

# Acupuncture for Analgesia in the Emergency Department - A Literature Review

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## ABSTRACT

**Objectives** - Pain is a common complaint in the Emergency Department (ED) and its management currently relies heavily on pharmacologic treatment, but evidence suggests that nonpharmacologic interventions may be beneficial. The objective of this study is to test the hypothesis that acupuncture analgesia (AA) can be an effective modality in the ED that is at least equivalent to standard ED care such as pharmacological care such as opioids or Non-Steroidal Anti-inflammatory Drugs (NSAIDs). If AA is equivalent to standard ED care can its use also lead to lower ED pharmacological analgesic use? **Methods** - A review of the literature on all types of AA interventions in the ED with pain reduction as an objective was conducted. **Results** - Ten studies met the inclusion criteria for summary analysis (16 additional studies are included as they provide background information, context, and rationale). The type of pain most studied varied from sore throat to low back pain and acute non-penetrating injuries to the extremities. Most studies reported at least one improved outcome after acupuncture treatment. Of these, the majority reported significantly reduced pain compared to the control group when available but failed to demonstrate an impact on medication use. Most studies showed a high level of heterogeneity and bias. Further research is warranted to establish acupuncture as an evidence-based analgesia modality in the ED that is at least equivalent to standard ED pharmacological care. **Conclusion** - Acupuncture interventions may be effective for analgesia in the ED and particularly auricular acupuncture would seem to fit in the hectic environment of the ED. However more adequately and rigorously designed blinded Randomized Control Trials (RCTs) are necessary to further investigate and validate those claims. AA in the ED needs to be conducted along with a set of more defined and standardized parameters. Research methods need to be standardized regarding pain measurement, acupuncture protocols and methodology as studying AA in the ED is in its infancy. Methods also need to take into account demographic and operating environments worldwide. Finally, analgesic medication usage needs to be measured to evaluate the impact of acupuncture on opioid and NSAID use in the ED to adequately determine the public health impact of offering AA in the ED.

## I. INTRODUCTION

In March 1976 the U.S. Army Medical Research and Development Command published a report titled "Acupuncture in the Management of Injury and Operative Pain Under Field Conditions". This document reports the initial development of two experimental programs to allow the quantitative assessment of the feasibility of AA for inte-

gration into the present pain control armamentarium under clinical and especially field conditions. It was the first evidence-based study in the western world investigating the use of AA in emergency care. After two studies evaluating electro-acupuncture performed on animals, the authors concluded that "Acupuncture works!". It was only the start of a series of studies designed to assess the effectiveness of AA in emergency care. There was more to research.

Forty years later "Battlefield acupuncture: Opening the door for acupuncture in Department of Defense/Veterans Administration health care" was published and on May 1, 2019, a search for "Battlefield Acupuncture" (BFA) returned 91 papers on PubMed (2,530 entries on Google Scholar) underlining the interest for a standardized and easily deployable AA protocol. As often illustrated in the book "Extreme Medicine: How Exploration Transformed Medicine in the Twentieth Century" by Kevin Fong MD, medicine's new branches of progress and growth often have war and trauma roots. The word "triage" comes from Napoleon era battlefield victim care prioritization method after all.

Beyond the battlefield EDs become crowded primary care destinations and today's 'opioid crisis' has been granted national emergency status in the United States. Pain being the 5th vital sign, in conjunction with the overprescription of drugs, the consequences of oligoanalgesia can lead to misguided treatment plans, low patient satisfaction and needlessly elevated healthcare costs because of return visits to the ED or urgent care. Could pain be addressed with a more natural and non-addictive or harmful approach? Among the modalities that could be offered as a substitute for pharmacological AA stands as the most evidence-based immediately available choice. Acupuncture has been recommended as first-line non-pharmacological therapy by the FDA in coping with the opioid crisis. The Joint Commission has also mandated that hospitals provide non-pharmacological pain treatment modalities<sup>5</sup>.

Based on the hypothesis that AA is an efficacious modality in the ED the objectives of this study are to evaluate the current evidence and assess its effectiveness. Specifically, is acupuncture effective at reducing pain for non-life threatening conditions presenting in the ED and is it at least equivalent to standard pharmacological care. If acupuncture is efficacious for analgesia in the ED the significance of this study is that acupuncture could be favored compared to other analgesia modalities and may lead to decreased medication use in the ED. If AA is an evidence-based modality in the ED such a result could pave the way for increased private and

public funding to lower the use of opioids and NSAIDs. A review of the literature was conducted on all types of acupuncture interventions in the ED with pain reduction as a primary outcome and medication use as a secondary outcome.

