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3 **Acupuncture therapy as an Evidence-Based Nonpharmacologic Strategy for Comprehensive Acute Pain Care: the**
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6 **Academic Consortium Pain Task Force White Paper Update**
7

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21 **Keywords:** acute pain, acupuncture therapy, nonpharmacologic pain care, comprehensive pain care, evidence-based
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23 **pain care**

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25
26 Abstract

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29 **Background:** A crisis in pain management persists as does the epidemic of opioid overdose deaths, addiction, and
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31 diversion. Pain medicine is meeting these challenges by returning to its origins: the Bonica model of multidisciplinary
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33 pain care.
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3 The 2018 Academic Consortium White Paper detailed the historical context and magnitude of the pain crisis, and the
4
5 evidence-base for nonpharmacologic strategies. Over 50% of chronic opioid use begins in the acute pain care setting.
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8 Acupuncture may be able to reduce this risk.
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11 **Objective:** This paper updates the evidence-base of acupuncture therapy for acute pain with a review of systematic
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13 reviews and meta-analyses: post-surgical/peri-operative pain with opioid sparing, acute non-surgical/trauma pain
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15 including acute pain in the emergency department (ED).
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19 **Methods:** To update reviews cited in the 2018 White Paper, electronic searches were conducted in PubMed, MEDLINE,
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21 CINAHL and Cochrane Central Register of Controlled Trials for ‘acupuncture’ and ‘acupuncture therapy’ and ‘acute
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23 pain’, ‘surgery’, ‘peri-operative’, ‘trauma’, ‘emergency department’, ‘urgent care’, ‘review(s)’, ‘systematic review’,
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25 ‘meta-analysis’ with additional manual review of titles, links, and reference lists.
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30 **Results:** There are 22 systematic reviews, 17 with meta-analyses of acupuncture in acute pain settings, and a review
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32 for acute pain in the intensive care unit (ICU). There are additional studies of acupuncture in acute pain settings.
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36 **Conclusion:** The majority of reviews find acupuncture therapy to be an efficacious strategy for acute pain with
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38 potential to avoid and/or reduce opioid reliance. Future multi-center trials are needed to clarify the dosage and
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3 generalizability of acupuncture for acute pain in the ED. With an extremely low risk profile, acupuncture therapy is an
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5 important strategy in comprehensive acute pain care.
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10 11 **Introduction**

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15 Medical pain management is in crisis. Pain is pervasive and has been inadequately addressed by strategies including
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17 the escalation of prescription opioids that created a tragic increase in overdose deaths, addiction, and diversion. The
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19 rising costs of pain care and managing adverse effects of that care has prompted action from state and federal
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21 agencies including the Veteran’s Health Administration (VHA),¹ the U.S. Department of Veteran Affairs (VA) and the
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23 Department of Defense (DOD),² National Institutes for Health (NIH),³ U.S. Federal Drug Administration (FDA)⁴ and
24
25 Centers for Disease Control (CDC).⁵ There has been pressure for pain medicine to shift away from an over-reliance on
26
27 opioids, overutilized procedures and surgeries toward more comprehensive pain care that includes evidence-based
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29 nonpharmacologic strategies. Comprehensive pain care programs build on the foundation developed by John Bonica,
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31 the father of pain medicine, and are further supported by the intervening decades of research into nonpharmacologic
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33 strategies.⁶
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3 The evidence base for acupuncture therapy is extensive. Acupuncture is supported or recommended as part of
4 comprehensive pain care by the U.S. Agency for Healthcare Research and Quality (AHRQ),⁷ the U.S Food and Drug
5 Administration (FDA),⁸ U.S. Department of Health and Human Services (HHS)⁹ and the Joint Commission (TJC).^{10,11} The
6 American Academy of Family Physicians (AAFP) endorsed the American College of Physicians (ACP) Guidelines
7 recommending acupuncture as a first option for acute, subacute and chronic low back pain (cLBP).^{12,13} A retrospective
8 claims-based study found initial visits to chiropractors, physical therapists or acupuncturists for new onset LBP
9 substantially decreased early and long-term use of opioids.¹⁴ A retrospective analysis of 427,966 patients with new
10 onset neck pain and back pain found patients who saw these conservative therapists, compared to primary care visits,
11 were 72-91% less likely to fill an opioid prescription in the first 30 days and 41%-87% less likely to continue filling
12 prescriptions for 1 year.¹⁵ While the claims data does not indicate pain severity or duration, the authors controlled for
13 comorbidities, using of the Elixhauser Index, which has served as a proxy for complexity in other studies. Conversely,
14 people with acute neck pain who initially saw an emergency department (ED) physician had highest odds of opioid use
15 during first 30 days.¹⁵

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Peri-operative opioid prescribing has been associated with persistent opioid use after surgery.¹⁶ As of 2017, over 50%
of chronic opioid use began in the acute care setting, after surgery, or for treatment of acute injury related pain.¹⁷ The
probability of long-term opioid use increases after as little as five days of prescribed opioids as the initial treatment of

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3 pain; the probability of patients remaining on opioids for the long-term is the highest when treatment is initiated with
4
5 long acting opioids.¹⁸ While opioid overdose deaths began to decrease slightly in 2018,¹⁹ they rose to an all-time high
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7 in 2019.²⁰ By the end of 2020, accelerated by the COVID-19 pandemic, opioid overdose deaths increased by over 35%
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9 from 2019.^{21,20,22}
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13 Tapering that may or may not include cessation of opioids has been a key strategy to reduce their risks and harms.
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15 However, dose tapering is often a lengthy and time-consuming process and attempts at rapid tapering of doses has
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17 unintended consequences, risks and patient suffering.^{23,24} Even low dose opioid use for more than 3 months increases
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19 risk of addiction 15-fold.²⁵ Sustained opioid dependence is also associated with declining function and exacerbation of
20
21 pain states (hyperalgesia) secondary to mechanisms of the action of opioids.^{26,27} Reducing reliance on opioids for acute
22
23 pain in the ED does not only depend on avoidance of prescribing opioids^{25,28} but by supporting access to effective
24
25 acute pain care strategies. Transforming the system of pain care to a responsive comprehensive model necessitates
26
27 that options for treatment and collaborative care must be evidence-based and include effective nonpharmacologic
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29 strategies that have the advantage of reduced risks of adverse events and addiction liability. The 2018 Academic
30
31 Consortium White Paper (WP)⁶ detailed the historical context and magnitude of the current pain problem including
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33 individual, social and economic impacts as well as the challenges of pain care for patients and a healthcare workforce
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35 engaging prevalent strategies not entirely based in current evidence.²⁹
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3 This is the first of a series of papers to update the evidence-base for nonpharmacologic therapies effective in acute
4 pain.⁶ This paper provides a review of reviews and meta-analyses of acupuncture for acute pain: post-surgical/peri-
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6 operative pain with opioid sparing, acute non-surgical/trauma pain including acute pain in the ED and primary care
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8 setting.
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13 **Methods**

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16 To update and detail the literature cited in the 2018 White Paper⁶ on nonpharmacologic strategies for comprehensive pain care,
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18 specifically research on acupuncture for acute pain, a search for systematic reviews (SRs) with or without meta-analyses (SRMs) was
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20 conducted for articles published through December 2020 in PubMed, MEDLINE, CINAHL and Cochrane Central Register of Controlled
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22 Trials for ‘acupuncture’ and ‘acupuncture therapy’ and ‘acute pain’, ‘surgery’, ‘peri-operative’, ‘trauma’, ‘emergency department’,
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24 ‘urgent care’, ‘review(s)’, ‘systematic review’, ‘meta-analysis’ with additional manual review of titles, links, and reference lists. We
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26 included articles published in peer reviewed journals where access to data was possible and excluded reviews when data or original
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28 papers could not be accessed (e.g. published in Chinese). Additionally, we detail research articles published since SRs that would
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30 help inform researchers, clinicians and policy makers on the current state of research.
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40 **Results**

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3 There are 22 systematic reviews, 17 with meta-analyses of acupuncture in acute pain settings, and a review for pain in
4 the intensive care unit (ICU) selected for review. Details of SRs and SRMs are represented in Tables 1, 2, 3, 6 and 7.
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8 Details of additional studies of acupuncture in acute pain settings are included in Tables 4 and 5.
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11 12 13 **Acupuncture Therapy for Acute Pain**

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17 Acupuncture is understood as the insertion and manipulation of fine solid-core needles at specified points or
18 combinations of points on the body. 'Acupuncture therapy' derives from the traditional East Asian paradigm
19 recognizing the interrelationship of organs and body points, and channels as well as associated symptoms,
20 dysfunction, and disease. Depending on the definition of the scope of practice in each state, acupuncture often
21 includes treating by means of mechanical, thermal or electrical stimulation, by insertion of needles, or by application
22 of heat, pressure, or other forms of stimulation. In practice, acupuncture needling is deployed by first assessing a
23 complex intersection of body organs, function, presentation and interaction with a patient. It also is often done in
24 combination with other therapies such as palpation, Tui na, Gua sha, cupping, moxibustion, e-stim, auricular
25 treatment, herbal medicine and recommendations on diet, exercise, self-reflection and meditative movement like Tai
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3 chi. Acupuncture therapy, therefore, includes an evaluation and decision-making process, acupuncture needling,
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5 accompanying therapies and recommendations that engage a patient in self-care.
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9 Significant research has focused on acupuncture in the treatment of pain. A systematic review with meta-analysis
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11 (SRM) of immediate analgesic effects (13 RCTs, n=1077) found acupuncture was associated with greater immediate
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13 pain relief, 30 minutes or less after end of a single treatment, compared to sham and analgesic injections.³⁰ A large
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15 individual patient data meta-analysis (39 trials) of 20,827 patients with chronic pain found acupuncture to be
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17 significantly better than sham treatment or usual care, with 85% retention of treatment benefit 1 year following a
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19 course of care.^{31,32} Patients with more severe pain at baseline improved more from acupuncture treatment than those
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21 with lower levels of pain, compared to sham or non-acupuncture controls.³³
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27 To be clear, severity of pain is a predictor of response to acupuncture in chronic pain, i.e. the worse the pain, the
28
29 better the response.³³ The immediate analgesia from a single acupuncture treatment provides better pain relief than
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31 sham or analgesic injection making acupuncture especially beneficial for acute pain with opioid sparing potential in
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33 hospital settings.³⁰ The largest hospital accreditation organization in the US, The Joint Commission (TJC), has revised
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35 their pain mandate originally introduced in 2000. Effective January 1, 2018, TJC requires their accredited hospitals and
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37 facilities to provide nonpharmacologic strategies for pain as a scorable Element of Performance.¹⁰ In support of these
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3 efforts, this narrative review includes SRs and SRMs of acupuncture for inpatient post-operative pain as well as for
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5 acute pain not related to surgery, acute pain in an ED setting, and for acute pain in primary care.⁶ We include the
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7 details of the effect sizes and quality of reviews as reported by the authors but do not systematize authors' reporting
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9 of results.
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16 ***Acupuncture therapy post-operative pain (Table 1)***

