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# Pressure to the P6 Acupoint and Post-Appendectomy Pain, Nausea, and Vomiting: A Randomized Clinical Trial

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**ABSTRACT**

***Introduction:*** The use of acupressure is growing. Several studies have applied pressure to the P6 to reduce postoperative nausea, vomiting, and pain but have reported conflicting results. This study aimed to investigate the effects of pressure to the P6 point on pain, nausea and vomiting after appendectomy. ***Methods:*** A single-blind, randomized controlled clinical trial was conducted on 88 patients after appendectomy. The subjects were randomly assigned to two groups. After the patients in the intervention group had regained their consciousness, pressure was applied to the P6 acupoint using special Acubands. In the control group, the Acubands were fastened loosely on the patients' wrists. The bracelets were kept for seven hours and pain, nausea, and vomiting were measured hourly. Student's t-test and chi-square test were used to analyze data. All analyses were performed in $SPSS_{11.5}$. ***Results:*** The two groups were not significantly different in terms of age, body mass index, duration of anesthesia, and length of incision. The mean pain intensity in the two groups was not significantly different at different times. Overall, 45.4% of the P6 group and 47.7% of the control group experienced postoperative nausea. The two groups were not significantly different in the mean intensity of nausea at different postoperative hours. In total, 12 patients in the P6 group and 18 in the control group had vomiting ***Conclusion:*** Pressure to the P6 did not significantly reduce pain and nausea after appendectomy. However, the incidence of vomiting was less in the P6 group. This method can be used to reduce vomiting after appendectomy. Similar studies are suggested to apply pressure with the onset of pain or nausea and vomiting.

## Introduction

Pain, nausea, and vomiting are common postoperative problems.[1-3] Studies have shown that mild pain is experienced by 30% of post-surgery patients. While another 30% will suffer from moderate pain, the rest (40%) have to deal with severe pain.[4] The incidence of postoperative nausea and vomiting varies between 20% and 30% depending on the type of surgery and patient-related factors.[5]

Opioids and non-steroidal antiinflammatory drugs are the most common treatment for postoperative pain. However, these drugs are expensive and bring about complications such as respiratory depression and gastrointestinal problems.[6] Conventional medications to control postoperative nausea and vomiting are also associated with complications. For instance, metoclopramide can lead to drowsiness, extrapyramidal symptoms, headache, and diarrhea. Ondansetron may also cause headache, diarrhea, and transient increases in liver enzyme levels.[7, 8] Therefore, the use of alternative, less

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harmful, cheaper methods has been taken into account in recent years.

A large number of non-pharmacological studies to reduce postoperative pain, nausea, and vomiting have focused on acupressure.[9,10] According to the philosophy behind acupressure, any imbalance or blockage of energy flow within the body can cause discomfort, illness, or pain.[11] Hence, acupressure seeks to restore the body to a state of balance. Chinese medicine identifies certain points of the body as acupoints. Pressure at these points will restore the body's inner balance, remove muscle spasms, improve blood circulation and the body's vital energy, and enhance the person's feeling of comfort.[12] Acupressure has been used as an ancient method to relieve pain[7] and reduce nausea and vomiting in several countries of the world, especially in China.[11,13]

Despite its popularity, the function, mechanisms of action, and level of effectiveness of acupressure remain controversial due to inadequate research.[11] Several studies have evaluated the effects of acupressure on pain, nausea, and vomiting after various surgeries. They have suggested a number of acupoints and methods of compression to reduce postoperative nausea and vomiting.[11] Although most focus in these studies has been on stimulating pericardium 6 (P6 or neiguan), conflicting results have been reported.[7, 9, 14, 15]

P6 is a main acupuncture point located in the anterior surface of the forearm, two inches higher than the transverse fold of the wrist, between the palmaris longus and flexor carpi radialis tendons.[7,16] Some studies have shown that pressing P6 reduces postoperative nausea and vomiting.[8,11,17,18] However, a systematic review on six randomized, controlled trials about the effects of stimulating P6 reported that this method was not effective in half of the studies.[19] Similarly, a recent Cochrane Review found pressure to the P6 not to affect postoperative vomiting but to reduce nausea.[9] Three other studies concluded that this technique fails to prevent nausea and vomiting after abdominal surgeries.[3,7,15]

Experimental studies have also examined the efficacy of stimulating some acupoints in reducing postoperative pain.[20] Sakurai et al. suggested that pressing P6 had little impact on pain after abdominal surgery and that further investigation is necessary.[6] Appendectomy is the most common emergency abdominal surgery.[21] Considering the conflicting results of previous studies, the present study aimed to assess the effects of pressing P6 on pain, nausea, and vomiting after appendectomy.

