a 1-h workshop using gold darts or traditional acupuncture needles [24]. A very recent report from the 2019 lay press advocates the use of acupuncture in pain management in the acutely injured [25].

The Procedure Itself: a Few Descriptors and a Bit of Language

It is outside the scope of this discussion to cover the details of acupuncture points. Sterile, single-use acupuncture needles are used, generally 0.16 mm, 0.18 mm, or 0.20 mm in diameter. Different styles of acupuncture exist: Traditional Chinese Medicine (TCM), auricular acupuncture, as in Battlefield Acupuncture, Chinese Scalp Acupuncture, Korean Hand Therapy, Balance Method, Yamamoto Scalp Acupuncture, Sports Acupuncture, Shonishin Japanese Pediatric Acupuncture and Master Tung, to name a few. *De qi*, a sensation of ache, numbness, or distention mentioned earlier, may be sought. Needle retention time ranges from seconds to some days [26].

The number of points used during acupuncture intervention in the ED may be as low as 2 or as high as 14. Points are labeled typically with letters and numbers: SI 3, LI 4, GV 20, TH 5, BL 60. Ear points include thalamus, cingulate, Shenmen, and point zero, and omega 2 [18]. (see Figs. 1 and 2) Traditional Chinese Medicine (TCM) recognizes 20 meridians, with branching sub-meridians. There are twelve primary meridians: LU for lung, SP for spleen, HT for heart, BL for bladder, GB for gall bladder, PC for pericardium, ST for stomach, LI for large intestine, KI for kidney, SI for small intestine, LV for liver, and TH for triple heater. The main meridians transport life energy, or *qi*. More than four hundred acupuncture points have been described. More advanced practice includes extra-ordinary meridians and distinct meridians. For example, Foot Yang Ming and Hand Jue Yin are Japanese and Chong Mo and Yang Wei Mo are Chinese extraordinary meridians, respectively. These were mentioned in the cases cited earlier. There are 8 Chinese and 4 Japanese extraordinary meridians.

Auricular acupuncture is of particular interest, since the external ear contains the highest concentration of acupuncture

points, with more than 200 cited, of which 43 auricular acupoints have been proven therapeutic according to the World Health Organization [27]. One study enrolled 19 pediatric patients with migraines. Two migraine lines were found on the ear, and gold semipermanent ear needles were placed, with patients monitored for 15 min. All subjects showed improvement or resolution of migraine headache, 14 of whom had complete resolution of symptoms. An electrical point finder was used in some cases. This device emits an acoustic alarm when a change in electrical resistance is detected, signifying a potentially active auricular acupoint (see Fig. 1) [28]. Typical abbreviations therefore could include BFA for Battlefield Acupuncture, or ATP for Auricular Trauma Protocol.

Proposed Mechanisms of Action

Multiple explanations have been proposed for the efficacy of acupuncture. These include the release of endogenous opioids [29], modulation of the adrenergic system [30], and the N-methyl-D-aspartate (NMDA) system [31].

As well, acupuncture has been demonstrated to modulate the inflammatory cascade, affecting the hypothalamic-pituitary axis and a number of cytokines. Some chemical mediators of inflammation which acupuncture acts on include substance P, vasoactive intestinal peptide, glutamate, nitric oxide, and gamma-amino butyric acid (GABA). There is evidence that acupuncture alters the metabolism of substrates involved in the facilitatory pathways of chronic pain, such as interleukin-1 and N-methyl-D-aspartate receptors. Human neuroimaging from functional MRI and PET scans show that stimulating acupuncture points moderates anti-nociceptive brain regions, including somatosensory areas, prefrontal and insular cortex, and hypothalamus [32].

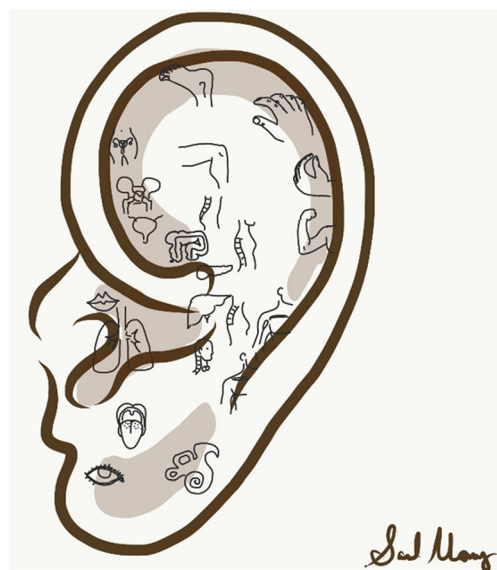


Fig. 2 Homunculus mapped onto the external ear

As for migraine, noted above for auricular acupuncture, it has been noted that the ear receives innervation from the auricular branch of the vagus nerve, the auriculotemporal branch of the trigeminal nerve, the great auricular nerve from the second and third cervical roots, and the facial and glossopharyngeal nerve. If vestibular migraine is related to neurogenic inflammation from activation of a trigeminal-vestibulocochlear reflex, then it has been postulated that trigeminal innervation of the ear is responsible for the auricular acupuncture effects of migraine headache treatment. Structure modulating trigeminal pain input has been demonstrated to be affected by acupuncture [28, 33].

