



## CLINICAL CASE REPORT



# Acupuncture in the Management of Intraoperative Nausea and Vomiting

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## Abstract

Intraoperative and postoperative nausea and vomiting (IONV and PONV, respectively) are common complications of anesthesia with significant associated morbidity. Strategies for their prevention and treatment have been organized in pharmacological and nonpharmacological measures. Acupuncture at PC6 has demonstrated efficacy in randomized trials, although evidence regarding its efficacy in treating IONV and PONV has not yet been fully established. We present the case of a patient who underwent peripheral vascular surgery on a limb under a subarachnoid block and who developed IONV refractory to conventional pharmacological therapy. Acupuncture at the PC6 and the TF4 points proved to be an effective alternative treatment to conventional pharmacological treatment and resulted in almost immediate cessation of IONV.

## 1. Introduction

Intraoperative and postoperative nausea and vomiting (IONV and PONV, respectively) are common complications of anesthesia and, although self-limiting, may cause significant morbidity, including dehydration, water and electrolyte imbalances, suture dehiscence, esophageal rupture, and serious airway compromise [1]. They are also associated with increased length of hospital stay and increased hospital costs [1–3].

Estimating an individual's risk for PONV can indicate who will most likely benefit from prophylaxis. In adults, only a

few baseline risk factors occur with enough consistency to be considered independent predictors for PONV [3]. Risk factors for PONV can be categorized into three groups: patient-specific risk factors, anesthesia-related risk factors, and surgical risk factors. Female sex, nonsmoking, and history of PONV or motion sickness are among the most important and prevalent patient-specific predictors. Anesthesia-related independent predictors are general anesthesia with volatile anesthetics, nitrous oxide, and the use of postoperative opioids. Surgical risk factors are associated with the type and the duration of surgery: PONV risk increases by 60% for every 30-minute increase in the

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duration of surgery. Breast and gynecological surgeries represent the most frequent reports of PONV in adults. Strabismus, hernia repair, orchidopexy, and penile surgery are associated with higher incidences of PONV in children [2,3].

The literature comparing IONV with PONV is scanty. Some studies suggest that the overall incidence of IONV can reach 42% in patients undergoing subarachnoid anesthesia for nonobstetric surgery, whereas the incidence rates for PONV in that group range from 40% to 90% [1]. The risk factors for IONV include both anesthesia-related causes (e.g., hypotension, excessive vagal activity, and parenteral or neuraxial opioids) and nonanesthesia-related causes (e.g., surgical stimulus, sudden mobilization in susceptible individuals, and medications such as antibiotics and uterotonic agents) [1].

Regional anesthesia is associated with a lower incidence of both IONV and PONV compared with general anesthesia. Nevertheless, when performing a neuraxial approach, the high sympathetic block, the development of hypotension, and the use of intrathecal morphine are associated with higher rates of IONV and PONV [4,5]. Increased vagal activity after a sympathetic block stimulates peristalsis, which could lead to these symptoms [6].

Management of IONV and PONV requires pharmacological and nonpharmacological measures, and these encompass acupuncture, acupressure, transcutaneous electrical nerve stimulation, and electroacupuncture [7,8]. However, the limited efficacy and the side effects associated with antiemetics used as prophylaxis and treatment for IONV and PONV have led to the need for alternative treatments [2,8].

Acupuncture is a Chinese millenary treatment consisting of the stimulation of specific points on any of 12 individual meridians that control the flow of energy ("qi") throughout the body [9]. Each meridian has a distinct number of points located along it, and it passes through or near the organ for which the meridian is named. Inhabiting the 12 meridians are 365 common points, with each point being denoted by the meridian name followed by a specific number. In addition to the points within the meridian system, several points and systems exist on "extra" meridians and anatomical regions such as the ear (i.e., auricular acupuncture) [9–11].

Acupuncture has numerous indications, including nausea and vomiting during the perioperative period. Although not completely understood, the antiemetic effect of acupuncture apparently stems from the resultant increase in hypophyseal secretion of beta-endorphins and adrenocorticotrophic hormone, with subsequent inhibition of the chemoreceptor trigger zone and vomiting center. Acupuncture also affects the upper gastrointestinal tract, decreasing acid secretion [12].

Acupuncture point PC6 (also named *Neiguan*) is located on the Meridian Pericardium *Jueyin*; its stimulation regulates the flows of *qi* and blood, which have been altered by surgery [5]. PC6 is located on the anterior side of the distal part of the forearm, 2 cm proximal to the wrist crease, between the tendons of the palmaris longus and the flexor carpi radialis [13]. Another important acupuncture point is auricular TF4 (*Shenmen*), located on the upper half of the ear, near the inferior lateral wall of the triangular fossa. *Shen* means mind, spirit, consciousness; *men* stands for

door, gate. It shares the name and the activities of another point on the Heart Meridian (HT7), although the former shows a broader range of therapeutic effects. TF4 stimulation relieves anxiety, reduces the occurrence of nausea and vomiting, and improves the functions of the stomach and the intestine to expedite postoperative recovery [14]. Similarly, other acupuncture points are associated with the reduction of pain, anxiety, and nausea and vomiting after surgery [2,9,15]. These can reduce the requirement for anesthesia [9]. Adverse effects arising from acupuncture are uncommon and usually self-limiting, with the most frequent being local erythema, edema, paresthesias and pain [2]. Serious complications have not been reported [2].