## Materials and methods

A single-blinded randomized controlled trial was conducted during a six-month period in Alzahra Hospital, Isfahan, Iran. Candidates for appendectomy who met the inclusion criteria were consecutively invited to the study. They were randomly allocated to two groups using a dice (odd numbers to the acupressure group and even numbers to the control group). Finally, 44 subjects were placed in each group.

Acupressure was applied using special wristbands called Psi Band (designed in the US, manufactured in China). A researcher was also trained in acupressure before the study started. Before the surgery, the patients were explained about the overall design of the study. Both groups were notified that a special bracelet will apply pressure to their wrists for seven hours to decrease their pain, nausea and vomiting. However, they were blinded to the grouping.

Each wristband had a special button which had to be located at the concerned point. The intervention was started in the recovery room after the patients had gained their full consciousness (aware of place, time, and person). All the patients were anesthetized, intubated, and injected with sodium thiopental (5 mg/kg), atracurium (0.6 mg/kg) and fentanyl (2 µg/kg). Anesthesia was maintained with a gaseous mixture of oxygen plus nitrous oxide (50% each),

 

morphine (0.1 mg/kg), and isoflurane gas equal to one minimum alveolar concentration (MAC).

To eliminate the effect of patient transfer on pain, nausea, and vomiting, all patients were transferred to the surgical ward by a specially trained team. After consciousness, the severity of pain, nausea, and vomiting were evaluated and recorded as baseline values. Then, two wristbands were fastened on patients' wrists by a co-researcher. In the intervention group, each wristband was perfectly placed to let the button touch P6. The bands were fastened hard enough to prevent their accidental movements as well as patient discomfort. The special gauges of the bands were then pressed so that the button can press P6 for four millimeters in depth. Radial pulses were then carefully examined to ensure that the wristbands would not interfere with the radial artery blood flow. The patients' hands were also examined to ensure the absence of impaired venous return. In order to keep the patients and staff blinded to the grouping, similar wristbands without the push button were also placed around the patients' wrists in the control group.

As post-surgical patients may experience the most severe pain, nausea, and vomiting in the first six hours after surgery,[5] we kept the wristbands in place until the seventh postoperative hour. However, the co-researcher loosened them for 10 minutes and tightened them again every two hours if the patients reported any discomfort.

The severity of pain and occurrence and severity of nausea and vomiting were assessed and recorded in both groups every hour for seven hours. In case of severe nausea and vomiting, an anti-emetic medication (metoclopramide, 10 mg) was administered and nausea was considered as severe. An analgesic medication (pethidine, 1 mg/kg) was also administered if the pain score was 60 or higher.

Data was collected by means of a form that was designed in four sections after a literature review. The first part contained demographic information including age, gender, height, and weight of the patients and the group the patient belonged to. There were two questions about the incision length (mm) and duration of anesthesia (minutes). The second part consisted of a visual analogue scale (VAS) to measure the severity of pain and a table to record values at different hours. The VAS consisted of a 100-mm calibrated line with a definite beginning and end. Descriptors were placed at each end of the line (0: no pain and 100: the most severe pain). Patients were asked to mark an X on place that corresponded with severity of pain. Then the length of the line was measured with a ruler and the results (in mm) were recorded in the mentioned table.

The third section included a VAS for measuring the severity of nausea. The VAS was exactly similar to the one described above and the collected values were recorded hourly. The fourth part comprised a table for recording the incidence of vomiting during different hours. This table was then used to calculate the severity of vomiting (more than five times in the past hour: severe, three-five times: moderate, less than three times: mild). The reliability and validity of instruments for measuring pain, nausea, and vomiting have been confirmed in previous studies.[22,23] However, the content validity of the instruments was reconfirmed by several faculty members in the School of Nursing and Midwifery, Kashan University of Isfahan Sciences (Iran). In order to calculate inter-rater reliability of the instruments, a researcher and a nurse (who had been trained before the main study) used the instruments to simultaneously monitor seven patients after surgery (without performing acupressure) for two hours. Then, the correlation coefficients were calculated ($r = 0.98$, $p = 0.02$).

All 15-70-year-old patients who were in the list of appendectomy under general anesthesia were included if they consented to. The patients were only included if they had no problems in the wrist and P6 area and their surgeon allowed them to take part. Any unforeseen complications during surgery and anesthesia, length of surgery more than two hours, having a history of nausea and vomiting associated with acute and chronic illnesses (such as digestive and ear disorders), having a history of nausea and vomiting in the past 24 hours, receiving drugs outside routine anesthesia protocol for appendectomy patients, drug and alcohol addiction, having a diagnosed neurological or psychiatric disorder, fever higher than 38 degrees, and prior use of acupressure or acupuncture were considered as exclusion criteria.

