

The effect of ultrasound-guided drug injection at Neiguan point on the prevention of postoperative nausea and vomiting after laparoscopic cholecystectomy

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Abstract

Background: This study explores the feasibility and effectiveness of ultrasound-guided acupoint injection at Neiguan acupoint to prevent postoperative nausea and vomiting (PONV) after laparoscopic cholecystectomy.

Methods: A total of 60 patients undergoing laparoscopic cholecystectomy in the General Surgery Department of Zhejiang Hospital from February 2021 to August 2021 were enrolled in this study. The patients were randomly divided into the injection group (n = 30) and the control group (n = 30). The patients in the injection group received ultrasound-guided injections of tropisetron at bilateral Neiguan acupoints, while those in the control group received intravenous injections of tropisetron. The incidence of PONV within 24 hours after surgery, the need for “rescue” treatment, the incidence of puncture complications, and patients’ satisfaction with PONV management were evaluated.

Result: Neiguan point can be accurately located by ultrasound guidance. Compared with the control group, the incidence of PONV was significantly decreased in the Injection group within 0 to 6 hours after surgery, and the vomiting rate was decreased within 6 to 12 hours after surgery ($P < .05$).

Conclusion: Ultrasound-guided drug injection at Neiguan to prevent PONV has the characteristics of visualization and accuracy, which is easy to promote and use, and the effect is satisfactory.

Abbreviations: ASA = American Society of Anesthesiologists, BMI = body mass index, LC = laparoscopic cholecystectomy, PONV = postoperative nausea and vomiting.

Keywords: curative effect, laparoscopic cholecystectomy, Neiguan point, PONV, postoperative, ultrasound

1. Introduction

Compared with traditional open cholecystectomy, laparoscopic cholecystectomy (LC) has become the main surgical method for the treatment of benign gallbladder diseases due to its advantages of less trauma, less postoperative pain, faster recovery, lower incidence of early and late complications, early postoperative activity, and shorter hospital stay.^[1] Postoperative nausea and vomiting (PONV) is a common complication after most surgeries, and the increase of intra-abdominal pressure is the main cause. LC is a minimally invasive surgery maintained by CO₂ pneumoperitoneum, which has a high clinical application rate.^[2] However, the incidence of PONV after LC is significantly

higher than that of other open surgeries due to the special anesthesia and operation methods.^[3–5] Studies have suggested that severe PONV can lead to a series of serious consequences such as incision rupture, esophageal injury, and electrolyte disturbance, which profoundly the surgical efficacy.^[6–8] According to statistics, the incidence of PONV is as high as 30% to 46%, which is one of the important factors causing poor prognosis and readmission of LC.^[7–10] It not only increases the strong discomfort experience of patients with LC after surgery but also causes a waste of medical resources.

Studies have reported that drug injection at Neiguan point can prevent PONV,^[11–15] but the actual operation of Neiguan

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Written informed consent was obtained from the patient.

The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

This study protocol was reviewed and approved by the ethics committees of Zhejiang Hospital (2021[7k]).

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point not only lacks standardization but also has individual differences in patients and insufficient understanding of the morphological structure of the operators. However, with the wide application of ultrasound technology, relevant studies have used Doppler tissue imaging technology to accurately detect the movement tissue of acupoints, and even applied 3-dimensional high-frequency ultrasound technology to the study of acupoints, which can clearly, vividly, and completely reflect the spatial structure of acupoints and the size, shape, position, and adjacent relationship of human anatomical structures.^[16,17]

To explore the feasibility and effectiveness of ultrasound-guided drug injection at bilateral Neiguan point in the prevention of PONV in patients undergoing LC by combining ultrasound imaging and acupoint morphology and anatomy.

2. Materials and methods

2.1. General information

This study was designed as a prospective randomized controlled study. The inclusion criteria were patients aged between 18 and 65 years, American Society of Anesthesiologists (ASA) grade I to II, body mass index (BMI) = 20 to 30 kg/m². Among them, the inclusion criteria were patients aged between 18 and 65 years, ASA grade I to II, BMI = 20 to 30 kg/m². Patients with intraoperative changes or anesthesia methods, operation time >3 hours, and postoperative pain numerical visual analog scale score >6 points were excluded. A total of 60 patients undergoing LC under general anesthesia in the Department of General Surgery of Zhejiang Hospital from February 2021 to August 2021 were selected. Patients were randomly divided into the experimental group and control group, with 30 cases in each group. The experimental group was the ultrasound-guided Neiguan injection group, and the control group was the intravenous injection group. This study protocol was reviewed and approved by the ethics committees of Zhejiang Hospital (2021 [7k]). Written informed consent was obtained from all the participants.