## II. METHODOLOGY

The method and research approach for this study was to search online databases (PubMed, Google Scholar, EBSCO, Cochrane Database of Systematic Reviews - up to July 1 2019 since their inception) using the following Medical Subject Headings (MeSH) in Boolean searches: acupuncture, emergency, pain, analgesia, ER, urgent care, battlefield acupuncture, emergency department, ED, emergency room, trauma, accidents, acute pain, complementary medicine, alternative medicine (in various combinations). Studies were selected according to the following criteria: only peer-reviewed studies that had been completed. Studies that consisted of protocols, study designs or feasibility studies weren't selected. Pilot and prospective studies were included in the selection and only studies that covered analgesia were included. Case studies were excluded as were very small sample studies or animal studies.

A broad database search returned 63 articles with the keywords mentioned above. After a review parsing the articles through the selection criteria, nine articles remained (along with 16 articles for background and rationale information): three pilot studies, four systematic reviews / meta-analysis and two Randomized Control Trials (RCTs). The references and sources within the selected articles were also searched further as well as proceedings of relevant medical conferences and white papers. **Goertz et al<sup>7</sup>** was found in **Chia et al<sup>2</sup>** references and included in the selection and as a result, ten papers are included in this review (**Table 1**).

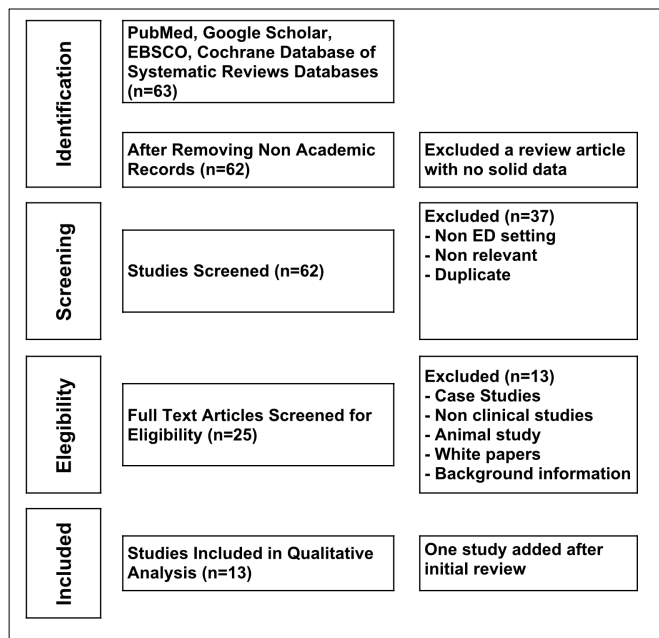


TABLE I  
STUDY SELECTION

One article (**Harkin et al, 2007**) found in **Chia et al<sup>2</sup>** (2018) wasn't available due to limited library resources. Finally, a qualitative summary of the articles meeting inclusion criteria was performed and findings were discussed and their implications for clinical practice and future research were examined.

## III. LITERATURE REVIEW

**Arnold et al<sup>1</sup>** performed an early pilot study (2009 - and the first study) involving 20 patients (out of 43 who were offered AA) at Cedars Sinai Medical Center ED in Los Angeles CA, a Level One trauma center (see Glossary) seeing 76,000 patients a year. The authors measured acupuncture-induced analgesia using a Visual Analog Scale (VAS) at 30 min intervals with a follow-up phone call 72 hours after patient discharge. Study results suggest that acupuncture may be an effective analgesic intervention for patients with acute non-penetrating musculoskeletal injury to the extremities. Acupuncture was administered by licensed acupuncturists who would apply a protocol based on the presentation. No difference in the Time in Department (TID) was reported. The inability to obtain VAS data from the historical non-acupuncture control group makes comparative analysis tentative at best (this would warrant incorporating fixed acupuncture points for like injury and the use of sham acupuncture). Also having three distinct acupuncturists may have led to differences in therapeutic approaches and acupuncture point selection (protocols were not reported in this study). This is a small pilot study that doesn't provide sufficient evidence AA is efficacious in the ED although the authors acknowledge there are promise and potential.