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19 In multiple systematic reviews with meta-analyses (SRMs), acupuncture was found to be effective in reducing post-
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21 surgical pain compared to sham acupuncture, controls and usual care with reduction in opioid need (21% opioid
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23 reduction at 8 hours, 23% at 24 hours and 29% at 72 hours post-surgery) and with lowered incidence of opioid-related
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25 side effects such as nausea, dizziness, sedation, pruritus and urinary retention.³⁴⁻³⁶ An SRM found acupuncture after
26
27 total knee arthroplasty reduced pain and was associated with delayed opioid use.³⁷ An SRM of peri-operative auricular
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29 acupuncture reduced postoperative pain and need for analgesic use compared to sham or standard-of-care controls.³⁸
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32 Another SRM on peri-operative auricular therapies found benefit for pain and intraoperative body mass-adjusted
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34 fentanyl amount but did not prolong time to first analgesic request in total hip arthroplasty.³⁹ An SRM of auricular
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36 acupuncture for acute and post-surgical pain provided immediate pain relief and benefit at 48 hours, was equivalent to
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3 analgesics and had fewer side effects.⁴⁰ These findings indicate the potential to reduce hospital readmission due to
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5 uncontrolled pain. (See Table 1)
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9 A 2015 SRM of acupuncture point stimulation for post-operative pain (59 RCTs; n=4,578) showed significantly
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11 improved visual analogue scale (VAS) pain scores with a further benefit of reduced total morphine consumption.³⁴ Still,
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13 a 2016 clinical practice guideline on post-operative pain management by the American Pain Society, the American
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15 Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists' Committee on
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17 Regional Anesthesia did neither 'recommend nor discourage' acupuncture therapy as part of recommended
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19 multimodal post-operative pain care. The guideline recommendation was based on only 6 studies that used active
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21 sham arms,⁴¹ which are not inert controls and therefore a flawed methodology.^{42,43} A subsequent SRM (2016) supports
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23 the use of acupuncture as adjuvant therapy in treating postoperative pain and for reducing opioid use.³⁵ A 2019 SR
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25 finds distal acupuncture needling compares favorably with peri-incisional TENS in pain reduction and opioid sparing for
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27 patients having open abdominal surgery.⁴⁴
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34 Trials published since 2016 include a double-blind placebo controlled (DBPC) trial where intraoperative electrical
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36 stimulation of acupuncture points reduced intraoperative opioid requirements, post-operative pain and duration of
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38 stay in the post anesthesia care unit.⁴⁵ Another DBPC trial showed that the addition of transcutaneous electrical
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3 acupoint stimulation (application of electrical stimulation at acupuncture points) (TEAS) to usual care for minimally
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acupoint stimulation (application of electrical stimulation at acupuncture points) (TEAS) to usual care for minimally
invasive lung cancer surgery reduced pain, reduced patient controlled intravenous analgesic (PCIA) attempts, and
reduced nausea and vomiting, supporting TEAS as a feasible option for sedation and postoperative analgesia in
thoroscopic pulmonary resection.⁴⁶

Additionally, acupuncture was effective, safe, and well tolerated for post-tonsillectomy pain in children with no
significant side effects.⁴⁷

Table 1: Acupuncture for acute post-operative pain: systematic reviews with/without meta-analyses

Table 1 abbreviations: Abd=abdominal; Acup=acupuncture; Acupuncture point stimulation =APS; AE=adverse event;
AT=acupuncture therapy; Ear acup=auricular acupuncture; estim=electrical stimulation; NSAIDS=no-steroidal anti-
inflammatory drugs; NV=nausea and vomiting; Peri-op=perioperative; PI= pain intensity; pre-op=pre-operative;
PONV=post-operative; n=number; nausea and vomiting; NNT= Number Needed to Treat; SOE=Strength of evidence;
TEAS=transcutaneous acupoint electric stimulation; TENS=transcutaneous electrical nerve stimulation; THA=total hip
arthroplasty; TKA=total knee arthroplasty; treatment=tx; VAS=Visual Analogue Scale

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6 ***Acupuncture therapy for acute pain in emergency department (ED)/ICU. (Table 2, Table 3, Table 4, Table 5)***
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9 As of 2021, for acute pain in the ED/urgent care setting there are 6 systematic reviews of acupuncture,⁴⁸⁻⁵¹ 3 with
10 meta-analyses (Table 2).^{49,51,52} Of these one is for ear acupuncture alone.⁵² Reviews included trials of acupuncture in
11 the treatment of various acute pain conditions and injuries in adults and children in the ED, including acute low back
12 pain (aLBP), acute neck pain, acute ankle sprain (AAS) and other musculoskeletal pain conditions, fractures and non-
13 penetrating injuries, acute abdominal pain, appendicitis pain, renal colic, acute headache and migraine, acute dental
14 pain, and acute pharyngitis.
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24 One SRM included 19 RCTs and 11 observational studies and reported acupuncture provided effective analgesia for
25 most acute pain conditions in the ED, while being non-inferior to selected analgesia medications, and providing
26 statistically significant, clinically meaningful and improved levels of patient satisfaction with respect to pain relief in
27 the emergency setting.⁴⁹ The authors concluded that acupuncture was low cost and low risk with high patient
28 satisfaction. In addition, there is one review of nonpharmacologic approaches for pain in the ICU, including
29 acupuncture (see Table 3).⁵³
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3 Studies not in SRs or SRMs (Table 4): A trial of ED patients found acupuncture's benefit comparable to
4
5 pharmacotherapy for acute low back pain (n=270) or ankle sprain (n=166) and that acupuncture was safe.⁵⁴ In an
6
7 observational study of 1008 patients including children in a surgery ward, acupuncture given as first aid immediately
8
9 after or optimally within 48 hours of a burn injury, reduced pain, reddening, pigmentation, scarring and PTSD that
10
11 commonly follows traumatic burns.⁵⁵ Two randomized trials found acupuncture for acute pain in the ED performed
12
13 better than titrated or intravenous morphine with minimal adverse effects.^{56,57}
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18 Studies also report high acceptability for acupuncture by patients with acute pain in the ED, when measured.^{54,58,59} A
19
20 retrospective study of ED acute pain patients found acupuncture decreased pain comparable to analgesics with
21
22 additional benefit of reduction in anxiety as well as high acceptability among both medical providers and patients
23
24 (Table 5).⁶⁰ Seventy-five percent of providers referred for acupuncture and 90% of patients agreed to acupuncture.
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26
27 When details are reported in studies, acupuncture sessions for acute pain in the ED averaged 10-30 minutes^{56,61} with
28
29 mean times of 23-24 minutes^{58,60} and did not disrupt ED course of care.⁵⁸⁻⁶⁰
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34 Acupuncture for acute pain in the ED is a developing area of research focus, based on single treatments during a
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36 narrow window of time. The details in Table 2 include outcome measures in addition to comparators.
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Table 2: Acupuncture for acute traumatic and emergency department acute pain: systematic reviews with/without meta-analyses

Table 2 abbreviations: Acup=acupuncture; AAS=acute ankle sprain; AE=adverse event; AT=Auricular therapies; AA=auricular acupuncture; AP=auricular pressure (as in ear seeds); AdjA= adjunct acupuncture; AdjEA=adjunct auricular acup; BFA=battlefield acupuncture; EAS=electroacupuncture stimulation (estim on needles inserted at acupoints); ED=emergency department; HTN=hypertension; n=number; OBS=observational study; RCT=randomized controlled trial; NRS=numerical rating scale; RICE=rest, ice, compression, elevation; SAC=standard analgesic care; SC=standard care; SOE=strength of evidence; UC=usual care; VAS=Visual Analogue Scale

Table 3 Nonpharm including acupuncture for acute pain in intensive care unit (ICU)

Table 3 abbreviations: BPS=Brief Pain Scale; ICU=intensive care unit; n=number; NRS=numerical rating scale; SOE=strength of evidence; Sx=symptom; VAS=Visual Analogue Scale

Table 4: Acupuncture RCTs for acute pain: inpatient, surgery, ICU and ED

Table 4 abbreviations: Acup=acupuncture; Adj=adjunct; aLBP=acute low back pain; BFA=battlefield acupuncture; DB=double-blind; EAS=electroacupuncture stimulation (estim on needles inserted at acupoints); ED=emergency department; Estim=electrical