2.2. Surgical and anesthetic interventions

All patients were routinely abstained from drinking and fasting for 6 to 8 hours before surgery, and their blood pressure, electrocardiogram, pulse oxygen saturation, and BIS were routinely monitored. After infiltration with local anesthetic (20 mL 0.75% ropivacaine or 0.5% bupivacaine with adrenaline), pneumoperitoneum was achieved by an open technique using a Hassan port. Intra-abdominal pressure was determined and delivered as described above. Insufflation was initiated with room temperature carbon dioxide with low flow (3 L/min) before proceeding to high flow (20 L/min). All patients were nil by mouth for 6 hours before their admission. Oral paracetamol was administered by the perioperative nurses before the induction of general anesthesia. Anesthesia was induced with fentanyl and propofol, and maintained with sevoflurane in O₂.

2.3. Ultrasound-guided drug injection at Neiguan point

After anesthesia induction, the patients in the control group were intravenously injected with 5 mg tropisetron, while the patients in the experimental group were given abduction of both upper limbs, routine disinfection, and ultrasound-guided injection of 1 mL 2.5 mg/mL tropisetron diluted with normal saline at Neiguan point. After injection, the ultrasound probe was rotated 90° to scan and observe the drug diffusion.

2.4. Observational index

The clinical data of the 2 groups were collected, including age, BMI, and ASA classification. The duration of anesthesia, operation time, and dosage of anesthetic drugs were recorded. The extubation time, length of postanesthesia care unit stay, degree and frequency of PONV, treatment, puncture complications (puncture site infection, hematoma, palm muscle strength, and skin paresthesia), and the severity of PONV were recorded. The severity of PONV was assessed by the nausea verbal descriptive scale: 0, no PONV occurred. Score 1, only nausea occurred; 2 points, vomiting occurred. The numerical visual analog scale was scored for patients with only nausea: a 100 mm scale was divided into 10 squares from left to right, each with 1 point. On the far left, a score of 0 means no nausea; on the far right, 10 points represent the most severe nausea imaginable. For those who vomited, only the number of occurrences was recorded. The satisfaction score was 1 for unsatisfied, 2 for generally satisfied, 3 for satisfied, 4 for very satisfied, and ≥3 for satisfied.

2.5. Statistical analysis

SPSS 24.0 software was used for statistical analysis. Descriptive statistics were prepared to compare the patient and clinical characteristics between the 2 randomized groups. Nonparametric data such as vomiting episodes were analyzed by the χ^2 test or Fisher exact test. Continuous nonnormal distribution data such as nausea were analyzed by the Mann-Whitney *U* test. The test level was $\alpha = 0.0500$, and $P < .05$ was considered statistically significant.

3. Results

3.1. Clinical information of patients

There were no significant differences in age, BMI, operation time, anesthesia time, or the consumption of propofol, sufentanil, and remifentanil between the 2 study groups ($P > .05$; Table 1).

3.2. Neiguan point

The acupoint of Neiguan is located at the palmar side of the forearm, between the palmaris longus tendon and the flexor carpi radialis tendon (Fig. 1). The morphology of Neiguan point showed that there were 3 connective tissue-rich parts containing nerves and blood vessels in the acupoint area. The superficial layer was situated between the skin and the flexor digitorum superficialis. It consisted of connective tissue containing the medial and lateral cutaneous nerves, as well as the superficial

Table 1
Comparison of basic data and situation during surgery between the 2 groups.

	Injection group n = 30	Control group n = 30	P
Age (yr)	45.63 ± 12.35	44.53 ± 11.06	.719
Body weight (kg)	64.36 ± 8.70	65.73 ± 9.91	.638
Height (m)	1.62 ± 0.06	1.63 ± 0.07	.543
Body mass index	24.34 ± 2.42	24.50 ± 2.32	.817
Anesthesia time (min)	72.63 ± 14.37	68.57 ± 18.71	.099
Operation time (min)	57.63 ± 14.21	55.20 ± 16.85	.311
Dosage of propofol (mg)	468.10 ± 115.17	452.62 ± 148.42	.296
Remifentanil dosage (mg)	0.70 ± 0.17	0.67 ± 0.22	.296
Sufentanil (μg)	34.01 ± 5.02	34.70 ± 6.08	.719