In a more recent study **Chia et al<sup>2</sup>** (2018) aimed at performing a systematic review of both English and Chinese randomized controlled trials: six RCTs - three in China (in Chinese), one in the US (**Goertz et al<sup>7</sup>**), one in Australia (**Harkin et al, 2007**) and one in Tunisia (**Grissa et al<sup>9</sup>**) the authors conclude that there isn't enough evidence to support or refute the use of AA in the ED either as stand-alone or as an adjunct treatment to standard ED care. VAS and Numerical Rating Scale (NRS) scores were assessed. Although for acute pain conditions acupuncture was found to be superior to sham acupuncture and more effective than intravenous morphine, the level of evidence is low and the quality of the studies insufficient to meet current best practices standards. This is the first systematic review to include Chinese language studies which for the most part were excluded due to bias and poor study design according to the authors. No specific protocols were identified.

In 2017, **Cohen et al<sup>3</sup>** focused their study on presentation in the EDs with acute low back pain (LBP), migraine or ankle sprain with a pain score on a 10-point Verbal Numerical Rating Scale (VNRS) of at least four. A relatively large sample of 1964 patients was assessed. Acupuncture alone was compared to acupuncture with pharmacotherapy and with pharmacotherapy alone. The effectiveness of acupuncture in providing acute analgesia for patients with low back pain and ankle sprain was comparable with that of pharmacotherapy but not for migraines. Acupuncture treatment protocols were designed and provided by certified acupuncturists (and unreported in the study). Finally, the

study emphasizes that pain in the department is not managed properly by any of the modalities. Other findings include the fact that patient satisfaction is not necessarily correlated with reduced pain scores. Also, patient satisfaction increases with acupuncture and time as opposed to pharmacological care. However, acupuncture patients were twice as likely to receive rescue analgesia (**pharmacological care - Table 2**).

	Ankle sprain	Lower back pain	Migraine
<b>First line therapy options</b>			
Diazepam (5 mg)		X	
Hartmann's solution(5% dextrose, 0.9% NaCl)	X	X	X
Metoclopramide (10-20 mg iv) or prochlorperazine (12.5 mg im) (if nausea and vomiting are significant)			X
Paracetamol (1 g)			X
Paracetamol (500 ms) with codeine (30 mg)	X	X	X
Tramadol (50-100 mg)	X	X	X
Dextropropoxyphene (32.5 mg) and paracetamol (325 mg)	X	X	X
Ibuprofen (400 mg), diclofenac (50 mg) or indomethacin (100 mg) as needed	X	X	X
<b>Second line therapy options (after one hour)</b>			
Morphine (2.5 mg iv, boluses)	X	X	X
Chlorpromazine (25 mg in 1000 mL normal saline iv)			X

im=intramuscular.iv= intravenous

TABLE 2  
STANDARD PHARMACOLOGICAL CARE

**Fox et al<sup>6</sup>** (2018) presented a pilot feasibility study involving 30 acute low back pain (LBP) civilian patients. The authors measured the efficacy of the Battlefield Ear Acupuncture (BFA) protocol (**Table 3**) for low back pain and concluded the protocol may be efficacious to improve LBP symptoms when combined with ED standard care. In BFA the practitioner places small needles on both ears and the needles are retained. The points are *Omega Two*, *Shen Men* (*Neurogate*), *Point Zero*, *Thalamus*, and *Cingulate Gyrus*. Based on this pilot study, it is recommended that further studies with larger, blinded, RCTs are undertaken. In particular, the authors emphasize the significance of offering a non-pharmacological approach in the context of the growing opioid crisis in the United States and the BFA protocol fits in the hectic combat-like environment of today's EDs - it also requires less training and isn't specific to the pain condition. Aiguilles Semi-permanentes (ASP) needles (SEDATELEC; Lyon, France - **Table 3**) were inserted and retained which might not be deployable in every state or country depending on local regulation (there could be an infection risk as needles are retained). Personnel administering the treatments were supervised by licensed acupuncturists. The pain measurements used were VAS and GUGT (Time to Get Up and Go Test).