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3 stimulation; ICU=intensive care unit; LBP=low back pain; n=number; Nonpharm=nonpharmacologic; OR=operating room;
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5 RCT=randomized controlled trial; Pharm=pharmaceutical; QOL=quality of life; SAC=standard analgesic care; SOC=standard of
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7 care; TENS=TENS=transcutaneous electrical nerve stimulation; Tx=treatment; UC=usual care; VAS=Visual Analogue Scale;
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10 VNRS=verbal numerical rating scale
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15 **Table 5: Pilot, retrospective or qualitative studies: acupuncture for inpatient or ED acute pain**
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18 Table 5 abbreviations: Abd=abdominal; Acup=acupuncture; AE=adverse events; n=number; ED=emergency
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20 department; min=minutes; msk=musculoskeletal; n=number; NRS=numerical rating scale; NVS= numerical visual scale;
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22 OBS=observational; Post-op=post-operative; PT=physical therapy; RCT=randomized controlled trial; sec=second;
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24 tx=treatment; txs=treatments
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31 ***Acupuncture acute LBP (Table 6)***
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34 There is evidence acupuncture is effective for acute low back pain (aLBP) in the short term, for 3 months or less, and
35
36 on a small to moderate magnitude.⁶² The American College of Physicians (ACP) recommends acupuncture as a first-line
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38 treatment for acute and subacute LBP based on their 2017 systematic review with meta-analysis (11 RCTs, n=1163,
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3 actually n=1139).^{13,63} That review is based primarily on a 2013 (Lee et al.) SRM (11 RCTs, n=1139)⁶³ that found
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5 acupuncture more effective than sham for aLBP, but not for function, and comparable to NSAIDs for pain with reduced
6
7 side effect's risk. Authors (2013) called for non-inferiority research to clarify equivalency with NSAIDs. The ACP SRM
8
9 considered two RCTs for aLBP in addition to Lee et al. 2013 SRM: Hasegawa 2014 (n=80),⁶⁴ and Vas 2012 (n=275).⁶⁵
10
11 Hasegawa compared a Japanese scalp needling technique to traditional Chinese body acupuncture. The body
12
13 acupuncture was not detailed but was not an 'inert' intervention and so not a true sham control. The trial used one
14
15 acupuncturist, a specialist in the scalp technique. While the scalp technique showed benefit relative to body
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17 acupuncture in some measures, the results are questionable based on the problematic design.⁶⁴ Vas et al. reported
18
19 real and sham acupuncture superior to placebo at 3 months, but equal to sham and placebo compared to medication
20
21 alone at 12 months.⁶⁶ However, the study was only powered to detect differences between true acupuncture and the
22
23 medication control group, where true acupuncture was superior to medication control. It was not powered relative to
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25 sham or placebo. Moreover, points used in the sham group are reported in the literature to be effective for LBP,
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27 making the sham arm an active acupuncture treatment.⁶⁷ Inclusion of Hasegawa and Vas in the ACP review is
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29 problematic and potentially misleading given these sham control design limitations.
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38 The benefit of acupuncture for aLBP is also informed by ED/urgent care setting trials. A multicenter equivalence, non-
39
40 inferiority RCT (n=528) of acupuncture for aLBP in the ED found acupuncture safe, acceptable, and comparable to
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3 medications (n=270) (Table 4).⁵⁴ A 2020 study (n=167) of a single abbreviated acupuncture treatment (8-9 minutes)
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5 for aLBP using hand points, movement and several back points provided no advantage in pain relief compared to
6
7 medications but did shorten the time to recovery from 14 to 9 days.⁶⁸ Although this recovery time benefit reached the
8
9 authors' threshold, inexplicably they report it as not clinically significant.
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13 The abbreviated auricular treatment BFA (Battlefield Acupuncture) did not provide additional benefit for acute pain
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15 including aLBP in the ED.⁶⁹ There may be an advantage to more comprehensive acupuncture treatment responsive to
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17 individual patient presentations⁵⁴ over rote abbreviated techniques like BFA.^{68,69} Moreover, BFA has been marketed as
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19 a 'battlefield' option for acute pain, but it has not been studied in that setting. It is used primarily for chronic pain
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21 within the VHA outpatient care. While BFA has benefited from auriculotherapy research,⁷⁰ it has not been studied
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23 relative to other auricular protocols. Nor is there any advantage proven for ASP[®] needles over other intradermal
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25 needles or ear seeds, for extended auricular therapy, as claimed by BFA Seminars.^{71,72} Rather, the 'harpoon' shaped
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27 needles⁷³ designed to imbed in the chondrial layer of the ear, may increase risk of harms.⁷⁴ Auricular acupuncture with
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29 Vaccaria seeds fixed to ear points has been shown to be as, if not more, effective than any retained intradermal
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31 needles with a greatly reduced risk of harms.⁷⁰
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3 Trials of acupuncture for specific kinds of acute back pain also enlighten its potential. An SRM on acute ED pain that
4 included 3 trials of acupuncture for renal colic found acupuncture as effective as medication with fewer side effects
5 (n=38),⁷⁵ making it a potent option for immediate renal colic pain while avoiding risks of NSAIDs or acetaminophen
6 (n=121).⁷⁶ Acupuncture was as effective as Dolantin but superior to Scopolamine in another trial on renal colic (n=240)
7 with onset time to pain relief significantly earlier for acupuncture with greatly reduced adverse reactions.⁷⁷ Since the
8 2017 SRM, another trial (n=115) found acupuncture superior to titrated morphine for ED renal colic with significantly
9 sooner onset of pain relief (50% reduction) and deeper pain relief with greatly reduced adverse effects.⁵⁶
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24 **Table 6 Acupuncture for acute LBP reviews with/without meta-analysis**

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27 Table 6 abbreviations: Acup=acupuncture; aLBP=acute low back pain; EA=electroacupuncture; LBP=low back pain;
28 nonpharm=nonpharmacologic; NOP=number of pills; NRS=numerical rating scale; NSAIDS=non-steroidal anti-inflammatory drugs;
29 n=number; ODI=Owestry Disability Index; RCT=randomized controlled trial; RMDQ=Rowland-Morris Disability Questionnaire;
30 SOE=strength of evidence; VAS=Visual analog scale
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40 ***Acupuncture for acute headache and migraine***

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3 Acupuncture is studied for acute migraine,⁷⁸ migraine prophylaxis and prevention, and impact on medical
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5 expenditure.⁷⁹ Table 7 details the SRs and SRMs that evaluate acupuncture for acute headache/migraine. While
6
7 existing study indicates acupuncture may be a potential strategy for acute migraine where benefit exceeds that of
8
9 sham acupuncture,^{29,80} comparing to protocol medications in the ED setting presents unique challenges. Acupuncture
10
11 is not readily available in US ED settings to conduct research, but more importantly standard medical protocols
12
13 preclude engaging acupuncture as a strategy for acute migraine.⁸¹ For example, opioids are one standard option in the
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15 ED that precludes an acupuncture intervention, even though the evidence-base for opioids effectiveness and safety for
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17 acute migraine remains limited.²⁹

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23 Where migraine and headache carry a significant global economic burden,⁸² real-world data from a 10-year national
24
25 cohort study in Taiwan found in migraine patients who received acupuncture treatment, medical expenditures on
26
27 emergency care and hospitalization were significantly lower than the group without acupuncture treatment.⁷⁹ A
28
29 review of 10 years of RCTs of acupuncture vs various controls in the treatment of migraine (49 trials) found
30
31 acupuncture reduces symptoms of migraine and improves QOL.⁸³ The meta-analysis showed acupuncture reduces
32
33 headache frequency more than no treatment or medications, but the quality of evidence was low. For acute migraine
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35 (3 trials), real acupuncture had greater effect in reducing headache related pain using VAS score, earlier onset and
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longer duration of headache relief and greater clinical effectiveness immediately after treatment compared with the sham acupuncture control. The authors recommend combining acupuncture with usual care.

Table 7 Acupuncture for acute migraine reviews with/without meta-analyses

Table 7 abbreviations: Acup=acupuncture; ED=emergency department; freq= frequency; HA=headache; n=number; NA=not applicable; hrs=hours; meta=meta-analysis; QOL= quality of life; SOE=strength of evidence; SRs=systematic reviews; SRM-systematic review with meta-analysis; tx=treatment

Discussion

The need for evidence-based comprehensive pain care strategies is based on insufficient management of acute pain, continued reliance on opioids for acute pain, the risk of opioids and ongoing rise in opioid deaths. This review of reviews and meta-analyses supports acupuncture therapy as a viable strategy for acute pain care.

Acute peri-op, ICU and ED pain

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3 Reviews of acupuncture for acute peri-operative pain related to various surgeries including major surgeries are listed
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6 in Table 1. Eleven systematic reviews, 10 with meta-analyses, detail the feasibility and benefits of acupuncture. Nine
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8 reviews also tracked a reduced need for analgesic medication, including opioids. This is a substantial finding given the
9
10 risk of even short term opioid use for acute pain.¹⁸
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14 For acute pain in the ED, 6 systematic reviews, 3 with meta-analyses, demonstrate increasing interest, feasibility and
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16 acceptability of acupuncture in the ED (Table 2) and ICU (Table 3). Table 5 details pilot, observational, retrospective or
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18 qualitative studies on acupuncture's reduction of acute pain, high level of acceptance and low risk of adverse
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20 events.^{58,60,79,84-88}
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24 Additional trials that evaluated acupuncture for acute pain in the ICU for surgical patients, inpatients or patients in
25
26 the ED are detailed in Table 4. Two studies evaluated acupuncture for pain in intubated ICU patients; one using
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28 electrical stimulation on needles inserted in acupuncture points (EAS)⁸⁹ and the other using TENS on acupuncture
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30 points.⁹⁰ The former found marked reduction in dosage of the sedative drug (midazolam) needed for pain and
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32 discomfort of mechanical intubation.⁸⁹ The latter found a reduction in pain, analgesic and sedation medication.⁹⁰
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37 Three studies evaluated a trademarked, abbreviated version of auricular therapy called battlefield acupuncture (BFA)
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39 for acute pain, with mixed results. A small study found the addition of BFA for aLBP to be feasible and effective,⁹¹ on
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3 par with auricular therapy in general.⁷⁰ In other studies, BFA for lower extremity surgery acute pain (n=233) and for
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5 acute abdominal, low back or limb pain in the ED (n=90) found BFA to be ineffective.^{69,92} Another trial using a
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7 different abbreviated acupuncture protocol for aLBP also found no benefit.⁶⁸ Yet a larger multi-center trial using a
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9 more robust acupuncture protocol for acute pain in the ED (n=528) found acupuncture provided analgesia
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11 comparable to medication for aLBP and ankle sprain.⁵⁴
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16 Two additional studies evaluated acupuncture as a nonpharmacologic pain strategy for acute or peri-operative
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18 setting. Acupuncture for pediatric/adolescent patients (n= 182) reduced pain;⁹³ and the other study of peri-operative
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20 adults (n=1127) treated with acupuncture resulted in reduced pain, nausea and anxiety.⁹⁴
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27 *Acute low back pain (aLBP) and migraine*

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30 Four reviews, 3 with meta-analyses of acupuncture for aLBP, are detailed in Table 6. The most recent review and
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32 meta-analysis (2021)⁹⁵ finds acupuncture significantly benefits aLBP symptoms including reduction in analgesic
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34 medication.
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38 Finally, Table 7 details seven acupuncture reviews for acute migraine: 2 with meta-analyses and 2 with overview of
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40 meta-analyses. Acupuncture had significantly larger effect than sham,^{29,96,97} and larger than medications⁹⁷⁻⁹⁹
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3 Acupuncture appears more effective than no treatment or sham in the prevention of acute migraine, with potential
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5 as a valid option in the ED.⁸⁰ And while a review of acupuncture for menstrual migraine found reduction in mean
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7 headache intensity from pooled data, it did not reduce monthly migraine frequency, duration or analgesic use.¹⁰⁰
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10 11 12 13 14 **Limitations**

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17 This narrative review allows for inclusion of diverse papers with substantial findings on acupuncture for acute pain
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19 across various clinical settings allowing clinicians and policy makers to review the breadth and depth of the literature.

