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Original Research Article

Preoperative chewing gum versus pericardial p6 point acupressure for attenuation of postoperative nausea and vomiting in patients undergoing laparoscopic cholecystectomy – A comparative evaluation

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ABSTRACT

Background: Preoperative use of non-pharmacological agents like chewing gum and acupressure at Pericardial p6 point in prevention on postoperative nausea and vomiting in patients posted for laparascopic cholecystectomy under general anaesthesia.

Objectives: The primary objective of the study was to compare the efficacy of preoperative chewing gum and pericardial P6 acupressure point application in reduction of postoperative nausea and vomiting. Secondary objective was to assess the anxiety and satisfaction scores of the patients in the study.

Materials and Methods: In this Quasi experimental study, 3 groups of 62 patients each, with intact mental status in the age group of 18-60 years of either gender posted for laparoscopic cholecystectomy under general anaesthesia, after obtaining written informed consent were included in the study.

Group 1 patients received standard treatment, group 2 patients received standard treatment plus Wrigley's extra sugar free chewing gum, group 3 patients received standard treatment plus bilateral p6 point acupressure by pressure right drug free single use pressure sensitive wrist strip." Patients were assessed for anxiety in preoperative period, before and after the intervention. In postoperative period patients were assessed for nausea and vomiting, requirement of rescue antiemetic and patient satisfaction.

The Chi-square test or Fischer's exact test, as applicable was employed to compare the postoperative incidence of nausea and vomiting.

Results: Highly significant decrease in Amsterdam anxiety score in chewing gum group ($p<0.001$), followed by significant decrease in acupressure group ($p=0.005$). No significant change in nausea in all the groups, but in context of vomiting, both chewing gum and acupressure showed significant decrease in number of episodes in first 6 hrs ($p=0.013$). For rescue antiemetics in nausea, there was no significant variance in usage among the groups. However, for vomiting, a substantial decrease was found. Group 2 required significantly less ($p=0.001$) amount of antiemetics followed by group 3.

The patients in the chewing gum group scored more in the satisfaction scoring index and this was found to be statistically significant ($p = 0.010$).

Conclusion: Both chewing gum and acupressure reduced nausea and vomiting and the need for rescue antiemetics. However, chewing gum proved to be better among the two.

1. Introduction

One of the most frequent side effects of general anesthesia surgery is postoperative nausea and vomiting (PONV),

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which affects 20–40% of all surgical patients and can reach 80% in high-risk cases.[1] PONV is known to be a leading cause of admission after planned surgery, which affects patient satisfaction and leads to hematoma, dehydration, electrolyte imbalance, bleeding, complications of surgical sites, wounds, and aspiration in postoperative patients.[2] Vomiting is caused by the chemoreceptor trigger zone (CTZ), the vagal mucosal pathway of the gastrointestinal tract, the neural pathways of the vestibular system, reflex afferent pathways from the cerebral cortex, and midbrain afferents.

Via cholinergic, dopaminergic, histaminic, or serotonergic receptors, stimulation of any of these pathways can trigger the feeling of vomiting; area postrema is also recognized to be a significant factor in emesis. Medication used for anesthesia directly affects the solitary tract nucleus, while opioids bind to the μ-opioid receptor and ionotropic 5-hydroxytryptamine type 3 (5-HT3) receptors to produce nausea and vomiting.[3]

Other factors that also cause nausea and vomiting are pain, hypoxemia, gut/oropharynx movement, and hypotension. Other risk factors include female gender[greatest risk factor, the incidence is 4 times compared to males], history of PONV (post-operative nausea vomiting) / motion sickness, type of surgery (abdominal, ear, nose, throat), use of nitrous oxide[1,2] and perioperative opioid use(single strongest predictor).[4] Amazingly smoking decreases PONV and it depends on the time since the last cigarette. It is yet to be established whether this decrease in PONV in smokers is due to nicotine in tobacco or other chemicals in cigarettes.[1,2] Many side effects, including dry mouth, sedation, hypotension, extrapyramidal symptoms, dystonic effects, and restlessness, are associated with traditional antiemetics such as anticholinergics, phenothiazines, antihistamines, butyrophenones, and benzamides. Even newer drugs like serotonin receptor antagonists (ondansetron, granisetron) have adverse effects like headache and dizziness[3] and are partly effective.[5] This has led to the emergence of interest in non-pharmacological therapies like p6 stimulation, gum/ginger chewing, preoperative carbohydrate drinks, and others, which have the advantage of low cost, limited side effects, and patient acceptability.[6] Among the above-mentioned therapies, chewing gum and acupressure have been attracting attention, because of more patient acceptability and lower side effects, but still, there are very less studies done on them and no comparison has been done between the two.

The augmented release of β-endorphins from the hypothalamus is the basis for the action of acupressure. Through norepinephrinergic and serotonergic system processes, it also modifies serotonin transmission.[7] The neurological underpinning of APu's antiemetic actions is undoubtedly these stated endorphins. The addition of bilaterally applied acupressure wristbands was found to significantly reduce PONV, according to the study. Compared to 63% of controls, only 33% of patients undergoing acupressure had PONV.[8] The fact that each patient was treated in a short length of time and that wristband administration required no specialized training further demonstrated its viability.