**Goertz et al<sup>7</sup>** performed a pilot study in 2006 in a military hospital ED (Malcolm Grow Medical Center, Andrews Air Force Base, Maryland) and the authors concluded that auricular acupuncture with the insertion and retention of ASP needles at two points on the ear (*cingulate gyrus and thalamic nuclei* - **Table 3**) led to a decrease of 23% in perceived pain on NRS while patients were in the ED. No difference compared to standard care after 24 hours was reported and

further studies with larger samples were recommended. The goal of the study was to find ways to alleviate pain in military personnel to maintain readiness. Treatment was performed by 'medical acupuncturists' and the credentials and certifications of the practitioners are not detailed in the study.

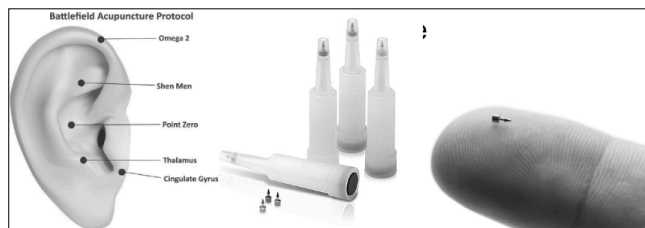


TABLE 3  
BATTLEFIELD ACUPUNCTURE

In 2016, with a 300 sample size study (150 for acupuncture) **Grissa et al<sup>9</sup>** provide evidence that AA is associated with faster results and fewer side effects compared to intravenous (IV) morphine. The research was conducted at a university hospital ED with 110,000 ED patients per year. Acupuncture is also found to be safer than IV morphine. This study is limited because pain was measured only in the department and the sham acupuncture group was not blinded and a placebo effect can be suspected especially in a population that is used to receive acupuncture ("young and healthy participants for whom acupuncture is an accepted practice"). Authors also recommend that other studies be performed in an international setting to evaluate demographics and cultural variability. Protocols applied were based on the book *Chinese Acupuncture and Moxibustion* (CAM, 1987, Foreign Language Press) and differed by presentation. Pain presentation specific protocols were defined for the study and local and distal acupuncture points were selected for each protocol. Among included studies, **Grissa et al<sup>9</sup>** is the only one reporting detailed protocols. Finally, the morphine group had significantly more abdominal pain and male patients while the acupuncture group had more low back pain patients as a result of the randomized patient allocation.

**Jan et al<sup>13</sup>** (2017) present one of the most extensive studies to date regarding AA in the ED as the authors searched seven databases and Google Scholar up to 31 July 2016 using MeSH descriptors for three topics concerning acupuncture, pain management, and emergency medicine. The sample size was 286 patients aggregate for meta-analysis and 458 patients for the systematic review. The authors concluded that AA in the ED may be effective and that it is non-inferior to selected analgesia medications (Opioids and NSAIDs). However, there is insufficient evidence as yet to show that acupuncture reduces analgesic medication usage. Also, protocols, clinical applications and, practitioner training need to be further investigated and clarified. Finally, significant study bias (practitioner and patient blinding) and heterogeneity were found in particular regarding patient and practitioner blinding. Acupuncture was also found to show low side effects. BFA was one protocol used as well as the following set of points: SI-3 *hou xi*, LI-4 *he gu*, GV-20 *bai hui*, PC-6 *nei guan*, TB-5 *wai guan*, GB-34 *yang ling quan*, GB-20 *feng chi*, ST-36 *zu san li*, UB-21 *wei shu* to UB-24 *qi hai shu*, UB-45 *yi xi* to UB-47 *hun men* and UB-60 *kun lun*.