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21 Some of the cited SRMs include trials that compare acupuncture to active sham interventions, a problematic
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23 methodology wherein controls that are not ‘inert’ can produce physiologic changes.^{31,42,43,101,102} When reporting on
24
25 these studies we indicate the authors’ quality assessments, but in some cases they are at risk of underestimating the
26
27 true value of acupuncture due to the active nature of the sham acupuncture used.⁴² Details of effect sizes and quality
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29 of reviews are included as reported by the authors, but it is beyond the scope of this narrative review to systemize
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31 authors’ reporting of results.
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37 The potential for acupuncture to avoid or reduce opioid use in acute pain is reported in some reviews and this data
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39 should not be undervalued. As little as five days of prescribed opioids as the initial treatment of pain increases the
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3 probability of long-term opioid use.¹⁸ Even the CDC recommends non-opioid and nonpharmacologic options as a first
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5 line of treatment for acute post-surgical pain.¹⁶ Against the background of the ongoing crisis of opioids, addiction and
6
7 death due to opioids, the metrics on analgesic use including opioids and NSAIDs should be encouraged as a clinically
8
9 meaningful outcome measure in future studies. Future multi-site trials to clarify the scope, timing and
10
11 generalizability of acupuncture for acute pain the ED are recommended. Based on research that previously established
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13 the advantage of multidisciplinary pain care, future research must focus on individual as well as combination strategies
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15 for comprehensive pain care that include evidence-based nonpharmacologic strategies in the acute pain care setting.
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24 **Acupuncture therapy safety**

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27 Acupuncture has a low risk of adverse events. More specifically, the associated effects of acupuncture have been
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29 categorized as secondary benefits, such as feeling relaxed, elated, tired, improved mood and sleep. The NIH Consensus
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31 Statement on Acupuncture published in 1998 found that ‘...the incidence of adverse effects is substantially lower than
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33 that of many drugs or other accepted procedures for the same conditions’.¹⁰³ Systematic reviews and surveys have
34
35 clarified that acupuncture is safe when performed by appropriately trained practitioners¹⁰⁴⁻¹¹¹ with infrequent minor
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37 side effects such as feeling relaxed, elated, tired or having sensation or itching at point of insertion.¹⁰⁸ Rare serious
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3 complications such as infection or pneumothorax are directly related to insufficient training.^{109,110,112} Safe use of
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5 acupuncture has also been established in vulnerable populations including pediatrics^{104,113-115} and for women who are
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7 pregnant.¹¹⁶⁻¹¹⁸ Active military service members who accessed acupuncture for chronic pain had reduced risk of long-
8
9 term adverse outcomes.¹¹⁹
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13 Research needs to continue to carefully track and report any adverse events associate with acupuncture and
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15 compared to medications used, such as opioids. Acupuncture's reduced risk is apparent in general, but one paper
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17 serves as a relevant example. In management of acute pain in the ED, acupuncture (n=150) was compared to titrated
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19 morphine (n=150).⁵⁷ Of the 300 participants, adverse effects were experienced by 89 (29.3%) patients: 85 (56.6%) in
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21 the morphine group and 4 (2.6%) in the acupuncture group. Primary AEs in the morphine group were dizziness, nausea
22
23 and vomiting. Acupuncture had a better success rate with faster resolution to 50% reduction of pain than the
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25 morphine group.
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34 **Frequency, dosage and timing of nonpharmacologic interventions for inpatient and acute pain care**

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37 Inpatient acupuncture therapy is usually delivered by a licensed independent practitioner, such as an acupuncturist,
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39 and are generally given as daily treatment for the term of the inpatient stay with referral for outpatient care follow-up.
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3 ED settings allow for a single treatment only. A session of inpatient or ED acupuncture care can last from 20-60
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5 minutes, with 30-45 minutes being typical. A session would likely include an interview assessment, palpation, point
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7 location, needling that may or may not include 'de qi' response, resting with needles in place, needle removal and
8
9 disposal, reevaluation and recommendations. Needle retention times vary, 15-25 minutes depending on whether one
10
11 aspect of the body or more is treated. If the front and back of the body are treated, needle retention might be 10-20
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13 minutes for each side. If only one aspect is treated, needle retention might be longer. Body acupuncture typically
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15 involves points both local to and distal from the problem area.
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21 Abbreviated treatments result in less optimal outcomes. For example, limited auricular protocol BFA was not effective
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23 for ED acute abdominal, low back pain or limb trauma.⁶⁹ Modified BFA was also not effective as an adjunct for pain
24
25 relief in lower extremity surgery.⁹² Another ED trial used an abbreviated 10-minute acupuncture treatment for aLBP
26
27 with usual care vs usual care alone finding no difference in pain relief.⁶⁸
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31 There is evidence-based data on dosage and frequency of acupuncture for acute pain and more research will be
32
33 beneficial to further define the optimal frequency, dosage and timing of care: what constitutes an optimal
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35 intervention in terms of session time, number of points palpated, needled, needle retention time, and with what
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37 additional hands-on therapies. Parameters of effective acupuncture treatment for chronic pain may inform acute pain
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3 care. For example, in a large individual patient data meta-analysis (39 trials, n=20,827), 95% of trials included local and
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5 distal points, 94% aimed to obtain 'de qi', 69% used 5-14 acupoints in a session (21% used 15-20 acupoints) and 50% of
6
7 trials lasted 20-29 minutes as the mean duration of a session, 47% lasted 30 minutes or more.³¹ The only patient
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9 characteristic that predicted outcome was severity of pain at baseline, wherein patients reporting more severe pain at
10
11 baseline experienced more benefit from acupuncture compared to either sham-control or non-acupuncture control.³³
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13 These findings from such a large study may be generalizable to acute pain care.
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21 **Multimodal approach to acute pain care**

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24 The era of the promise and promotion of opioids coincided with a retraction of insurance coverage for
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26 multidisciplinary pain care strategies that in turn created a barrier in access to, and funded research of,
27
28 nonpharmacologic therapies.^{120,121} Multimodal pain care is now recognized as the optimal, inclusive and responsive
29
30 approach to patients experiencing pain: inclusive of all evidence-based therapies including effective nonpharmacologic
31
32 strategies and responsive to patient's diverse and evolving needs.¹²¹ Evidence-based nonpharmacologic therapies are
33
34 recommended in comprehensive pediatric and adult pain care.^{10,122,123} Multimodal pain care is recommended by the
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36 American Pain Society in their guidelines to post-operative pain management.⁴¹ Effective nonpharmacologic strategies
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3 are recommended by the ACP in their guidelines for acute low back pain.¹³ Comprehensive multi-modal pain care must
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5 include effective nonpharmacologic strategies such as acupuncture in the inpatient and acute care setting with a
6
7 seamless referral system to support ongoing care once a patient is discharged. Yet as clearly stated in the review of
8
9 back pain by Cherkin et al, "...Despite improved knowledge about the benefits and harms of treatments for chronic
10
11 back pain in the past several decades, there is a large and consequential mismatch between treatments found safe and
12
13 effective and those routinely covered by health insurance...The barriers to change identified in the IOM (Institute of
14
15 Medicine) and Lancet reports make it clear that deficiencies in our health care delivery and payment models are
16
17 centrally involved in the continued failure to improve care for back pain."¹²⁴ This deficit applies equally to all types of
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19 pain. There is a pervasive failure to align insurance coverage, to ensure access to evidence-based, safe and effective
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21 pain treatments.¹²⁵
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31 ***Acupuncture biomechanisms***

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34 Scientific discoveries over the past several decades have demonstrated complex and robust biological mechanisms for
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36 the therapeutic effects of acupuncture. A full review of biomechanism literature is not within the scope of this paper
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38 and we aim only to highlight some of the most significant contributions of recent science. Impact on the
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3 musculoskeletal system includes evidence that acupuncture needle insertion stimulation influences connective tissue
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5 and fascia, collagen production and fibroblast alignment and activity.¹²⁶⁻¹²⁸ Acupuncture has also been shown to
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7 reduce inflammation locally which in turn impacts pain processing by the central nervous system.¹²⁹⁻¹³¹ There is robust
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9 research showing how acupuncture stimulates neuroplastic changes that are known to interfere with the processes of
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11 central sensitization well recognized to perpetuate chronic pain. The impact on the central and peripheral nervous
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13 systems include neurochemical alterations of endogenous opioid¹³²⁻¹³⁴ and endocannabinoid systems.^{135,136}
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18 Neuro-immune mechanisms include alterations in nuclear factor kappa B (NFκB) pathway, TRPV1 and TRPV2 channels
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20 of mast cells, reduced levels of SP, neurokinin-1 receptor (NK-1R), interleukin-6 (IL-6), IL-1β, and tumor necrosis factor
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22 (TNF)-α¹³⁷ thereby inhibiting the release of excitatory neurotransmitters while promoting the release of inhibitory
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24 neurotransmitters from neurons and glial cells. Acupuncture also regulates neuro-inflammatory substances that inhibit
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26 microglial crosstalk.^{138,139}
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31 Central mechanisms of acupuncture include deactivation of the limbic system, important for emotion and internal
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33 homeostasis that impact chronic pain.¹⁴⁰⁻¹⁴² Functional magnetic resonance imaging (fMRI) evidence demonstrates
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35 beneficial modulation of the maladaptive alterations in somatosensory cortical maps that have been shown to
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37 accompany chronic pain states and interfere with optimal motor recruitment patterns.^{143,144}
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As pain and physiology research have evolved, discoveries demonstrate the interconnected roles of the immune system, central and peripheral nervous systems, and all organ systems in the phenomena of nociception and its interpretation by the brain. This level of interconnectedness requires comprehensive strategies to understand pain, assess it and deliver care. As iterated by John Bonica since the 1940s, pain care requires attention to mind and body and is best delivered through comprehensive strategies that were the cornerstone of his vision for pain treatment.¹⁴⁵ The inclusion of evidence-based therapies such as acupuncture therapy have a vital role to play in comprehensive pain care.

Summary

Our narrative review includes 22 systematic reviews, 17 with meta-analyses; it supports the feasibility and benefit of acupuncture therapy as an effective stand-alone or adjunct intervention in acute peri-operative pain and acute pain in the ED/urgent care setting. The evidence supporting effectiveness, safety, reduced need for opioids and NSAIDs, and improved patient satisfaction are compelling reasons for acupuncture therapy to be covered for acute pain by public and private insurance. Policy barriers for licensed acupuncturists to be Medicare billing providers need to be addressed. Healthcare practitioners and administrators need training in the evidence-base of acupuncture therapy and

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3 to advocate for policy initiatives that remedy systemic reimbursement barriers to evidence-based comprehensive pain
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5 care strategies. The support, promotion and dissemination of ongoing research into the expanding role of effective
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7 nonpharmacologic treatments for pain will need to continue to address both the short and long term therapeutic and
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9 economic impact of comprehensive pain care practices. Multimodal pain care is now recognized as the optimal,
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11 inclusive and responsive approach to patients experiencing pain: incorporating all evidence-based therapies including
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13 effective nonpharmacologic strategies responsive to patient's diverse and evolving needs.
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30 Author contributions

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33 All authors participated in searches and evaluation of reviews and studies. All authors drafted the manuscript; AN and HT
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35 responsible for coordination of finalized manuscript.
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Acupuncture therapy as an Evidence-Based Nonpharmacologic Strategy for Comprehensive Acute Pain Care: the Academic Consortium Pain Task Force White Paper Update

TABLES

Table 1: Acupuncture for acute pain post-operative care: Systematic reviews and meta-analyses

Authors	Modality	Systematic Review	Meta-analysis	Setting/condition, number (n)	Comparators	Results	Reduced analgesics including opioids	Quality and Recommendation
Sun et al. 2008 ³⁶	RCTs: 6 Estim 4 Manual Acup 3 Ear acup 1 Capsicum plaster 1 Acupressure	15 trials	10 trials	Surgery type: Abdominal (6) maxillo-facial (2) knee (2) hemorrhoid (1), back (1), thoracotomy (1), hip arthroplasty (1), molar tooth extraction (1), n=1166	Sham and usual care: 10 general anesthesia, 4 local anesthesia, 1 unreported	At 8, 24, 72 hrs: PI 8 hrs: (WMD -14.57 mm; 95% CI: -23.02, -6.13); 24 hrs (WMD: -5.59 mm, 95% CI: -11.97, 0.78) 72 hrs (WMD: 29.75 mm, 95% CI: -13.82, -5.68). May not be clinically relevant. Opioid side effects as NNT: Nausea NNT=6; Vomiting no diff; Pruritus NNT=13; Dizziness NNT=6; Sedation NNT=11; Urinary retention NNT=5: opioid sparing is clinically meaningful. No significant AE.	21% decrease at 8hrs; 23% at 24 hrs; 29% at 72 hrs. Opioid sparing effect considered clinically relevant.	Overall SOE not assessed. Moderate reduction in pain intensity that may or may not be clinically relevant. Relative reduction in opioid consumption from 21%-29%, which is considered clinically relevant. Recommend acupuncture as adjuvant and further research is needed.
Asher et al. 2010 ³⁸	Ear acup	17 RCTs: 8 peri-op; 4 acute pain; 5 chronic pain	8 trials; 5 peri-op acute pain	17 trials n=1009; Peri-op n=551	Sham and usual care	Pain reduction: SMD was 1.56 (95% CI: 0.85, 2.26), indicating that on average, the mean decrease in pain score for the auriculotherapy group was 1.56 standard deviations	Analgesic consumption lower in tx group: SMD 0.54; 95% CI: 0.30, 0.77; five studies)	Overall SOE: moderate Recommend auriculotherapy as reasonable adjunct for pain, especially postoperative pain and for patients' intolerance to pain meds.