The Research Council and the Human Research Ethics Committee of Kashan University of Medical Sciences approved the study. In addition, hospital officials permitted the study to be performed. All patients were informed about the design of the study and assured about data confidentiality and their right not to participate. They also signed a written informed consent. The patients were also assured that they would receive pain and nausea/vomiting medications if the acupressure techniques did not suffice. We also observed all ethical issues in accordance with the last version of the Declaration of Helsinki.

Student's independent t-test was used to compare the mean scores between the two groups. Chi-squared test was used for nominal and rank data. All statistical analyses were performed using SPSS for Windows 11.5 (SPSS Inc., Chicago, IL, USA).

## Results

In total, 88 patients with a mean age of 29.99 (13.92 years were studied. No significant differences were observed between the two groups in terms of age, body mass index, duration of anesthesia, and the incision length (Table 1). The mean pain intensity in the acupressure group was more than the control group at the first and fourth hours after the operation, but less at other times (Table 2).

Postoperative nausea was observed in 20 patients in the acupressure group and 21 in the control group. There was no significant difference between the two groups in the incidence or intensity of nausea at different times (Table 3). Overall, 12 patients in the acupressure group and 18 in the control group had vomiting ($p = 0.01$) (Table 4). While all patients with vomiting in the acupressure group and 11 in the control group experienced mild vomiting, others had moderate vomiting. Severe vomiting was not seen in any of the patients. Five patients in the acupressure group and 12 in the control group received anti-emetic medication.

## Discussion

In the present study, the mean score of postoperative pain in the P6 group was not significantly different from that of the control group, i.e. pressure to the P6 is not effective on reduction of postoperative pain. Therefore, researchers should try to find

**Table 1.** Demographic characteristics of the P6 and control groups

| Variable | Group | | p (t-test) |
|---|---|---|---|
| | P6 | Control | |
| **Age** (year) | 30.32 (14.03) | 29.66 (13.96) | 0.81 |
| **Body mass index** (kg/m$^2$) | 22.78 (4.12) | 22.00 (4.13) | 0.36 |
| **Incision length** (mm) | 60.39 (13.24) | 56.17 (11.98) | 0.95 |
| **Duration of anesthesia** (min) | 84.89 (20.72) | 85.45 (16.97) | 0.61 |

Values are expressed as mean (SD).

 

**Table 2.** The mean intensity of pain in the two groups during the first seven hours after appendectomy

| Time | Group | | 95% CI† | Statistical indicators |
|---|---|---|---|---|
| | P6 | Control | | |
| **Baseline** | 51.8 (37.3) | 47.5 (33.6) | -10.7,19.3 | p = 0.57, t = 0.564 |
| **First hour** | 43.5 (24.2) | 41.9 (21.1) | -8.0,11.1 | p = 0.76, t = 0.324 |
| **Second hour** | 37.6 (24.5) | 41.5 (28.1) | -15.1,7.1 | p = 0.48, t = -0.712 |
| **Third hour** | 37.3 (23.0) | 39.3 (22.3) | -11.5,7.6 | p = 0.69, t = -0.404 |
| **Fourth hour** | 44.9 (17.5) | 40.3 (20.0) | -3.3,12.5 | p = 0.06, t = 1.150 |
| **Fifth hour** | 38.5 (18.8) | 39.2 (15.1) | -7.9,6.5 | p = 0.46, t = -0.187 |
| **Sixth hour** | 36.9 (15.8) | 39.4 (14.4) | -8.9,3.9 | p = 0.85, t = -0.781 |
| **Seventh hour** | 37.0 (15.1) | 38.1 (14.9) | -7.3,5.3 | p = 0.75, t = -0.320 |

Values are expressed as mean (SD). †Confidence interval of the difference

**Table 3.** The mean intensity of nausea in the two groups during the first seven hours after appendectomy

| Time | Group | | 95% CI† | Statistical indicators |
|---|---|---|---|---|
| | P6 | Control | | |
| **Baseline** | 8.98 (18.67) | 8.50 (18.68) | -7.4,8.3 | p = 0.96, t = 0.120 |
| **First hour** | 14.34 (25.62) | 14.77 (26.36) | -11.4,10.5 | p = 0.94, t = -0.078 |
| **Second hour** | 17.73 (23.88) | 19.41 (29.63) | -13.1,9.7 | p =0.96, t =-0.293 |
| **Third hour** | 19.98 (24.50) | 23.68 (31.04) | -15.5,8.1 | p = 0.82, t = -0.621 |
| **Fourth hour** | 21.91 (26.11) | 24.14 (31.67) | -14.5,10.1 | p = 0.67, t = 0.720 |
| **Fifth hour** | 20.80 (25.23) | 24.59 (30.44) | -15.6,8.1 | p = 0.81, t = -0.637 |
| **Sixth hour** | 15.91 (20.89) | 18.09 (22.03) | -11.2,6.9 | p = 0.77, t = -0.477 |
| **Seventh hour** | 12.30 (16.14) | 14.93 (19.44) | -10.2,4.9 | p = 0.59, t = -0.692 |