Limitations of Acupuncture in the Emergency Setting

Acupuncture sessions in the non-emergency setting last typically from 15 min up to 1 h. An acupuncturist may employ approximately 10–15 points, leaving needles in place for 10–15 min. There may be as many as 400 total points employed in practice, with 20 meridians recognized by TCM and 14 main channels associated with specific organs. It is a complex system to learn. Acupuncture does not seem to cause an inordinate amount of excess time in the ED. However, most reports have not directly studied time spent [19•].

Acupuncture presents some difficulties in a hectic environment. Fewer acupuncture points and shorter treatment sessions may be required. Access to certain parts of the body may be limited by presenting acute conditions [22].

Insurance Coverage and Licensure: Reaching Mainstream Society

Acupuncture is used in 103 World Health Organization countries, with insurance coverage in 18 countries [10•, 34]. More recently, Blue Cross Blue Shield of Tennessee approved coverage of acupuncture, while removing oxycontin from its list of approved pain therapies [35]. Therefore, the insurance industry is already on record as approving coverage for acupuncture, especially as an alternative to narcotic usage. Whether Medicaid and Medicare follow suit remains to be seen.

It is notable that more than 20 years ago a National Institute of Health panel indicated that acupuncture could be useful as an adjunct treatment, or alternative therapy or management of addiction, stroke rehabilitation, osteoarthritis, low back pain, and carpal tunnel syndrome [36].

There are currently certifying agencies for acupuncture, most notably the National Certification Commission on Acupuncture and Oriental Medicine and the American Board of Medical Acupuncture. The American Academy of

Medical Acupuncture and the American College of Physicians have endorsed acupuncture as treatment for pain in general [32•].

There is mounting evidence that family physicians trained in acupuncture prescribe fewer “strong” opioids such as oxycodone or fentanyl than those without acupuncture training. A survey of American Family Practitioners who had completed either a 20-h course with an emphasis on auricular acupuncture, or a course in medical acupuncture spanning over 220 h of training on multiple forms of acupuncture noted that only 2% of those trained in auricular acupuncture and no physicians trained in medical acupuncture said they had written prescriptions for oxycodone or fentanyl for over 10 patients within the past month. While the American Academy of Family Physicians has no specific policy on acupuncture as of this writing, it has endorsed acupuncture as one of several nonpharmacologic treatment options for most patients with acute, subacute, or chronic low back pain [37].

Acupuncture: Debunking the Concept of Placebo Effect

It may seem counterintuitive to some that a non-pharmacologic treatment can possibly reduce pain. In case series, the placebo effect must be taken into consideration. However, acupuncture releases endogenous opioids in the body. Its analgesic effects are blocked by naloxone [38, 39].

This has been confirmed by others, who noted that there is evidence that acupuncture stimulation releases endorphins, and that effects of acupuncture can be blocked by opioid antagonists [40]. Functional magnetic resonance imaging has shown effects with acupuncture, with changes in the oxygenation signals in the limbic system [41•].

Adverse Effects or Complications of Acupuncture

Any use of needles carries with it the risk of blood-borne infections such as hepatitis or HIV, local bleeding, or soft tissue infection. Organ puncture, pneumothorax, or cardiac tamponade can result from penetrating injury. Serious adverse events appear to be exceedingly rare. Practitioners in this country are required to use disposable sterile needles.

In one review of 675 patients, the seven potentially significant adverse events were three needle breaks, and 4 syncopal episodes [18]. Hematoma, erysipelas, and needling pain are other potential complications.

Although outside of the scope of this discussion, thoracoabdominal acupuncture has been associated with significant and life-threatening complications. One study from Korea listed 10 cases of pneumothorax, including bilateral

pneumothorax, and 2 cases of pneumoperitoneum, one of which required emergency total colectomy. Spinal cord injury and cardiac tamponade have also been reported. Notably, in that country, only Korean Medicine doctors, with different training from medical doctors, have been permitted to perform acupuncture treatment [42]. Long acupuncture needles- up to 15 cm- have been associated with acute traumatic pancreatitis and injury to the abdominal aorta. Whether some complications may be avoided with specific training and precise guidance on the depth, direction, and angle of needle insertion is unclear [43, 44].