Study	#	Year	Design	Size	Location	Population / Conditions	Intervention / Protocol	Pain Index	Secondary Outcomes	Results	Comments
<i>Arnold et al</i>	1	2009	Pilot	23 pts	CA, USA	Acute, Nonpenetrating Musculoskeletal Injury of Extremities	Acupuncture by LAc	VAS	TID, Patient satisfaction	Acupuncture can be an effective analgesic intervention for patients with acute injury to the extremities.	Small study - Further limiting comparison between the 2 groups was the inability to obtain VAS scores from the nonacupuncture group.
<i>Chia et al</i>	2	2018	Syst. Rev. of RCTs	Six RCTs w/ 651 pts included	Australia	Various Acute Pain in ED	Acupuncture by various crew	VAS / NRS	n/a	Insufficient evidence to support or refute the use of acupuncture in the ED	Heterogeneity of studies that are included is a limitation
<i>Cohen et al</i>	3	2017	A Multicentre, Randomised, Equivalence & Non-Inferiority Trial	1964 pts	Australia	Ankle Sprain, Migraine, LBP - VNRS ≥ 4	Acupuncture by LAc	VNRS	Rescue analgesia	Effectiveness of acupuncture in providing acute analgesia for patients with back pain and ankle sprain was comparable with that of pharmacotherapy.	Largest sample
<i>Fox et al</i>	6	2018	Pilot	30 pts	NY, USA	LBP	Auricular Acupuncture (BFA) with Standard Care - Retained ASP Needles - supervised by certified physician acupuncturist	NRS, GUCT	NRS, ROM, LOS, Adverse events	Protocol may be efficacious for LBP in the ED	Small sample size
<i>Goertz et al</i>	7	2006	Pilot	87 pts	Air Force Base ER	Military Base ED	Medical acupuncturists (BFA) - ASP needles - Auricular acupuncturist	NRS	N/A	23% in perceived pain on NRS while patients were in the ER. No difference vs standard care after 24 hrs	Richard Niemtzow among authors indicates possible bias in favor of BFA
<i>Grissa et al</i>	9	2016	Prospective randomized trial	300 (150 acu)	Tunisia	Moderate to severe acute onset pain with stable clinical conditions	Acupuncture	HR, VAS, SBP, DBP	Resolution time, adverse events	Acupuncture was associated with more effective and faster analgesia with better tolerance.	Acupuncture only evaluated in relation to pharmacotherapy
<i>Jan et al</i>	13	2017	Syst.Rev. Meta	458 and 286 for meta / 8 studies were retained	Multiple	ED pts / Primary: Pain / Secondary: medication use, patient satisfaction	Acupuncture & Auricular Acupuncture (BFA) - most by LAc - points in more than one study include: SI3, LI4, DU20, P6, SJ5, GB34, GB20, GB40, ST36, UB21-24, UB45-47, UB60	PS-10	Analgesia use, patient satisfaction, adverse effects, time-based outcomes, cost of consumables	Acupuncture is effective for analgesia in the ED it is non-inferior to selected analgesia medications - insufficient evidence that acupuncture reduces analgesic med usage - protocol needs research	Study bias and heterogeneity
<i>Jan et al</i>	14	2017	Syst.Rev. Meta	6 RCTs 2 OBS 458 pts (4 RCTs 258 pts for meta)	Multiple	Various	Auricular Acupuncture (BFA) - ASP Needles - Half of studies non-acupuncturists	PS-10	Medication usage, patient satisfaction, adverse effects, time-based outcomes and cost	Ear acupuncture has some limited evidence of effectiveness for acute pain in an emergency setting as a stand-alone treatment and as an adjunct treatment to standard emergency care.	Acupuncture performed by non acupuncturists in half of the studies
<i>Kim et al</i>	15	2013	Syst.Rev.	4 studies / 2 OBS / 2RCT / 42-100 size	Multiple	Acute pain syndromes, common acute conditions with a range of musculoskeletal and non-musculoskeletal symptoms and acute, non-penetrating injuries of the extremities	Acupuncture by licensed acupuncturist - Mixed protocols.	VAS / NRS	Adverse events	Current evidence is insufficient to make any recommendations concerning the use of acupuncture in the ED	Only studies with acupuncture AND standard ED care - sham not blind
<i>Liu et al</i>	18	2015	Pilo Cohort	60 ED Pts	Taiwan ED	Acute LBP	Acupuncture - LI4, L110, ST36, GB34, LV3	VAS / HRV	N/A	Acupuncture was associated immediate effect in reducing the pain of acute LBP safely	Taiwan study - Points used have no connection to CAM or Deadman (LI4, GB34 and ST36 okfor pain, LI10 for back pain)

TABLE 4

STUDIES SUMMARY

GUGT, Timed get up and go test; CAS, colored analog scale; CRP, C-reactive protein.; FPS-R, Faces Pain Scale-Revised; VAS, visual analog scale; WBC, white blood cell; HRV, heart rate variability; SBP, systolic blood pressure; DBP, diastolic blood pressure; LAc, licensed acupuncturist; RCT, randomized control trial; LBP, Low Back Pain; BL, bladder; CV: Ren Mai; DU: Du Mai; EP: extra point; GB: gallbladder; HT: heart; KI: kidney; LI: large intestine; LU: lung; LV: liver; PC: pericardium; SI: small intestine; SJ: triple energizer; SP: spleen; ST: stomach