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Authors	Modality	Systematic Review	Meta-analysis	Setting/condition, number (n)	Comparators	Results	Reduced analgesics including opioids	Quality and Recommendation
						greater than the mean decrease for the control group.		
Liu et al. 2015 ³⁴	APS= body acup, estim, acupressure, ear seeds, capsicum plaster therapy	59 trials	39 trials: pooled trial subgroups n=2097acup	Surgery: Abdominal, knee, oral, cardiac, hemorrhoid, C-section; n=4,402	Sham/ placebo control (36 trials); and usual care (n=2,305): standard anesthetic and post-op analgesia regimens used in all trials.	Improved VAS scores esp. abd. cardiac and c-section surgery.	APS reduced analgesic requirement in post-op patients without AE	Overall SOE: Level I evidence for body point acupuncture stimulation reducing post-op pain intensity and patient's analgesic need. Overall SOE: Level II for abd surgery; Level III for cardiac and c-section' APS favorable, low risk, low complication rate, economical. Ongoing research needed
	Ear point stim	14 trials	12 trials	Post-surgical (n not stated)	Sham/ placebo and usual care	Reduced post-op pain intensity	Reduced analgesic requirement without AE	Overall SOE: Level I evidence for ear point stim reducing post-op pain intensity.
	Ear and body acup	7 trials	7 trials	Post-surgical (n not stated)	Sham/ placebo and usual care	Reduced post-op pain intensity	Reduced analgesic requirement without AE	Overall SOE: Level II evidence reduction of post-op pain for mixed body and ear acup.
Cho et al. 2015 ⁴⁸	E-stim at non-penetrating acup point; ear acupressure; manual acup	2- Acupoint estim 1- Ear acupressure 2 -Manual acupuncture	5 trials	Post-op back surgery n=410	vs sham (3) vs usual care (2)	Acup reduced acute post-operative pain in first 24 hours	Reduced opiate demand similar to sham at 24 hrs. Reduced opiate dose when compared to usual care.	Overall SOE: moderate Encouraging, but larger pragmatic trials needed.

Authors	Modality	Systematic Review	Meta-analysis	Setting/condition, number (n)	Comparators	Results	Reduced analgesics including opioids	Quality and Recommendation
Chou et al. 2016 ⁴¹	(Acup as one reviewed modality)	2 Superficial intradermal needles thoracic surgery (abbreviated tx) 1 Classical acup lumbar disc surgery 1 knee surgery acup vs proximal needling 1 knee surgery post anesthesia 1 postop (1994) active placebo	6 trials	Pre op, intra-op, post-operative' [n not stated]	Active comparators not inert controls potentially underestimating the value of acup.	Inclusion of only 6 trials, 2 with superficially retained needles considered an abbreviated tx. Trials dated from 1994 to 2008.	Not reported.	Overall SOE: "insufficient evidence" Considered safe. Do not encourage or discourage acupuncture for surgical pain.
Fuentealba et al. 2016 ⁴⁹ (Chile)	Acup and ear acup	5 trials 2 systematic revs	No meta	Post op tonsillectomy, knee replacement, dental surgery; (n not stated)		Reduced pain by 36% (at 20 mins) and 22% (at 2 hrs) for tonsillectomy. Reduced pain by 2% for TKA. Reduced pain by 24% (*at 2 hrs) for dental procedures.	42% reduced analgesic consumption (at 2 hrs).	Overall SOE: not assessed No meta due to study heterogeneity. Acup may be useful to manage postoperative pain. more study needed.
Wu et al. 2016 ³⁵	Acup EA TEAS	13 RCTs 4 Acup 4 EA (4) 5 TEAS	11 RCTs 2 Acup 4 EA 5 TEAS	Post-operative n=682	'control' arms not detailed	Conventional acup and TEAS lowered post-op pain on 1 st post-op day.	TEAS reduced opioid use	Overall SOE: moderate Findings support use of acup as adjuvant therapy for post-op pain

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Authors	Modality	Systematic Review	Meta-analysis	Setting/condition, number (n)	Comparators	Results	Reduced analgesics including opioids	Quality and Recommendation
	Acup point estim							
Tedesco et al. 2017 ³⁷	Acup	4 of 77 RCTs on acup	3 of 39 RCTs on acup	Post Total Knee Arthroscopy (TKA) n=230 of 2,391	Sham or nothing as comparator	Significant improvement for acup vs control group with MD= -1.14 (95% CI, -1.90 to -0.38; PO= .003 on VAS at 6 months.	Modest but clinically significant evidence acup associated with reduced and delayed opioid consumption.	Overall SOE: low for pain relief Acup studies less risk of bias. Findings support use of acup after TKA.
Murakami et al. 2017 ⁴⁰	Ear acup and electro ear acup.	10 trials	3 trials pain intensity as primary measure, n=349; 6 trials evaluating analgesic requirement, n=303	Acute care and post-op; n=700	4 Analgesics, 5 sham acup 1 distraction	Ear acup was superior to comparator (MD = -0.96, 95% CI= -1.82– -0.11), but the MD was small.	Reduced analgesic need (fentanyl, piritamide, desflurane, Papaveretum, Ibuprofen); Acup was superior (MD = -1.08, 95% CI -1.78– -0.38]), with a small MD.	Overall SOE: low to moderate. Immediate pain relief equivalent to analgesics and to 48 hrs. Promising modality for pain reduction in 48 hours with low side effect profile
Ye et al. 2019 ³⁹	Peri-op auricular (AT includes auricular acupuncture, auricular point buried-bean, auricular massage, auricular magnetic therapy, and auricular moxibustion)	9	7/9	Total hip arthroplasty (THA); n=605	(measures: VAS, intraoperative amount fentanyl, time to first analgesic request, NV, peri-op bradycardia, peri-op hypotension/. 2/9 tracked NSAIDs; sham acup 4/9.	peri-op VAS value of the intervention group was significantly lower than control group at different time points in patients after THA. (6 hrs-7 days). The observation time points of post-op 12 h (SMD with 95%CI=-1.03 (-1.51,-0.55), P<0.001), post-op 24h (SMD with 95%CI=-0.95 (-1.53, -0.37), P=0.001), P=0.08),	Acup group had lower values than the control group (SMD with 95% CI = -0.73 (-1.09, -0.36), P = 0.0001). Evidence of AT on post-op pain and Intraoperative body mass-adjusted fentanyl amount for the patients after THA was	Overall SOE: low but affirmative for AT and post THA pain. Verification is needed in future multicenter, trials.

Authors	Modality	Systematic Review	Meta-analysis	Setting/condition, number (n)	Comparators	Results	Reduced analgesics including opioids	Quality and Recommendation
						post-op 48 h (SMD with 95%CI=-0.89 (-1.48, -0.30), P=0.003), post-op 72h (SMD with 95%CI=-0.79 (-0.92,-0.66),P<0.001), post-op 5 days (SMD with 95%CI=-0.60 (-0.94, 0.26), P<0.001), post-op 7 days (SMD with 95%CI=-0.68 (-1.01, -0.35), P<0.001) .	affirmative but did not prolong time to first analgesic request or the incidence of post-op medication-related complications.	
Zhu et al. 2019 ⁴⁴	17 trials: distal: 9-EA, 1-TEAs, 1-manual acup, 3-acupressure, 1-auricular, 1-capsicum plaster. 17 trials peri-incision: TENS using surface electrodes. 1 trial distal and local	35 trials (30 in English, 5 in Chinese)	15/17 distal 11/17 peri-incision	Inpatient. distal: n=959 peri-incisional: n=805	Distal trials: 5=sham 7=nonactive tx 5=both Peri-incision TENS trials: 11=sham 3=nonactive tx 3=both	PI at rest 4, 12, 24, 48 hrs: 4 h: MD - 11.82 mm, 95% (- 15.47, - 8.16), I2 64%; 12 h: MD - 11.92 mm, 95%CI (- 13.58, - 10.26), I2 84%; 24 h: MD - 7.14 mm, 95%CI (- 8.95, - 5.13), I2 40%; 48 h: MD - 9.45 mm, 95%CI (- 12.41, - 6.50), I2 68%. Peri-incisional stimulation also showed beneficial effects compared with their controls. [4 h: MD - 10.70 mm, 95% CI (- 15.32,-6.0), I2 45%; 12 h: MD - 13.52 mm, 95% CI (- 15.25, - 11.78), I2 92%; 24 h: MD - 7.13 mm, 95%CI (- 12.38, - 1.88), I2 65%; 48 h: -	Both reduced postoperative opioid consumption at 24 h compared to sham. Peri-incisional stimulation was superior in reducing opioid consumption at 24 h whereas distal acupoint stimulation reduced opioid-related adverse effects, including nausea and dizziness. The pain intensity on movement at postoperative	Overall SOE: moderate Peri-op distal acupoint or peri-incisional stimulation is safe and effective for post-op pain and opioid sparing. They could be alternative or adjunct analgesic intervention. More studies, larger sample size and direct comparison needed in future.

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Authors	Modality	Systematic Review	Meta-analysis	Setting/condition, number (n)	Comparators	Results	Reduced analgesics including opioids	Quality and Recommendation
						<p>10.32 mm, 95% CI (-14.28, -6.37), I2 47%]. distal acupuncture showed better effects than controls at 4 h [MD -26.49 mm, 95% CI (-35.56, -17.42), I2 83%], 24 h [distal: -17.48 mm, 95%CI (-23.25, -11.70), I2 88%] and 48 h [distal: -16.61 mm, 95%CI (-21.95, -11.62), I2 82%]. Peri-incisional stimulation also showed beneficial effects compared with their controls at 4 h [MD -4.46 mm, 95% CI (-13.62, 4.70), I2 0%], 24 h [-9.53 mm, 95% CI(-14.19, -4.87), I2 0%] and 48 h [-14.02 mm, 95%CI (-19.06, -8.98), I2 0%]</p> <p>Subgroup analysis showed no difference between peri-incisional or distal stimulation on postoperative pain reduction. Both reduced pain at rest compared to their controls.</p>	4 h was lower in distal stimulation. Both reduced post-op opioid consumption at 24 h.	