Values are expressed as mean (SD). †Confidence interval of the difference

**Table 4.** Incidence of vomiting in the two groups during the first seven hours after appendectomy

| Incidence of vomiting | Group | | Statistical indicators |
|---|---|---|---|
| | P6 | Control | |
| **None** | 32.0 (72.7) | 26.0 (59.1) | |
| **One time** | 9.0 (20.5) | 4.0 (9.1) | p = 0.01 |
| **Two times** | 3.0 (6.8) | 7.0 (15.9) | $X^2 = 11.14$ |
| **Three times** | 0 | 7.0 (15.9) | |

Values are expressed as mean (SD).

some alternate points for reducing post-appendectomy pain. To the best of our knowledge, this was the first study to explore the effects of pressure to the P6 on post-appendectomy pain. Previous research on the efficacy of pressure on other acupoints in reducing postoperative pain has reported conflicting results. Lee et al. suggested the benefits of pressure on the SP6 in reducing labor pain.[24] In contrast, Sakurai et al. found pressure on four acupoints to be ineffective in reducing pain after abdominal surgeries.[6]

Most previous studies in the field of acupressure have been conducted on acupoints fully known to be effective in pain reduction according to traditional Chinese medicine.[7,24] For example, Lee et al. stimulated SP6 acupoint, a well-known point for painless delivery.[24] However, we investigated the effects of stimulating P6 acupoint on postoperative pain since it has been used in reducing postoperative nausea and vomiting.[3,7,8,15,18,25] In addition, some say a reduction in nausea and vomiting may result in decreased postoperative pain.[5] Nonetheless, we failed to find a significant difference in the severity of postappendectomy pain between the P6 and control groups. Similarly, Sakurai et al. reported pressure to the P6 to be inefficient in reducing pain after abdominal surgeries.[6]

In this study, the severity of nausea was less in p6 group than the control group at all hours, however, the differences between the two groups was not statistically significant. Lower mean severity of nausea may cause the patients express less discomfort and then less drugs may be administrated. In a study by Wang and Kain, anti-emetic drug was administered for patients with a nausea score higher than 20 (on a scale of 0-100).[26] In the present study, nausea score of the p6 group was less than 20 in most of the time, while in the control group it was higher than 20 in several post operation hours.

In the present study, the incidence and severity of vomiting was lower in the P6 group than in the control group. Several studies have evaluated the effects of acupressure on nausea and vomiting. A number of these studies have stimulated P6 acupoint[5,7,14,15] and reported inconsistent results. Samad et al. concluded that this method was not effective in reducing nausea and vomiting after cholecystectomy.[7] On the contrary, other studies reported the efficacy of this method in reducing nausea and vomiting after adenotonsillectomy and gyn-ecologic surgeries.[5, 27]

In general, studies could not reach a consensus on the impact of this technique on postoperative nausea and vomiting. In most of studies, pressure to the P6 was started before the induction of anesthesia[5, 7] because it is believed that the maximum levels of beta-endorphin are seen 20 minutes after the stimulation of P6. Beta-endorphin desensitizes the chemoreceptor trigger zone in the brain and prevents postoperative nausea and vomiting. Researchers believe that such effect is difficult to be obtained after the induction of general anesthesia.[7] However, in the current study, acupressure was started when the patients regained consciousness. It is supposed that the chemoreceptor trigger zone in the brain can be stimulated by acupressure after the level of anesthetics has declined. The lower severity of nausea and lower incidence of vomiting in the P6 group than in the control group confirms the effectiveness of pressure to the P6 in reducing post-appendectomy nausea and vomiting. These results are consistent with the findings of Sakurai et al. who stimulated the P6 acupoint after surgery and reported a 70% reduction in the incidence of postoperative vomiting.[6]

In the present study, we administered analgesics for patients with severe pain. As the severity of pain was almost equal in the two groups, painkillers were equally used in both groups. This might have been a limitation since receiving pain medication could have affected the patients' feeling of pain. The patients' awareness of the study objectives and the researchers' presence may also have affected the patients' psychological state and their levels of pain, nausea, and vomiting. However, such limitations were not under the researchers' control.

## Conclusion

This study showed that pressure to the P6 acupoint had no significant effects on post-appendectomy pain and nausea, but could reduce the incidence of vomiting. Therefore, it is recommended for the nurses to be trained to apply pressure to the P6 for reducing postoperative vomiting. Further studies to stimulate the P6 acupoint at the onset of pain or nausea and vomiting are suggested.

## Ethical issues

None to be declared.

## Conflict of interest

The authors declare no conflict of interest in this study.

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