We present the case of IONV refractory to conventional pharmacological therapy that was successfully managed with acupuncture and acupressure as an alternative therapy. In our case, the conventional therapy would have been the administration of naloxone or a conversion to an anesthetic procedure involving general anesthesia with an increased risk of cardiac and pulmonary complications. Thus, acupuncture proved to be a safe and effective alternative to the conventional pharmacological treatment of IONV.

## 2. Case Presentation

We report the case of a 78-year-old female patient scheduled for a left femoropopliteal bypass owing to a history of a very limitative intermittent claudication with several months of evolution. An inferior limb Eco-Doppler showed a significant atherosclerotic occlusion on the left femoral artery with surgical indication. She had a poorly controlled arterial hypertension, although it had been medicated with two different classes of antihypertensive drugs. She had no clinical history of anesthetic complications including IONV or PONV.

After the preanesthetic evaluation, exclusion of contraindications and American Society of Anesthesia (ASA) standard monitoring (noninvasive arterial blood pressure and heart rate, pulse oximetry, continuous electrocardiogram), 4 mg dexamethasone IV was administered as a PONV prophylaxis. After that, the subarachnoid block was performed using a beveled Quincke needle with a 25-gauge caliber; then, 12 mg hyperbaric bupivacaine and 0.4 mg morphine were administered. The technique proceeded uneventfully.

After the quality of the subarachnoid block had been tested, surgery was initiated. The surgical procedure consisted of skin incisions, then dissection until identification of the vascular structures (femoral artery, saphenous vein, popliteal artery among others) in the femoral and popliteal area. When these structures had been identified, the lesions could be identified and bypassed with healthy veins or prosthetic material. Twenty minutes after the beginning of the surgery, when the vascular structures were being identified, the patient started complaining of nausea and started vomiting. An intravenous administration of 4 mg ondansetron was prescribed, resulting in a slight improvement of the symptoms. Thirty minutes after the initial treatment and because of a recurrence of symptoms, a decision was made to sequentially administer 0.625 mg

droperidol, 4 mg dexamethasone, and 20 mg propofol, but this did not result in any significant improvement.

The patient remained hemodynamically stable, maintaining sinus rhythm with no hypotension. She remained conscious and cooperative. Blood gas analysis excluded hydroelectrolytic abnormalities and hypoxia as potential causes. The patient felt no pain, only discomfort associated with active vomiting. No further diagnosis was considered other than the anesthetic procedure, and the exclusion diagnosis was based on potential anesthetic and surgical complications.

Given the availability of qualified professionals who have recognized training and competence and are thus authorized to practice acupuncture and given the refractory nature of the IONV, the decision was made to implement a nonpharmacological treatment with acupuncture by piercing the skin with traditional acupuncture needles at the PC6 and the TF4 acupoints. After 5 minutes, the patient had improved significantly, and IONV ceased. Acupuncture needles were maintained in place throughout the surgical procedure, which lasted 3 hours. From time to time, the needles were stimulated through manual manipulation. At the end of the intervention, the acupuncture needles were withdrawn. An acupressure sphere with an elastic band was positioned on PC6, where it remained during the immediate postoperative period in the recovery room. A post-anesthetic evaluation on the following day revealed no PONV after discharge from the recovery room. The patient was stable, without any pain.

### 3. Discussion

A high dose of neuraxial morphine is the most probable culprit for the clinical presentation seen with this patient. Intrathecal morphine is a viable option in peripheral vascular surgery. Benefits have been shown in coronary bypass surgery concerning analgesia, early extubation, and decreased length of intensive care [16]. Nevertheless, intrathecal morphine is associated with dose-dependent vomiting that may, in orthopedic surgery, reach incidence rates of 100% with 1-mg doses [5]. Doses exceeding 0.2 mg given intrathecally are often associated with a high rate of PONV; lower doses have revealed no increased consumption of antiemetic drugs [4,5]. Comparing morphine to lipophilic opioids via the neuroaxial route, intrathecal morphine slowly crosses the brain–blood barrier, binds to epidural fat to a lesser extent, connects most avidly to specific receptors in the gray matter of the central nervous system, and has a lower plasma uptake, maintaining its high concentrations in cerebrospinal fluid for longer periods [1]. Other pharmacologic strategies with demonstrated efficacy in the prophylaxis of PONV after a subarachnoid block with morphine include ondansetron and naloxone [8].