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Authors	Modality	Systematic Review	Meta-analysis	Setting/condition, number (n)	Comparators	Results	Reduced analgesics including opioids	Quality and Recommendation
						Distal better effect for pain on movement or cough.		

Table 1 abbreviations: Abd=abdominal; Acup=acupuncture; Acupuncture point stimulation =APS; AE=adverse event; AT=acupuncture therapy; Ear acup=auricular acupuncture; estim=electrical stimulation; NSAIDS=no-steroidal anti-inflammatory drugs; NV=nausea and vomiting; Peri-op=perioperative; PI= pain intensity; pre-op=pre-operative; PONV=post-operative; n=number; nausea and vomiting; NNT= Number Needed to Treat; SOE=Strength of evidence

Table 2: Acupuncture for acute traumatic and emergency department acute pain: systematic reviews with/without meta-analyses

Authors, year	Modality	Systematic Review	Meta-analysis	Setting/condition Number (n)	Outcomes/comparators	Results	Quality and Recommendation
Kim et al. 2013 ⁵⁰	Needle insertion including auricular points	Systematic Review 2 RCTs 2 OBS	NA	Acute pain syndromes and non-penetrating injuries of the extremities (cardiac including heart attack) ED setting n=225	Pain VAS or NRS Physiological parameters (respiratory rate, heart rate, systolic and diastolic blood pressure) Medication consumption Length of stay in ED Patient satisfaction with the treatment Time points: immediate post-treatment Acup plus UC vs UC alone Safety, effectiveness, and feasibility of acup in the ED	Studies showed it feasible to provide acupuncture in the ED and further study to test the role of acupuncture in the ED.	Overall SOE not assessed. Internal validity assessed with Cochrane risk of bias tool- but no rating provided Current evidence found in study was insufficient to accept of refute the use of acupuncture in the ED Future studies should address the process and cost related benefits of acup use in the ED -Future research with large RCTs to evaluate

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Authors, year	Modality	Systematic Review	Meta-analysis	Setting/condition Number (n)	Outcomes/comparators	Results	Quality and Recommendation
							<p>effectiveness of acup in the ED</p> <p>-Future OBS regarding safety and acceptability of acup to ED staff and patients</p> <p>-Current evidence insufficient to provide any recommendation of acup in the ED setting</p>
Jan et al. 2017 ⁵⁴	Auricular therapies. (AT) including AA, AP	SRM 6 RCTs	<p>Meta 4 RCTs/n=286</p> <p>AT vs sham n=127</p> <p>AT+SC vs SC alone n=154</p> <p>AT alone or +SC vs control as sham alone or +SC n=271</p>	Acute pain management N=458	<p>Pain (PS-10) difference in:</p> <p>AA vs sham, AA-as-an-adjunct to other analgesia (AdjEA) vs standard analgesia care (SAC)</p> <p>AA vs control medication usage, patient satisfaction</p>	<p>AA vs sham: SMD</p> <p>AdjEA vs SAC:</p> <p>AA vs control:</p> <p>1 RCT showed reduction in NSAID usage for sore throats with reduced mean number of doses at 6 hrs, 24 hrs and 48 hrs</p> <p>In OBS AdjEA 62% of respondents said that they “would have the same treatment again”</p> <p>71% reported they were either mostly satisfied or very satisfied</p>	<p>Overall SOE not assessed.</p> <p>Ear acup has limited evidence of effectiveness for acute pain in the ED setting as stand-alone treatment as an adjunct</p> <p>Future studies with comparator group of AC vs SAC</p> <p>Future studies with patient satisfaction as secondary outcome</p> <p>Future studies assessing various techniques of ear acup, ear vs body acup, and utilization of certified acupuncturists vs non-acupuncturists</p> <p>Further testing using AdjEA vs SAC with</p>

Authors, year	Modality	Systematic Review	Meta-analysis	Setting/condition Number (n)	Outcomes/comparators	Results	Quality and Recommendation
							medication usage as secondary outcome
Jan et al. 2017 ⁵¹	Acup (26), auricular therapy (3), EAS (1)	SRM 19 RCTs and 11 OBS in systematic review	14 RCTs n=1210	Acute pain management in the ED setting n=3169 SR n=1210 meta 11 OBS Migraine, hip fractures biliary colic, aLBP, sore throat. 4-spinal pain, 3-mixed pain, 3- limb fractures 3- migraine, 3-renal colic 11- traditional acup 5- ear acup (4-BFA)	Pain (PS-10) difference: -Acup vs sham -Acup vs standard analgesia care (SAC) -Acup-as-an-adjunct to other analgesia (AdjA) vs (SAC) (pain scored recorded within 240 minutes of treatment) Analgesia use Patient satisfaction Time and cost of acup	Acup vs sham: SMD WMD 1.60 (both favoring acup) Acup vs SAC: SMD WMD (Acup comparable to SAC) AdjA vs SAC: SMD WMD (AdjA more effective than SAC (without sham)) Ear acup appeared to have better efficacy than sham with SMD 1.69 2/4 RCTs reported reduction in analgesic use at 24 and 48 h Patient satisfaction, reported in 5 RCTs, showed improvement compared to sham on 100-point scale 5 OBS measured patient satisfaction all reported improvement with AC	Overall SOE not assessed. Acup appears to provide effective analgesia for some acute pain conditions in the ED, while being non-inferior to selected analgesia medications Low cost, low risk, and patient satisfying therapy Effectiveness is reducing analgesic medication use is uncertain Future RCTs might measure the # needed to treat for 30% to 50% pain reduction or 'adequate analgesia' that has better correlation to patient satisfaction More RCTS where AdjA is compared to SAC More investigation into other pain conditions with acup vs SAC, ear vs body acup, and acup delivered by ED health providers vs qualified acupuncturists

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Authors, year	Modality	Systematic Review	Meta-analysis	Setting/condition Number (n)	Outcomes/comparators	Results	Quality and Recommendation
						<p>3 RCTs quoted costs of acup consumables less than \$5 per patient, 3 other RCTs stated acup is 'low-cost treatment'</p> <p>Acup provided statistically significant, clinically meaningful and improved levels of patient satisfaction with respect to pain relief in the emergency setting</p>	
Chia et al. 2018 ⁵²	Acup, auricular acup, EAS	Systematic Review <u>6 RCTs--</u>	NA	Acute clinical conditions in the ED including acute pain, HTN, and cardiac arrest n=651	Pain= most frequently assessed outcome Effective/success rate of treatment based on individual study criteria	<p>Acup vs sham for acute pharyngitis Acup 44.4% vs sham 10.5%, at relieving pain</p> <p>Acup vs standard ED care for acute pain Acup was more effective and faster pain control compared with IV morphine success rate acup 92% vs 78%</p> <p>EAS vs standard ED care for acute pain significant reduction in mean VAS score seen in both groups (Acup group 25.90±17.62 ; conventional ED care group 22.18±24.09</p>	<p>Overall SOE not assessed.</p> <p>Further studies evaluating clinical efficacy and effectiveness of acup in the ED. Multi-center RCTs are needed</p>

Authors, year	Modality	Systematic Review	Meta-analysis	Setting/condition Number (n)	Outcomes/comparators	Results	Quality and Recommendation
						Acup as an adjunct to standard ED care for acute pain syndrome auricular acup + SC better than SC alone in immediate pain control with 2.18 mean difference in NRS pain reduction	
Sakamoto et al. 2018 ⁵³	Acup, auricular, scalp acup	SRM 10 acup studies 5 RCTs 1 Cohort 4 Case series	4/9 direct modality acup RCTs: n=525	Acute pain in the ED n=724	Pain= most frequently assessed outcome with VAS or NRS; Acup vs no intervention Acup no comparator Acup vs sham Acup vs titrated morphine Acupuncture vs IV acetaminophen vs IM diclofenac	Acup decreased pain immediately until ED discharge (4 RCTs, 1 cohort, 4 case series) and improved nausea, anxiety, time to pain resolution and adverse effects Pain decrease similar to control immediately, 30 minutes, and 24 hours after acup (3 RCTs) 84% of patients reported benefit, 52-82% would use again, nearly all patients reported high satisfaction with >50% reporting highest satisfaction	Overall SOE not assessed. Studies addressing feasibility of implementation, opioid usage, and efficacy in terms of multidimensional functional outcomes are warranted Interventions have potential to improve acute pain management and patient satisfaction and improve patient outcomes and quality of life, while reducing overall ED utilization and length of stay
Liu et al. 2020 ⁶⁴	Acup; acup+Chinese herbs/tincture; acup+mas	SRM 17 trials Acute ankle sprain (AAS)	Acup+RICE vs RICE n=143	Out-patient Care Tx 1-21 days; Acute ankle	Kofoed Ankle Score. VAS, duration of pain, use of analgesics, ankle circumference, 'Effective rate', 'cure rate' (Chinese studies) AE.	Meta favored acup vs no tx, vs massage, vs 'ice/hot pack +Chinese medicine, Vs. infrared radiation and vs RICE (rest, ice,	Overall SOE not assessed. Acup may be beneficial for AAS; more large-scale well-designed RCTs warranted

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Authors, year	Modality	Systematic Review	Meta-analysis	Setting/condition Number (n)	Outcomes/comparators	Results	Quality and Recommendation
	sage; acup+RICE; acup+meds		Acup+dimethylsulfide vs DS alone n=87 Acup+Chinese med vs Chinese med alone n=530	sprain (AAS) n=1528	Comparators: no tx, placebo, or traditional therapies for acute ankle sprain involve nonsteroidal anti-inflammatory drugs, RICE (rest, ice, compression, and elevation), functional support, exercise, manual mobilization, etc.	compression, elevation), but not vs dimethyl sulfoxide. Acup plus dimethyl sulf. alone, acup plus massage vs massage alone, acup plus RICE vs RICE alone	

Table 2 abbreviations: Acup=acupuncture; AAS=acute ankle sprain; AE=adverse event; AT=Auricular therapies; AA=auricular acupuncture; AP=auricular pressure (as in ear seeds); AdjA= adjunct acupuncture; AdjEA=adjunct auricular acup; BFA=battlefield acupuncture; EAS=electroacupuncture stimulation (estim on needles inserted at acupoints); ED=emergency department; HTN=hypertension; n=number; OBS=observational study; RCT=randomized controlled trial; NRS=numerical rating scale; RICE=rest, ice, compression, elevation; SAC=standard analgesic care; SC=standard care; SOE=strength of evidence; UC=usual care; VAS=Visual Analogue Scale

Table 3 Nonpharm including acupuncture for acute pain in intensive care unit (ICU)

Authors/year	Modality/ kind of Study/n	Setting and types of pain	Outcomes/ Comparators	Results	Recommendation
Sandvik et al. 2020 ⁵⁵	Review of 12 studies	ICU	Measures: VAS (7); NRS (2); Edmonton Sx Assess (1);	Reduced pain intensity from hypnosis,	Overall SOE not assessed

