



## Review

# Acupuncture and related techniques during perioperative period: A literature review



H. Volkan Acar

Department of Anesthesiology and Intensive Care, Ankara Training and Research Hospital of Ministry of Health, 06340 Ankara, Turkey

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## ABSTRACT

Acupuncture has been used in the Far East for more than 2000 years. Since the early 1970s, this technique has been gaining popularity among Western medical community. A number of studies suggest that its mechanism of effect can be explained in biomedical terms. In this context, a number of transmitters and modulators including beta-endorphin, serotonin, substance P, interleukins, and calcitonin gene-related peptide are released. For that reason, acupuncture can be used in a wide variety of clinical conditions. Studies showed that acupuncture may have beneficial effect in perioperative period. It relieves preoperative anxiety, decreases postoperative analgesic requirements, and decreases the incidence of postoperative nausea and vomiting. In this review article, we examine perioperative use of acupuncture for a variety of conditions.

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## 1. Introduction

Acupuncture has been a major therapeutic method for thousands of years in the Far East. Traditional Chinese Medicine (TCM) including acupuncture is based on the concept of vital energy (*qi*) flows throughout the body by multiple channels (meridians).<sup>1</sup> When there is an interruption in this flow, it can cause disease. Stimulation of points located on meridians is believed to restore Yin-Yang balance and to have a therapeutic effect.

The use of acupuncture gained popularity in the early 1970s. After a meeting in 1979, the WHO published a list of diseases that can be treated with acupuncture.<sup>2</sup> Most importantly, FDA approved acupuncture needles as a medical device in 1996.<sup>3</sup> The NIH published a report concluding that “there is sufficient evidence of acupuncture’s value to expand its use into conventional medicine”.<sup>4</sup>

Both central and peripheral mechanisms may contribute to the therapeutic effects of acupuncture.<sup>5</sup> Studies have shown that acupuncture exerts its effect at three different levels: the peripheral site, spinal cord and supraspinal structures.<sup>6</sup> Acupuncture stimulation promotes the release of endogenous opioids from lymphocytes, monocytes/macrophages and granulocytes at the peripheral site, which in turn suppresses nociception in the

E-mail address: [hvacar@yahoo.com](mailto:hvacar@yahoo.com)

peripheral nerve terminals. Serotonin, nerve growth factor and bradykinin, as well as opioids and cannabinoids, may also be responsible for the analgesic effect. At the spinal cord level, noxious input transmission was blocked after acupuncture stimulation, an effect that increases the levels of opioids, noradrenaline and 5-hydroxytryptamine (5-HT). The main effect of acupuncture in supraspinal structures is to inhibit sensorial and affective components of pain. A number of nucleuses, including the nucleus raphe magnus, periaqueductal gray, locus coeruleus, arcuate, preoptic area, accumbens, caudate, and amygdala, are responsible for this effect.<sup>6</sup>

In this literature review, our aim is to discuss the effects of acupuncture and related techniques during perioperative period. Although there are several other reviews on this topic, a large number of papers were published in recent years, too. So, it is a necessity to discuss up-to-date information on this area in the light of current information.

## 2. Acupuncture and anesthesia

The use of acupuncture for the perioperative period has a history of more than 50 years. “Acupuncture anesthesia” was first used in Shanghai, China, in 1958.<sup>7</sup> The first article in the Western medical literature was published in JAMA in 1971.<sup>8</sup>

While “perioperative” refers to the three phases of the surgical period, including the preoperative, intraoperative, and postoperative phases, acupuncture can be used in all of these phases for specific indications.

### 2.1. Preoperative period

Preoperative anxiety is the leading problem for anesthesiologists in the preoperative period. In Western literature, the first study dealing with the use of acupuncture for preoperative anxiety was performed by Wang et al.<sup>9</sup> In this study, 55 volunteers were divided into three groups: *shenmen*, relaxation, and sham. Permanent ear press needles were inserted and kept in place for 48 h in all groups. The results showed that the effect of acupuncture started in 30 min and lasted for up to 48 h, while the relaxation point resulted in a lower anxiety score when the three groups were compared. Following this volunteer study, the same research group investigated anxiety in preoperative patients.<sup>10</sup> Three groups of patients underwent unilateral acupuncture at three points for 30 min. The authors found that ear acupuncture in the relaxation group resulted in a more significant anxiolytic effect than a traditional Chinese medicine group and control group. The very first study evaluating the effects of body acupoints on preoperative anxiety was performed by Fassoulaki et al.<sup>11</sup> The authors used acupressure to stimulate the *yintang* (EX-HN3) point, which is located at the root of the nose. Ten minutes of acupressure led to a significant decrease in the bispectral index and verbal stress scale scores compared to sham acupoint stimulation. Later studies confirmed that acupuncture is an efficient nonpharmacological method for relieving anxiety in adults, children, and parents whose children are undergoing surgery (Table 1).<sup>12–18</sup> However, a study that investigated the effect of stimulating body acupoints did not find a difference between true and sham acupuncture points.<sup>19</sup>