Studies on pharmacological treatments to prevent or control the symptoms associated with neuraxial morphine have been conducted, the great majority of which involved gynecologic patients. Ondansetron and naloxone proved to be effective in the prophylaxis of PONV after a subarachnoid block with morphine in those patients [8,17]. Alternatively, low doses of atropine and droperidol can also be

helpful as prophylaxis for IONV and PONV [18]. Ondansetron is effective not only as prophylaxis but also as a treatment for PONV, IONV, and pruritus induced by intrathecal morphine in gynecological patients [19]. Other studies demonstrated that droperidol and ondansetron in combination were more effective in controlling nausea and vomiting after the use of intrathecal morphine than they were when given separately [20]. Dexamethasone alone (intravenous or subarachnoid routes), or in combination with ondansetron, also showed positive results regarding PONV [21,22]. Patients in the intervention groups of the studies described above received half the dose of subarachnoid morphine given in this case (0.2 vs. 0.4 mg), which may justify the observed refractory nature of IONV.

Consensus guidelines for PONV management report an effective reduction in nausea and vomiting and a need for alternative antiemetics after stimulation at PC6 [2]. According to traditional Chinese medicine, the acupuncture point PC6 (also named *Neiguan*) is located along the Meridian Pericardium *Jueyin*; its stimulation regulates the flows of *qi* and blood, which have been altered by surgery [5]. PC6 is located on the anterior side of the distal part of the forearm, 2 cm proximal to the wrist crease, between the tendons of the palmaris longus and the flexor carpi radialis [9]. This technique is described as having an effectiveness similar to or greater than that of prophylactic antiemetic drugs, such as ondansetron, droperidol, or metoclopramide [8]. Conversely, another recent meta-analysis showed no significant differences between stimulation of the PC6 acupoint and the use of antiemetic drugs in PONV prophylaxis, and the evidence is inconclusive regarding a combined approach (acupuncture and pharmacological) compared with a pharmacological approach only [23].

The timing and the duration of PC6 stimulation are important topics of discussion. Recent studies evaluating the timing of acupuncture showed no impact on PONV whether it was started prior to or after the induction of anesthesia, although older reviews showed some benefit when this technique was performed earlier [3]. The duration of stimulation is variable: in PC6 acupuncture, needles remain in place for times from 5 minutes to the total duration of the surgery; in acupressure, the elastic bands can be kept in place for 24 hours [3]. One study demonstrated that PC6 stimulation until 72 hours after surgery significantly increased the success of the technique compared with stimulation limited to 30 minutes prior to the surgery [24]. No apparent differences between unilateral or bilateral acupuncture at PC6 in the treatment and the prophylaxis of IONV and PONV have been noted [3]. In our case, we also used acupuncture needles in the ear's Shenmen point. This point is situated at the apex of the triangular fossa. It is not associated with any specific organ, but is one of the most recognized auricular points and is used to treat several conditions, such as pain, sedation, or inflammation. Neuropsychologically, it is thought to alleviate fear, anxiety, and apprehension and to help regulate the sympathetic nervous system.

Studies on gynecologic surgery have highlighted the auricular *Shenmen* as having a positive effect on PONV [13]. A study on gynecologic surgery demonstrated poor results for acupressure in the prevention of IONV in patients

undergoing spinal anesthesia. The time frame between the deployment of the elastic band of acupressure and the induction of anesthesia was considered to be short and a possible explanation for the findings [13,25]. Acupressure in cardiac and endoscopic urologic surgery failed to demonstrate any reduction in nausea and vomiting. The small sizes of the intervention groups in both studies should be taken into account [26,27].

Acupuncture is a widespread technique, but requires proper training. The Portuguese Society for Ambulatory Surgery has issued guidelines recommending the use of acupuncture and acupressure at P6 for the treatment or the prevention of IONV and PONV. Nevertheless, very few clinicians use these techniques, even though they are highly recommended, because of the lack of proper training and fear of litigation. The certified courses in our country are time and money consuming, and one viable alternative is cooperation between professionals with different backgrounds, as in our case.

Because this is a case report, further studies should be implemented to confirm our findings. This study may have a possible observational bias related to the synergistic effects of both the medication given and the acupuncture treatment. Also, no previous assessment of the patient according to the practice of traditional Chinese medicine practice might have led to the use of different acupuncture points.

In conclusion, high doses of intrathecal morphine are associated with IONV and PONV that can be refractory to pharmacological treatment. Acupuncture is an effective and proven form of prophylaxis and treatment for these complications, as is illustrated by this case. A multidisciplinary approach to IONV and PONV seems to be more successful.

## Disclosure statement

The authors declare that they have no conflicts of interest and no financial interests related to the material of this manuscript.

## Author contributions

Nurses Vanessa Covas and Manuela Santos were qualified for the practice of acupuncture and were therefore responsible for choosing and applying the acupuncture treatment. They were not initially involved in the anesthetic procedure or the patient's treatment, but their help was sought by the anesthesiologists and they agreed to render it. Notwithstanding, in accordance with the legislation in our country, medical doctors are responsible for provision of safe care to patients, as well as for all treatments given to the patients.

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