With a more limited number of included studies and with also a higher heterogeneity (Eight RCTs) **Jan et al**<sup>14</sup> (2017) conclude that auricular acupuncture, either as stand-alone or as an adjunct modality, significantly reduced pain scores and has potential benefits for use in the ED. Although further studies are required, the most important conclusion of this review is that ear acupuncture has some limited evidence of effectiveness for acute pain in an emergency setting as a stand-alone treatment and as an adjunct treatment to standard emergency care. The authors recommend further study to determine if ear acupuncture influences medication use. Finally, four reviewed studies specified that the practitioner delivering the acupuncture utilized non-acupuncturists trained in the specific prescription alone which would indicate bias. BFA was the most commonly used technique.

In a 2013 systematic review **Kim et al**<sup>15</sup> examined the analgesic effect of acupuncture on patients with non-emergent and non-life threatening conditions, Four English databases were searched (MEDLINE, EMBASE, CENTRAL and, AMED). Out of 102 identified studies, only two RCTs and two uncontrolled observational studies were eligible. The article concludes that the current evidence is insufficient to make any recommendations concerning the use of AA in the ED. The effectiveness and safety, as well as the feasibility of acupuncture, should be tested in future RCTs. This article reviewed only articles where acupuncture was used in conjunction with “standard medical care” (pharmacological modalities) which precludes the evaluation of AA on its own compared to a standard ED care control group. It is also pointed out that ED environments differ per location and culture - also a valid point is that a single acupuncture session might not be clinically relevant, especially for chronic pain conditions. Less heterogeneity in terms of conditions treated is also warranted in further studies. Acupuncture was administered by certified acupuncturist and protocols were diverse, ranging from TCM style and auricular to Matsumoto style acupuncture (See Glossary) which is based on palpation hence very subjective. This study features **Goertz et al**<sup>5</sup> (2006) which didn't appear in my original search and was added later in this review. Harkin et al (2007) was also identified as a potential inclusion but the full text couldn't be obtained.

In a Chinese (Taiwan) study by **Liu et al**<sup>18</sup> in 2015 60 ED patients were divided into two groups (experimental 46 and control group 14). The authors measured VAS and Heart Rate Variability (HRV) as indicators of pain variability. The results show improvement in VAS but not in HR and the article concludes that acupuncture has potential as analgesia in the ED but that more research is needed. Patients were divided into groups based on their willingness to receive acupuncture treatment which proves to be a limitation of the study because acupuncture is common in Chinese society (Taiwan). Also, the study was not blind even with the sham acupuncture patches. The protocol used the following acupuncture points: LI-4 *he gu*, LI-10 *shou san li*, ST-36 *zu san li*, GB-34 *yang ling quan* and, LV-3 *tai chong*.

#### IV. RESULTS

Although numerous studies are investigating and supporting the use of AA as a non-pharmacological intervention,

the study of the role of acupuncture in the ED has been limited because it is difficult to design studies and implement quality trials in the hectic environment of the ED. In this review, most of the studies were published after 2013 (Out of ten included studies eight of them have been published after 2013 - **Table 5**) indicating that interest for acupuncture in the ED is relatively recent despite (or due to) the fact that BFA originated in 2001.

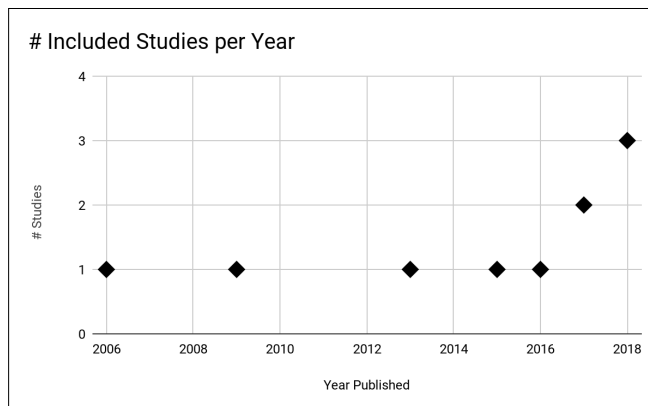


TABLE 5  
INCLUDED STUDIES PER YEAR

The scope of the included studies ranges from a large RCT with 1964 patients<sup>3</sup> to systematic reviews and meta-analysis with 258 to 651 patients<sup>2, 13, 14, 15</sup> to small size pilot studies (23 to 60 patients)<sup>1, 6, 7, 18</sup>. Pain reduction is the primary outcome of all studies and secondary outcomes range from patient satisfaction, adverse effects and comparison to standard ED care to time spent in the department. Reviewed studies are summarized in **Table 4**.