Conclusions

Acupuncture is an ancient treatment modality. It has been utilized for literally thousands of years. Its role in terms of pain relief in the emergency management of painful conditions is still being elucidated. Technology has shown that the salutary effects of acupuncture are demonstrable objectively. Respiratory depression, gastrointestinal side disorders, and hypotension, widely reported with the use of narcotics, are nearly nonexistent with acupuncture. There is increasing evidence demonstrating that acupuncture reduces narcotic use. Although literature is increasing, there is a lack of high-quality evidence in Western literature that acupuncture, as an adjunct to usual care, is beneficial in managing pain and anxiety in the emergency setting. Acupuncture may be a suitable alternative when concerns for analgesic drug side effects are significant. It has a distinct advantage of being low risk and low cost. Randomized controlled trials with rigorous designs are welcomed.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

Papers of particular interest, published recently, have been highlighted as:

- Of importance

1. Wu JN. A Short history of acupuncture. *J Altern Complement Med*. 1996;2:19–21.
2. Veith I. Sir William Osler- acupuncturist. *Bull NY Acad Med*. 1975;51:393–9.

3. Clarke TC, Black LI, Stussman BJ, et al. Trends in the use of complementary health approaches among adults: United States 2002–2012. *National Health Statistics Report*. 2015.
4. NIH Consensus Conference. Acupuncture. *JAMA*. 1997;280:1518–24.
5. World Health Organization. Viewpoint on acupuncture. Geneva, Switzerland. World Health Organization 1979
6. Han JS. Acupuncture analgesia: areas of consensus and controversy. *Pain*. 2011;152:S41–8.
7. Pain management. The Joint Commission 2019
8. Cantrill SV, Brown MD, Carlisle RJ, et al. Clinical policy: critical issues in the prescribing of opioids for adult patients in the emergency department. *Ann Emerg Med*. 2012;60:499–525.
9. Motov S, Strayer R, Hayes B, et al. AAEM white paper on acute pain management in the emergency department. *American Academy of Emergency Medicine*, 2017. Available at: <http://www.aaem.org/UserFiles/file/WhitePaperAcutePainManaginED102417.pdf> Accessed Feb 13, 2019
10. Chia KL, Lam RPK, Lam CK, Tsui SH. Acupuncture in the emergency department: a systematic review of randomized clinical trials. *Acupunct Med*. 2018;36:183–92 **This is an excellent review of randomized clinical trials of acupuncture. This is especially topical, since acupuncture is not part of traditional western medicine, and may not be accepted by many into their clinical practice because of lack of evidence.**
11. Tsai SL, Fox LM, Murakami M, Tsung JW. Auricular acupuncture in emergency department treatment of acute pain. *Ann Emerg Med*. 2016;68(5):583–5.
12. Beltaief K, Grissa MH, Msolli MA, et al. Acupuncture versus titrated morphine in acute renal colic: a randomized controlled trial. *J Pain Res*. 2018;11:33–341.
13. Grissa MH, Baccouche H, Boubaker H, et al. Acupuncture vs intravenous morphine in the management of acute pain. *Am J Emerg Med*. 2016;34(11):2112–6.
14. Cohen MM, Smit D, Andrianopoulos N, et al. Acupuncture for analgesia in the emergency department: a multicenter, randomized equivalence and non-inferiority trial. *MJA*. 2017;206(11):494–9.
15. Borup L, Wurlitzer W, Hedegaard M, et al. Acupuncture as pain relief during delivery: a randomized controlled trial. *Birth*. 2009;36:5–12.
16. Vickers AJ, Cronin AM, Maschino AC, et al. Acupuncture for chronic pain: Individual patient data meta-analysis. *Arch Intern Med*. 2012;172:1444–53.
17. Tsai SL, McDaniel D, Taromina K, et al. Acupuncture for sickle cell pain management in a pediatric emergency department, hematology clinic and inpatient unit. *Med Acupunct*. 2015;27:510–4.
18. Jan AJ, Aldridge ES, Rogers IR, et al. Does acupuncture have a role in providing analgesia in the emergency setting? A systematic review and meta-analysis. *Emerg Med Australas*. 2017;29:490–8.
19. Sakamoto JT, Ward HB, Vissoci JRN, Eucker SA. Are nonpharmacologic pain interventions effective at reducing pain in adult patients visiting the emergency department? A systematic review and meta-analysis. *Acad Emerg Med*. 2018;25:940–57 **This is an overview and meta-analysis of all non-pharmacologic pain interventions in the emergency setting, including acupuncture.**
20. Harkin C, Parker R. A prospective, randomized control trial of acupuncture for select common conditions within the emergency department. *J Chines Med*. 2007;8:45–52.
21. Arnold AA, Ross BE, Silka PA. Efficacy and feasibility of acupuncture for patients in the ED with acute, nonpenetrating musculoskeletal injury of the extremities. *Am J Emerg Med*. 2009;27(3):280–4.
22. Reinstein AS, Erickson LO, Griffin KH, et al. Acceptability, adaptation, and clinical outcomes of acupuncture provided in the emergency department: a retrospective pilot study. *Pain Med*. 2017;18:169–78.