	Hypnosis, massage, distraction, relaxation, spiritual care, harp music, music therapy, listening to natural sounds, passive exercise, acupuncture (n=576), ice packs and emotional support.	Pain provoking tissue damage, disease, surgery/medical and nursing procedures	Observational pain scale and BPS (2). Various design: quasi-experiments with control groups (6); a tx with matched controls (1); case-controlled study with pre and post-tests (1); an intervention w/o control using pre and post-tests (1); qualitative descriptive (2); crossover design with randomization (1).	acupuncture, and natural sounds	Suggest use of comprehensive multimodal interventions to investigate effects of nonpharm tx protocols on pain, intensity, pain proportion and impact on opioid consumption and sedation requirements.
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Table 3 abbreviations: BPS=Brief Pain Scale; ICU=intensive care unit; n=number; NRS=numerical rating scale; SOE=strength of evidence;

Sx=symptom; VAS=Visual Analogue Scale

Table 4: Acupuncture RCTs for acute pain: inpatient, surgery, ICU and ED

Authors/year	Modality/ kind of Study/n	Setting and types of pain	Intervention and Comparators	Results
Zheng et al. 2012 ⁶⁵	Acup or EAS Exploratory study n=45	Intensive care unit (ICU) pain of intubated patients (under mechanical ventilation)	Usual care (UC) n=15 UC plus acup n=15- v24, Yin tang) de qi and 6 hrs UC plus EAS n=15- (GV 24, Yintang); 30 min on and off/6 hrs	EAS markedly reduced dosage of sedative drug (midazolam) needed for pain/discomfort of mechanical intubation.
Murugesan et al. 2017 ⁶⁶	Acup Double blind RCT n=157	Outpatient, acute dental pain, irreversible pulpitis, tooth extraction	Acup needles 15-20 min, Classical acup + placebo tablet (n= 53) Sham acup + placebo tablet (n=52) Sham acup + Ibuprofen (n=52) VAS pre and post tx: 15, 20, 45, 60 min. Fu: 12, 24, 48 hrs.	Acup + placebo tablet statistically significant lower pain values, no diff between either sham arm including with ibuprofen. Acup + placebo tablet higher % no pain on fu=statistically significant to comparison groups.
Cohen et al. 2017 ⁵⁶	Acup Equivalence, non- inferiority RCT n=528	Multicenter ED Acute LBP n=270 Migraine n=92 Ankle sprain n=166	Prescribed acup protocol per clinical condition Acup alone (n=177) Acup + pharm(n=178) Pharm alone (n=173) Pharm: Diazepam 5mg, Hartmannn' solution, paracetamol 1gm, paracetamol 500 mg+codeine 30mg, Tramadol 40-100mg,	Acup analgesia comparable to pharm for acute back pain and ankle sprain. Three arms similarly effective at reducing pain at T1 but fewer than 40% of participants had reduction of pain of 2 points or more at T1 where more than 80% had pain of 4 or more. By T48 61% of acup alone, 57%

Authors/year	Modality/ kind of Study/n	Setting and types of pain	Intervention and Comparators	Results
			Dextropropoxyphene 32.5 mg + paracetamol 325g, Ibuprofen 400mg, diclofenac 50 mg, indomethacin 100 mg as needed. After one hour, 2 nd line: morphine 2.5mg iv. Boluses, chlorpromazine 25mg in 1000ml normal saline. VNRS Scale T0 and at every hour until discharge; Functionality by Oswestry LB Disability Q, 24hr Migraine QOL or Patients Global Assessment of Ankle Injury Scale at T48 Acceptability T1, T48; health resource use, length of stay, readmission rate, additional analgesia.	combined, 52% pharm alone were definitely willing to repeat tx. Mild AE in each arm. Safe and acceptable.
AminiSaman et al. 2018 ⁶⁷	DB RCT n=60	OR: spinal anesthesia for trans urethral lithotripsy surgery	TENS (n=30) electrodes applied to GV channel at point between Lumber 3-4, and Lumbar 5-S1 (extra point: M-BW-25: Shiqizhuixia) vs control of no intervention (n=30)	Intervention reduced pain of spinal anesthesia; duration of spinal anesthesia implementation procedure by physician in the intervention group was significantly shorter than that of the control group.
AminiSaman et al. 2018 ⁶⁸	TENS at acup points RCT N=50	ICU pain of intubated patients (under mechanical ventilation)	Li 4 and St 36 bi 30 min, 4x/24 hours; vs. sham (same device, not activated)	Reduction in pain, analgesic and sedation medication
Fox et al. 2018 ⁶⁹	Ear acup n=30	ED aLBP	Ear acup (n =15) Standard care (n=15)	Acup was feasible and effective in reducing pain intensity; comparable outcomes in 'get up and go test'
Beltaief et al. 2018 ⁵⁸	Acup n=115	ED Acute renal colic	Acup (n=54) vs titrated morphine (n=61)	Time to 50% pain reduction: acup (14 minutes) vs morphine (28 minutes). Acup associated with much faster and deeper analgesic effect; Acup better tolerance profile compared to titrated morphine.
Crawford et al. 2019 ⁷⁰	Ear acup BFA n=233	Lower extremity surgery acute pain	modified BFA (n=81) [right ear include cingulate gyrus, thalamus, omega 2, shen-men, and point zero] sham acup (n=74) [asp at ear upper limb pts] usual care (n=78)	Overall pain levels unchanged at any timepoint; modified BFA does not change pain, opioid use or QOL in those with lower extremity surgery.

Authors/year	Modality/ kind of Study/n	Setting and types of pain	Intervention and Comparators	Results
Liu et al. 2019 ⁷¹	nonpharm interventions n=182	Primarily pediatric and adolescent athletes: Acute sprains Elective surgery Appendectomy or extremity surgery	Acup with estim vs no tx: (n=72). Hypnosis vs no hypnosis: (n=50). Imagery relaxation vs no intervention: (n=60) 15-30 min txs	Acup, hypnosis and relaxation beneficial. Acup with estim improved pain relief for athlete sprains.
Schiff et al. 2019 ⁷²	Nonpharm n=1127	Peri-op pain, nausea, anxiety	SOC +Acupuncture or Reflexology or Guided imagery (n=916) SOC (n=211) (do not give n for each I group)	SOC insufficient; acup better than reflexology for nausea, otherwise all therapies provided equal advantage to SOC for pain and anxiety.
Jan et al. 2020 ⁷³	BFA n=90	ED acute abdominal, low back pain or limb trauma.	Standard Analgesic care-SAC (n=30) BFA+ SAC=Adj-BFA (n=30) Sham + SAC= Adj Sham (n=30) Intervention provided by nurses, NPs, physicians, trainees	No significant differences across groups. BFA cannot be recommended for acute pain in ED. (BFA is an abbreviated form of acupuncture)
Skonnord et al. 2020 ⁷⁴	Abbreviated, short, single tx of 'Western medical' acup protocol plus movement: n=167 Acup=86	Acute nonspecific LBP; 11 primary care settings	(n=171) 2 lumbar (right) hand points strong de qi; then patient mobilization movements 2 min, then 6 needles at Huatuojiayi L2-L4 segments to de qi. (tx time 8-9 mins.) plus usual care vs standard of care: advice re activity, meds (paracetamol and or ibuprofen) info on sick leave (Norwegian national guidelines).	No diff in pain relief across groups Usual care time to recovery=14 days Acup care plus UC time to recovery=9 days. While an abbreviated treatment, meets 3- day threshold of clinical relevance but authors inexplicably conclude it is not clinically relevant.

Table 4 abbreviations: Acup=acupuncture; Adj=adjunct; aLBP=acute low back pain; BFA=battlefield acupuncture; DB=double-blind; EAS=electroacupuncture stimulation (estim on needles inserted at acupoints; ED=emergency department; Estim=electrical stimulation; ICU=intensive care unit; LBP=low back pain; n=number; Nonpharm=nonpharmacologic; OR=operating room; RCT=randomized controlled trial; Pharm=pharmaceutical; QOL=quality of life; SAC=standard analgesic care; SOC=standard of

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care; TENS=TENS=transcutaneous electrical nerve stimulation; Tx=treatment; UC=usual care; VAS=Visual Analogue Scale;
VNRS=verbal numerical rating scale

Table 5: Pilot, retrospective or qualitative studies: acupuncture for inpatient or ED acute pain

Authors/year	Modality/kind of study/n	Setting/type of pain	Intervention/comparator/Outcome measures	Results
Crespin et al. 2015 ⁷⁵	Acup/retrospective obs/n=2500	Post op pain care after total hip or total knee replacement	Elective acup as adjunct to physical therapy beginning first day post-surgery. All Patient Refined-Diagnostic Related Groups (APR-DRG) severity of illness measures; self-reported pre and post tx pain scores 0-10	Nearly 75% of patients elected to have acup in addition to PT; acup reduced pain by 45% in short term and improved patients' capacity to perform PT during initial postsurgical recovery.
Quinlan-Woodward et al. 2016 ⁷⁶	Acup/pilot RCT/n=30	Inpatient/post breast cancer surgery	Acup (n=15) Usual care (n=15) NRS for pain, nausea	Pain nausea and anxiety were reduced in acup group on the first day, and pain was also reduced on the 2 nd day after surgery.
Reinstein et al. 2017 ⁶²	Acup Retrospective OBS n=248	Pain and anxiety ED Back (n=57) Head (n=41) Limb (n=37) Abdomen (n=27) Chest (n=17) Groin (n=3)	Feasibility outcomes: 248/279= 89% of patients agreed to acupuncture 55/75= 73% of clinical providers referred patients for acupuncture Acupuncture sessions averaged 23 minutes (SD 8.9) and ranged from 6 to 78 minutes. Acup tx vs usual care analgesics. NRS 0-10 for pain and anxiety.	Acup acceptable and effective for pain and anxiety reduction with standard care. Of patients with pre pain (n=182), 43% reported ≥50% pain reduction and 57% reported ≥30% pain reduction. Similar benefits seen regardless of whether any pain medication also was received in the ED (n=88) vs acupuncture alone (n=92).
Burns et al. 2019 ⁶⁰	Acup Retrospective OBS n=379	ED acute pain: neck/back/shoulder/hip (n=133) abd pain including urinary tract and gastric (n=123)	Acup: 53.7% of 706 patients agreed to acup (n=379) 86% had 8-15 needles,	Acupuncture is feasible and acceptable for acute pain patients in ED;

		chest pain incl. anxiety/hypertension related (n=35) head pain (incl headache, bells' palsy, epistaxis, trigeminal neuralgia). (n=37) joint/limb pain (n=31) substance withdrawal pain (n=6) generalized pain (all over or more than one site) (n=14)	92.6% 20-30 min needle time (mean 24.4 min) pre-and post-acupuncture pain, stress, anxiety, and nausea scores.	Patient-reported pain, stress, and anxiety scores all significantly improved after acupuncture, with similar benefits seen regardless of whether any pain medication also was received. Receiving only opioids during ED visit was not associated with improved pain scores. AE not reported.
Aikawa et al. 2020 ⁷⁷	Acup OBS n=102	ED, acute msk pain (n=102) LBP, neck pain, knee pain, shoulder pain.	10 sec intense tx at single or 2 acupoints NVS before and after tx. SI 3, BL 62, GB 41.	Almost all reported decrease in pain, only 4% had desire for analgesic medication.
Tsai et al. 2020 ⁷⁸	Acup Retrospective study n=24	Outpatient and inpatient units; pediatric sickle cell pain	90 txs/24 patients, mean tx duration 18.5± 4.8 min. pre/post pain scores	No AE Pain reduction
Mahmood et al 2020 ⁷⁹	Acup Retrospective n=12	Inpatient and outpatient units, pediatric sickle cell pain	Adjuvant acup 15-20 min	Acceptable, feasible; improved pain
Tsai et al. 2020 ⁸⁰	Acup manual (75%) Electro acup (1%). Combined manual and electro (24%)	Outpatient, migraine	Acup (n=477) mean 8.9 sessions) with medications alone (n=1908): sumatriptan, Rizatriptan, Ergotamine, Caffeine, Acetaminophen, Ibuprofen, and other nonsteroidal anti-inflammatory drugs (NSAIDs).	In migraine patients who underwent acupuncture treatment, the medical expenditures on emergency care (P=.01) and hospitalization v(P=.01) were significantly lower than patients without acupuncture treatment. It is cost effective to encourage combining acupuncture and western medicine to treat migraine patients.