The results of the studies reviewed vary and are heterogeneous in terms of blinding, protocols, pain indices used and methodology. While a majority of studies recommend that more research must be undertaken to ascertain the efficacy of AA in the ED they agree and concede that it is at least non-inferior to standard ED care for a range of non-life-threatening injuries such as low back pain, ankle sprains and, abdominal pain.

The single large RCT<sup>3</sup> included concludes that acupuncture is comparable to pharmacological treatment for back pain and ankle sprains (but not for migraines) and that acupuncture is a viable modality for treating pain in the ED. It was found being more effective than intravenous morphine. The second-largest blind randomized trial<sup>9</sup> in this review involved 300 patients in a Tunisian hospital and also concludes that acupuncture is at least equivalent to pharmacological treatment in the ED. Both RCTs warrant more research to be performed.

Among the aggregate studies (systematic reviews and meta-analysis), one study<sup>2</sup> surveyed the most research worldwide (including Chinese language articles) and after examining the aggregate the authors concluded that the evidence is poor regarding the efficacy of AA in the ED and warrant for more studies. Although Chinese language articles were searched they were not included by the authors because of bias and poor study design (550 articles retrieved and only

three included). Heterogeneity and bias from underlying studies are highlighted in all aggregate studies and although efficacy from AA in the ED is deemed feasible more research is required and adequate and uniform parameters need to be clearly defined.

The pilot studies reviewed provide some promising evidence that AA is efficacious in the ED as they all report positive outcomes in their explorations. The sample sizes are small and they only constitute the first steps in defining parameters and researching the impact of acupuncture on primary and secondary outcomes.

Other aspects brought to the attention of the medical community in a majority of the reviewed articles are patient satisfaction, length of stay in the ED, adverse effects, procedure cost and personnel training. Patient satisfaction isn't necessarily correlated with pain reduction<sup>3</sup>. As far as TID is concerned studies that examined this factor agree that AA did not increase TID and thus does not lead to a significant cost of care increase. A single study measured the cost of acupuncture and the figure only includes the cost of supplies<sup>5</sup> omitting overhead allocation and personnel cost. Across all published results acupuncture is deemed safe and with limited or mild adverse effects.

Regarding treatment protocols, five studies used auricular acupuncture (with Aiguilles Semi-Permanentes or ASP needles recommended for BFA - **Table 3**), five other studies used body (distal) acupuncture performed by trained ED personnel or licensed acupuncturists. No common protocol or point selection specific to pain presentation was identified as a common ground among the studies, reflecting the fact that acupuncture treatments are patient, presentation and practitioner specific. One exception is the use of BFA as a potential acupuncture standard procedure suited for the hectic environment of the ED<sup>6, 7, 13, 14</sup> (with also numerous articles supporting its analgesic function outside of the emergency department).

Finally, an examination of pain indices used in the studies shows that VAS is the prevalent mode of measuring pain before and after analgesic treatment (**Table 6**). However, because not all studies used an identical index and measured pain at similar intervals this contributes to the overall heterogeneity of the reviewed studies.