23. Burns J, Jackson. Academy of Integrative pain management, inaugural global pain clinician summit 2018, November 9, 2018. Poster presentation
24. Niemtow R, Belard JL, Nogier R. Battlefield acupuncture in the US military: a pain-reduction model for NATO. *Med Acupunct*. 2015;27:344–8.
25. <https://www.ksat.com/health/battlefield-acupuncture-reduces-opioid-use-for-civilians> Accessed March 3, 2019
26. Goertz CDM, Niemtow R, Burns SM, et al. Auricular acupuncture in the treatment of acute pain syndromes: a pilot study. *Mil Med*. 2006;171:1010–4.
27. WHO. A standard international acupuncture nomenclature: memorandum from a WHO meeting. *Bull World Health Organ*. 1990;68:165–9.
28. Graff DM, McDonald MJ. Auricular acupuncture for the treatment of pediatric migraines in the emergency department. *Pediatr Emerg Care*. 2016; www.pec-online.com Accessed February 13, 2019
29. Cao X. Scientific bases of acupuncture analgesia. *Acupunct Electrother Res*. 2002;27:1–14.
30. Kim SK, Park JH, Bae SJ, et al. Effects of electroacupuncture on cold allodynia in a rat model of neuropathic pain: mediation by spinal adrenergic and serotonergic receptors. *Exp Neurol*. 2005;195:430–6.
31. Sun RQ, Wang HC, Wan Y, et al. Suppression of neuropathic pain by peripheral electrical stimulation in rats: μ -opioid receptor and NMDA receptor implicated. *Exp Neurol*. 2004;187:23–9.
32. American Academy of Medical Acupuncture. Acupuncture: evidence based approach to the management of chronic back pain. Available at <https://www.military.com/military-report/Tricare-and-acupuncture.html> accessed Feb 28, 2019. **This is a state-of-the-art review of the management of a chronic painful condition, including evidence-based data.**
33. Espinoza-Sanchez JM, Lopez-Escamez JA. New insights into pathophysiology of vestibular migraine. *Front Neurol*. 2015;6:12.
34. World Health Organization. WHO traditional medicine strategy: 2014–2023. Geneva: WHO; 2013.
35. Michelle Corbet, Blue Cross Removes Oxycontin, adds acupuncture amid opioid crisis. *Daily Memphian* Dec 26, 2018
36. NIH Consensus Conference. Acupuncture. *JAMA* 1998 Nov 4; 280(17): 1518–1524
37. Family practitioners who learn acupuncture prescribe fewer opioids. Available at www.aafp.org/news/health-of-the-public/20190221acupuncture-opioids.html Accessed February 25, 2019
38. Cheng RS, Pomeranz BH. Electroacupuncture analgesia is mediated by stereospecific opiate receptors and is reversed by antagonists of type 1 receptors. *Life Sci*. 1980;26:631–9.
39. Mayer DJ, Price DD, Rafii A. Antagonism of acupuncture analgesia in man by the narcotic antagonist naloxone. *Brain Res*. 1977;121:368–72.
40. Han JS, Terenius L. Neurochemical basis for acupuncture analgesia. *Annu Rev Pharmacol Toxicol*. 2982(22):193.
41. Scheffold BE, Hsieh CL, Litscher G. Neuroimaging and neuromonitoring effects of electro and manual acupuncture on the central nervous system. *Evid Based Complement Alternat Med* 2015: 61742. **This article gives an overview of neuroimaging effects of acupuncture. This is particularly important in demonstrating that acupuncture produces measurable and objective changes which establish some scientific basis for its efficacy.**
42. Lee HJ, Kim Y-J, Kim WY. Safety concerns with thoracoabdominal acupuncture: experience at a tertiary-care emergency department. *Pain Med*. 2017;18:2504–8.
43. Chang SA, Kim YJ, Sohn DW, et al. Aortoduodenal fistula complicated by acupuncture. *Int J Cardiol*. 2005;104:241–2.
44. Uhm MS, Kim YS, Suh SC, et al. Acute pancreatitis induced by traditional acupuncture therapy. *Eur J Gastroenterol Hepatol*. 2005;17:675–7.

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