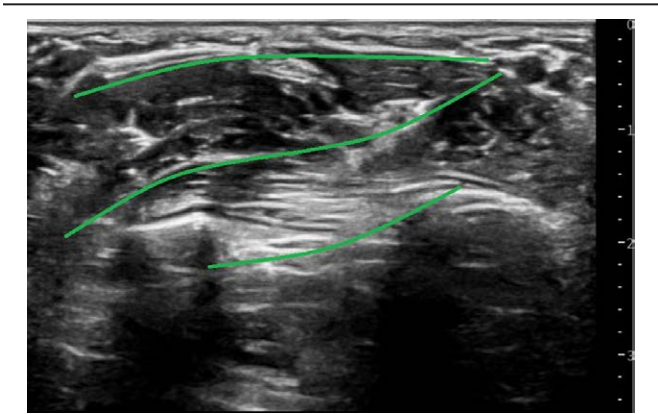


Figure 1. Neiguan point was guided by ultrasound. The fascial layer represented by the green line is the site of Neiguan point.

blood vessels of the forearm. The middle part was located between the flexor digitorum supralis and extensor digitorum profundus, which was the connective tissue containing the median nerve and its palmar branch and artery. The deep part is located between the pronator quadratus muscle and the interosseous membrane, which is the connective tissue containing anterior interosseous nerves and arteries. Acupuncture at Neiguan at different depths showed that only deep acupuncture stimulation could achieve the intervention of PONV.

3.3. The occurrence of PONV in patients

Compared with the control group, the incidence of PONV was significantly decreased in the injection group within 0 to 6 hours after surgery, and the vomiting rate decreased within 6 to 12 hours after surgery ($P < .05$; Table 2).

4. Discussion

PONV is caused by the complex interaction between the gastrointestinal system, the central nervous system, and the autonomic nervous system and is affected by various factors of the patient's surgery and anesthesia.^[2,18] Although PONV does not endanger the life of patients, it will have adverse effects on the rehabilitation of surgical patients, significantly prolong the length of hospital stay, increase medical costs, and reduce patient satisfaction. In recent years, more and more studies have shown that the application of traditional Chinese medicine in the perioperative period can inhibit sympathetic nerve excitation and reduce inflammatory response, which is of great significance for ensuring intraoperative hemodynamic stability, reducing postoperative pain, and promoting the recovery of gastrointestinal function.^[8,19,20] Clinical reports have shown that acupuncture at Neiguan point, as an adjuvant treatment, can effectively relieve the symptoms of PONV in various patients and reduce the incidence of PONV.^[21,22] However, compared with modern medicine, traditional acupuncture lacks standardization and standardization, and it is difficult to promote it in clinical practice. Therefore, accurate positioning of the Neiguan point is very important to improve clinical efficacy.

With the wide application of ultrasound technology, ultrasound positioning has been recognized by various medical disciplines because of its great advantages of being visual, accurate, and convenient.^[23,24] There have been relevant studies using Doppler tissue imaging technology, acupuncture acupoint tissue suggests the existence of specificity and can accurately detect acupoints.^[25,26] It clearly, realistically, and completely reflects the spatial structure of acupoints and the size, shape, position, and adjacent relationship of human anatomical structure. In this

Table 2
Comparison of incidence and severity of PONV 24 hours after operation between the 2 groups.

Time after surgery (hr)	Injection group n = 30		Control group n = 30		P
0–6					
Nausea	1	3.3%	5	16.7%	.085
Vomiting	0	0	5	16.7%	.020
6–12					
Nausea	0	0	1	3.3%	.313
Vomiting	0	0	3	10.0%	.038
12–18					
Nausea	1	3.3%	0	0	.313
Vomiting	0	0	0	0	—
18–24					
Nausea	0	0	0	0	—
Vomiting	0	0	0	0	—
Total					
Nausea	2	6.7%	6	20.0%	.129
Vomiting	0	0	8	27%	.010

PONV = postoperative nausea and vomiting.

study, ultrasound imaging, acupoint morphological anatomy, and acupuncture were combined to determine the position of the ultrasound probe and the injection point of the acupoint, and the antiemetic drugs were injected into Neiguan accurately under the guidance of ultrasound. Compared with the control group, the incidence of PONV was significantly decreased in the injection group within 0 to 6 hours after surgery, and the vomiting rate was decreased within 6 to 12 hours after surgery ($P < .05$). However, this study did not compare the efficacy of injection into the shallow, middle, and deep connective tissue rich parts of Neiguan point in the prevention of PONV, which needs to be further explored in the future, so as to better determine the best site of acupoint injection to prevent PONV, and to better implement the application of acupuncture in clinical practice. Considering that the effective time of intravenous tropisetron is <24 hours, the efficacy of preventing PONV observed in this study was not tracked to 48 hours after surgery. Whether the continuous effective time of drug injection at Neiguan point under ultrasound is longer needs further study.

Author contributions

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