Some investigators have also suggested that acupuncture can be used for dental anxiety, anxiety before extracorporeal shock wave lithotripsy, and anxiety in prehospital transport settings.<sup>20–22</sup>

### 2.2. Intraoperative period

General anesthesia has three main characteristics: loss of consciousness, muscle relaxation and surgical analgesia. Although numerous studies have shown that acupuncture has an analgesic

effect in animal models and humans, the current literature does not provide sufficient evidence that acupuncture is effective for loss of consciousness and muscle relaxation. Accordingly, recent acupuncture studies have focused on the use of acupuncture as an adjuvant to general anesthetics to decrease the doses of anesthetics and/or opioids intraoperatively.

Intraoperative acupuncture studies can be classified into three categories: acupuncture as an adjuvant for general anesthetics, acupuncture as an adjuvant for local anesthetics, and acupuncture as an adjuvant for intravenous analgesics/sedatives.

Early studies of intraoperative acupuncture have reported very promising results with up to 70% decreases in the anesthetic requirements.<sup>23–26</sup> However, the major limitation of these studies is the low methodological quality, while most are not double-blind, placebo-controlled studies. This factor is thought to decrease the credibility of the positive results presented in these studies.

An intraoperative acupuncture study with good methodology was performed by Greif et al.<sup>27</sup> The cross-over study in volunteers has revealed that stimulation of bilateral ear acupuncture points (lateralization control point) caused an 11% decrease in the desflurane requirement. Another study with a similar design used four acupoints in the right ear and showed an 8.5% decrease in the desflurane requirement.<sup>28</sup> Another study found that preoperative electroacupuncture resulted in a decrease in the intraoperative opioid consumption.<sup>29</sup> Although these studies concluded that acupuncture might decrease the anesthetic requirements intraoperatively, other studies do not support this claim. Morioka et al. and Kvorning et al. did not find a decrease in the level of inhalation anesthetics with the stimulation of body acupoints.<sup>30,31</sup>

Based on these, one may not conclude that acupuncture reduces intraoperative anesthetic/opioid consumption.<sup>32–34</sup> However a recent review article emphasize the value of perioperative acupuncture in specific surgical populations.<sup>35</sup> Perioperative acupuncture may improve recovery in outpatient surgery population and may also reduce postoperative morbidity and mortality in elderly patients.

### 2.3. Postoperative period

A great number of studies have investigated the effectiveness of acupuncture for postoperative pain relief and postoperative nausea and vomiting (PONV), while these two indications are the most common challenges that face anesthesiologists in the postoperative period. Additionally, acupuncture is also used for postextubation laryngospasm, postoperative sore throat, emergence agitation (EA) and postdural puncture headache (PDPH).

#### 2.3.1. Postoperative pain

A wide variety of acupuncture techniques, including manual acupuncture, electroacupuncture, acupressure, transcutaneous acupoint electrical stimulation (TAES), ear acupuncture, and the use of capsicum plasters on acupoints, have been used for relieving postoperative pain.<sup>36–45</sup> Some of these studies have yielded positive results, while others have yielded negative results.<sup>36,38,40,42,46–48</sup> The success of acupuncture treatment in this indication depends on several factors, such as the selection of points, timing of acupuncture, duration of sessions and selection of stimulation technique (Table 2).

**2.3.1.1. Ear acupuncture.** Acupuncture caused a decrease in analgesic requirements in knee arthroscopy and total hip arthroplasty patients.<sup>41,42</sup> These two studies by Usichenko et al. used permanent ear press needles that were inserted preoperatively and retained in situ for 3 days postoperatively. After knee arthroscopy, ibuprofen consumption by the acupuncture group was significantly less than the control group (500 mg vs. 800 mg, respectively).<sup>41</sup> In the

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