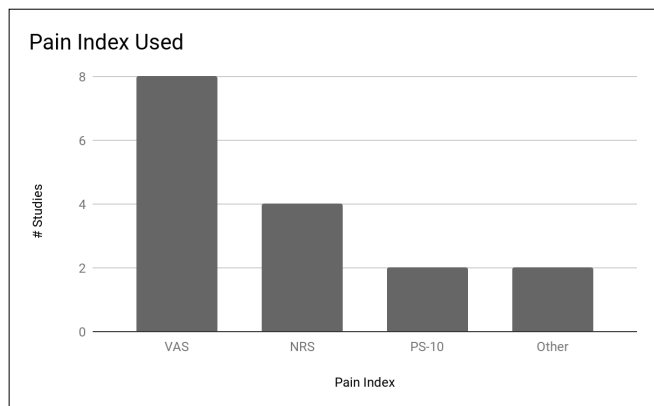


TABLE 6  
PAIN INDICES USED

This literature review finds that there is not enough evidence to support or reject the efficacy of AA in the ED which proves my hypothesis incorrect. This is also due to the limited number of studies and the fact that research is relatively recent in this field. More solid evidence is needed to evaluate the significance for key groups such as trauma centers, acupuncturists, public health officials and policymakers. Although acupuncture has been designated as a first-line modality to aid in the opioid crisis because of its evidence-based analgesia properties<sup>25</sup> it hasn't been designated specifically for pain in the ED which is a hectic and fast-paced environment. In the context of other AA solid evidence, the paucity of most studies, the small sample size, the conclusion of most studies point out that more research is needed.

There are multiple limitations in the studies reviewed. First of all the pain measurement index used is not uniform across studies. Heterogeneity is also present in the acupuncture treatment delivery methods (point protocols, practitioner profiles and, training). Secondary outcomes such as the impact on medication use have not been solidly assessed even though some studies find that acupuncture is at least non-inferior to medication<sup>1, 2, 3</sup>.

Other limitations include the lack of analysis regarding the time it takes for acupuncture to be effective in the ED (although some articles concede that it doesn't increase TID). Also because pain is one of the main reasons for visits to the ED the question of prior medication use hasn't been raised (existing prescriptions or over the counter medication use).

A strength of this review is that the higher frequency of studies in time shows rising interest in the use of acupuncture in emergent care (including the use of acupressure in emergency transport in Germany<sup>16</sup> and emergency pediatric care<sup>20, 25</sup>). All studies identify a potential role for acupuncture in the ED and the data compiled and analyzed here may help future clinical trials to better understand and evaluate this topic and hypothesis by evaluating a well-defined set of metrics: pain scale type, pain severity, resolution time, medication type and usage (before, during and after ED visit), patient satisfaction adverse events and cost.

The implications for clinical practice are that a consensus among the emergency medicine and acupuncture communities regarding the training of personnel, protocols evaluation, ED classification (would a Level One trauma center require the same set up as a Level Two trauma center?), cost of operation and overhead.

The implications for research are that there is a need to design larger RCTs and include additional measurements such as short and long term pain medication use after ED event. Future research also needs to distinguish between nociceptive and neuropathic pain, chronic and acute pain and provide more acknowledgment and weighting of cultural and demographic differences. Short term and long term opioid and medication use need to be analyzed in more detail, both qualitatively and quantitatively. Also, the efficacy of ear and body acupuncture needs to be analyzed and compared. Protocols tailored to each pain presentation must be defined and

analyzed in particular concerning the patient flow of care and the specific environment of the ED.

Finally, because pain is subjective and patient satisfaction isn't necessarily correlated with pain reduction<sup>3</sup> I find that most studies lack in measuring both consistently. From a world health perspective diversity brings an inherent heterogeneity in studies because acupuncture is perceived differently across cultures and demographics<sup>15, 18</sup>.

## V. CONCLUSION

AA may be effective for pain in the ED but more research is needed to deepen and consolidate the evidence using more refined criteria as well as aiming toward establishing protocols that are adapted to the patient flow of care in the ED. High quality and rigorous RCTs are warranted to start making recommendations to trauma centers and other healthcare stakeholders. This includes a larger sample size, adequate blinding and eligibility criteria as well as uniformity throughout trials. Although limited results show that AA is at least equivalent to pharmacological care further studies need to place focus on short term and long term medication use as it hasn't been researched if AAED impacts the long term use of opioids and NSAIDs. It is not until the knowledge gaps have been filled and that clinical evidence is established and cost estimates determined that acupuncture can be recommended as a first-line treatment for pain in the ED. While the research question asking if acupuncture is an effective analgesia modality in the ED remains unanswered directions for future research and validation have been identified: using a uniform and standardized pain scale at set intervals, reliably measuring pain medication usage, using established point protocols and in particular investigate the efficacy of BFA as a one-size-fits-all protocol for pain in the ED, the environment being somewhat of a battlefield. The hypothesis that AA is efficacious in the ED and leads to lower medication use is proven incorrect because solid evidence is lacking. However, considering the recent interest in the field there is a path identified to further research and assess AA efficacy in the ED.

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