Table 5 abbreviations: Abd=abdominal; Acup=acupuncture; AE=adverse events; n=number; ED=emergency department;

min=minutes; msk=musculoskeletal; n=number; NRS=numerical rating scale; NVS= numerical visual scale; OBS=observational;

Post-op=post-operative; PT=physical therapy; RCT=randomized controlled trial; sec=second; tx=treatment; txs=treatments

Table 6 Acupuncture for acute LBP reviews with/without meta-analysis

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Authors, year	Modality	Systematic Review	Meta-analysis	Setting condition n	Outcomes/comparators	Results	Quality and Recommendation
Lee et al. 2013 ⁸²	Acup 8/11 manual, EA, modern, wrist ankle	11 RCTs	7 RCTs	Outpatient, aLBP n=1139	3 acup vs nonpenetrating sham 7 acup vs NSAID medication 2/7 acup, acup plus meds vs meds alone 1 acup + meds vs meds alone 6- 'Cured, improved or failed' scale. 6- NRS or VAS 4-function, 2 physical exam, 2 analgesic use	Acupuncture may be more effective than NSAIDs for global assessment, but effect is small. Acup more effective than sham in reducing acute pain, but not so for function or subacute pain. Acup plus meds more effective for pain relief and overall function than meds alone. Fewer side effects than NSAIDs.	Quality mixed and needs consistency. Evidence shows potential for acupuncture, but further study needed to establish if benefit compared to NSAIDs reflects evidence of equivalence. More research needed to establish optimal dose and frequency of acup.
Chou et al. 2017 ⁸¹	Nonpharm including acup	11 RCTs of Lee et al plus 2 RCTs	NA	n=1163 aLBP (actually 1139)	Acup vs no acup Acup vs sham Acup vs meds Acup vs acup plus meds vs meds Pain and function measures	Acup decreased pain intensity more than sham, no clear impact on function. Greater likelihood of improvement compared to NSAIDs at end of tx.	SOE low to moderate for cLBP; SOE low for aLBP. There is limited evidence acupuncture is effective for acute LBP in short term (less than 3 months) and on a small to moderate magnitude. More evidence needed for acute LBP, to understand incremental benefits of combining and sequencing interventions.
Xiang et al. 2020 ⁹⁵	Acup 4/14: 1 scalp acup, 3 body acup	14 RCTs n=2110) 4 trials(sub) acute LBP (<12 wks)	9 RCTs	4 aLBP in outpatient setting (n=753)	Acup vs sham vs placebo vs UC Acup vs sham	Moderate evidence of efficacy for acupuncture in terms of pain reduction immediately after treatment for NSLBP (sub)acute and chronic) when compared to sham or placebo acupuncture. Only minor AE.	Quality moderate. Need for research on specific techniques used, including needle placement, stimulation, needle depth and the experience of the acupuncturists. Recommends standardization of the

							outcome measures and focus on duration/frequency of acupuncture sessions in future studies.
Su et al. 2021 ⁹⁶	Manual acup, EA, AA	13 RCTs n=899	13 RCTs n=899	Settings not described. aLBP	Acup (manual acup, EA, ear acup) vs drugs or sham acup	Acup significantly benefits VAS score (pain), ODI score and NOP. Effect on RMDQ equal to controls.	Quality moderate. Acup significantly benefits aLBP symptoms including reduction in analgesic medication. Heterogeneity of trials contributes to cautious recommendation of acup for aLBP. More research is needed.

Table 6 abbreviations: Acup=acupuncture; aLBP=acute low back pain; EA=electroacupuncture; LBP=low back pain;

nonpharm=nonpharmacologic; NOP=number of pills; NRS=numerical rating scale; NSAIDS=non-steroidal anti-inflammatory drugs; n=number;

ODI=Owestry Disability Index; RCT=randomized controlled trial; RMDQ=Rowland-Morris Disability Questionnaire; SOE=strength of evidence;

VAS=Visual analog scale

Table 7 Acupuncture for acute migraine reviews with/without meta-analyses

Authors, year	Modality	Systematic Review	Meta-analysis	Setting/condition, n	Outcomes/comparators	Results	Quality and Recommendations / Next Steps
Pu et al. 2016 ¹⁰² (Chinese language)	Acup	NA	5 trials	Acute migraine n=618	At 2 hrs and 4 hrs in acute migraine.	Acup may effectively relieve the intensity of pain in acute migraine.	Quality unclear. Analgesic effect of acup is significantly superior to sham acup
Coeytaux et al. 2016 ¹⁰³	Acup	Overview of SRs	Overview of Meta	Migraine, headache prevention: Cochrane	HA freq and response; compared to routine care	Significant improvement	Quality not assessed.

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Authors, year	Modality	Systematic Review	Meta-analysis	Setting/condition, n	Outcomes/comparators	Results	Quality and Recommendations / Next Steps
				SR (n=22 studies, n=4985 participants) Tension-type HA: Cochrane SR (n=12 trials, 2349 participants) Chronic HA	(n=5 studies); Sham acupuncture control (n=15); Prophylactic drug tx (n=5) HA response and # of HA days; compared to Routine care (n=2); sham acup (n=7); physiotherapy, massage, or relaxation (n=4) Specific outcome is unclear; compared to Sham acup (n=unclear)	in HA frequency compared with routine care and with prophylactic drug tx at 2 mos. Acup was significantly superior to routine care and sham acup for response and reduction in HA days at 2, 3-4, 5-6 mos Significantly larger effect size compared to sham acup	Acup should be tx option to prevent migraine Acup should be a tx option for frequent episodic or chronic tension HA None stated
Zhang et al. 2019 ¹⁰⁴	Acup	Overview of 15 SRs	Overview of 15 Meta	Acute and preventive tx of migraine (n=13 migraine; n=1 included episodic migraine; n=1 menstrual migraine included)	N=15 VAS, clinical outcome, freq. Controls =no acup, sham acup, drug tx	N=6 acup superior to drugs; n=4 acup superior to sham acup, drugs; n=3 acup superior to sham acup; n=1 acup superior to drugs, other TCM treatments; n=1 acup superior to tx migraine but did not mention control group in conclusions	Methodological quality low. Acup has advantage in pain improvement of VAS score, HA days/freq, analgesic use and efficacy of response rate. Poor quality of studies indicate better quality research needed
Li et al. 2020 ¹⁰⁵ Overview of SRs	Acup (body acup, EA,	Overview 15 SRs	NA	N=15 SRs	Sham acup, placebo, medicine, other nonpharm therapy, wait list. Primary outcome: effective	AMSTAR 2 rating: 14/15 critically	High quality evidence using Grade tool.

Authors, year	Modality	Systematic Review	Meta-analysis	Setting/condition, n	Outcomes/comparators	Results	Quality and Recommendations / Next Steps
	ear acup, warm acup, scalp acup)				rate. Secondary: intensity, freq, duration of HA; use of painkiller, QOL, recurrence, AEs.	low-quality rating and 1 low quality PRISMA-A: 11/15 adequately reporting over 70% GRADE: high quality evidence of acup superior to western medicine (fewer HA days, painkiller uses, reduced freq and HA degree compared to western medicine or sham acup)	Acup may be an effective and safe therapy for migraine, but quality of SRs need to be improved
Yang et al. 2020 ¹⁰⁶	Acup or acupoint stimulation with needle, heat, electricity, pressure, laser	13 trials n=826	9 trials	Menstrual migraine	Sham devices; routine care; medications; acup with medications. Primary outcome: number of migraines per month at completion of acup tx. Secondary: days with migraine per month; mean HA intensity by VAS; medication use; freq migraines per month 3-6 mos f/u; AEs.	Acup was not superior to sham acup to reduce monthly migraine freq and duration, intensity, or analgesic use. Pooled data: significant improvement in mean headache intensity in	Quality moderate. No strong evidence to support acup in tx of menstrual migraine.

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Authors, year	Modality	Systematic Review	Meta-analysis	Setting/condition, n	Outcomes/comparators	Results	Quality and Recommendations / Next Steps
						<p>acup group compared to drugs.</p> <p>Studies were underpowered, moderate to high risk of bias.</p> <p>No AEs</p>	
Natbony and Zhang 2020 ⁹⁸	4 ear acup methods; 1 body acup	Non-systematic review	NA	Acute migraine (5) ED setting; Episodic migraine prevention outpatient (1 SRM, 2 trials); chronic migraine prevention outpatient (3).	Pain reduction for acute migraine; reduction in migraine days in episodic and chronic migraine. Compared to various medication	Acup has potential for acute migraine in ED; acup appears more effective than no tx or sham for prevention of episodic migraine. More study is needed for chronic migraines and to address barriers to access for acute migraines. Effective dosage and frequency of tx overall needs to be addressed in trials and the duration of benefit.	Quality not assessed. Acup is a valid options for prevention of episodic migraines and has potential in ED for acute migraines.
Halker et al. 2020 ²⁹	Overview acute tx for episodic migraine (including acup)	Included 4 acup trials	NA	Outpatient, acute migraine, n=475	3 trials compared to placebo; acup superior to placebo on pain scale at one day.	Acup may improve acute migraine pain compared with sham.	SOE low for acupuncture. More research is needed. SOE low or insufficient for opioids for acute migraine.

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3 Table 7 abbreviations: Acup=acupuncture; ED=emergency department; freq= frequency; HA=headache; n=number; NA=not
4 applicable; hrs=hours; meta=meta-analysis; QOL= quality of life; SOE=strength of evidence; SRs=systematic reviews; SRM-
5 systematic review with meta-analysis; tx=treatment
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