Chewing gum is also known to reduce postoperative paralytic ileus following gastrointestinal surgeries. Chewing of gum stimulates the Vagus nerve which further increases gastrointestinal motility.[9]

With the hypothesis, that preoperative use of chewing gum and pericadial P6 point acupressure can reduce the incidence of postoperative PONV and anxiety, this study was designed and we aimed at comparing the efficacy of these two.

However, till now there is limited data on the effect of chewing gum on PONV. The rationale of this study was to assess the safety and effectiveness of preoperative chewing gum and pericardial p6 point acupressure as an adjuvant for attenuating postoperative nausea and vomiting because chewing gum and p6 point acupressure are considered to have the potential to be a novel, drug-free alternative treatment for PONV.

2. Materials and Methods

This Quasi-Experimental study took place at a tertiary care health Centre over a period of 12 months after clearance from the ethical committee (Ethics committee registration number: SRHU/Reg/Int/2023-287(44) and Clinical trial registration number: CTRI/2024/01/061074.

The study included grade I/II American Society of Anaesthesia (ASA) patients with intact mental status in the 18–60 age range, submitted for laparoscopic cholecystectomy under general anesthesia, following obtaining signed informed consent. Patients who were excluded from the study included those with conditions that made chewing gum inappropriate, such as achalasia or bulbar palsy, impaired pharyngeal or esophageal function, phenylketonuria (which makes it unsafe to chew gum containing aspartame), full upper or lower dentures (which makes chewing gum impractical), planned postoperative mechanical ventilation, and history of postoperative nausea as well as vomiting from prior surgery, patients with encephalopathy who are unable to chew gum, have allergies to any of the medications administered, patients with contraindications to forearm pressure, such as burns, wounds, trauma, fistulas, and pregnant or nursing women.

Randomization was done using lottery method using computer generated numbers in sealed envelopes, which were randomly distributed amongst the patients.

All eligible patients were thoroughly examined in the pre-anesthetic clinic. APFEL score was noted and the preoperative anxiety score was noted by a postoperative care

unit nursing professional, who was totally unaware of the study. Further patients were classified as follows:

Group I: Patients receiving standard treatment (control).

Group II: Patients receiving standard treatment plus WRIGLEYS extra sugar-free chewing gum.

Group III: Patients receiving standard treatment plus bilateral p6 point acupressure by Pressure Right drug-free single-use pressure sensitive wrist strip.

In the preoperative room, patients were given medication according to the groups. Group II received chewing gum 3 times for a duration of 15-30 minutes with a time gap of 2 hours, starting from 2hr after admission to the operation theatre. Every time the patient chewed the gum, he/she was to spit the chewing gum after 15 min of chewing. The attending anaesthesiologist ensured the same before taking the patient for surgery.

Sixty minutes before entering the operation room, a pressure band was applied to both arms at the P6 point for group III patients. Three finger-breadths in front of the distal crease, on the plantar aspect of the wrist, the band was located between the flexor carpi radialis and palmaris longus tendons. Patients were instructed to wear bracelets for 72 hours after their treatment.

In the preoperative area, patients were assessed for anxiety using anxiety score General anaesthesia was induced with standard doses of inj. Fentanyl and inj. Propofol. Inj. The laparoscopic equipment and the Laryngeal Mask Airway inserted was facilatated by use of inj. Atracurium in standard dosage. All patients received an IV stat dose of dexamthasone (4 mg) just before the commencement of surgery. Sevoflurane with a minimum alveolar concentration of 1 in an air/oxygen mixture was used to maintain anesthesia. Additionally, as needed for intraoperative analgesia, periodic bolus doses of injectable fentanyl (50 mcg IV) were used. Following the removal of the laparoscope, each portal site's fascial level received 2-3 mL of injection bupivacaine 0.5% for local anesthesia. Following skin closure, any remaining neuromuscular block was treated with injections of neostigmine and glycopyrrolate at recommended dosages, and sevoflurane, the maintenance anesthetic, was stopped. Throughout the perioperative phase, fifteen to twenty-five mL/kg of IV fluids were administered to each patient. Injectable diclofenac sodium and Paracetamol were used to relieve postoperative pain.

Patients were monitored for nausea, vomiting/retching, drowsiness, and restlessness during the postoperative period. PONV was measured using the PONV intensity scale at twenty-four, forty-eight, and seventy-two-hour intervals after surgery by a blinded observer who asked each patient directly before discharge and over the phone about the occurrence of PONV symptoms and any other side effects that may have occurred during the procedure. Presence or absence of nausea, vomiting or retching was noted. Additionally, it was seen that any rescue antiemetic medication (inj. Ondansetron 0.15 mg/kg) was required. It was considered a full "response to the prophylactic antiemetic when there was no emesis (or retching) and no need for antiemetic rescue medication during the whole 72-hour research period. During the 72-hour postoperative study period, the absence of nausea, vomiting, or retching episodes, and the" requirement for rescue antiemetic medicine were deemed to be markers of total control after surgery.

The degree of patient satisfaction was measured employing a 3-point verbal rating scale (1 being unsatisfied, 2 being satisfied, and 3 being extremely satisfied).

2.1. Statistical analysis

Primary outcome = Comparison of post-operative incidence of nausea and vomiting

For estimation of sample size, the following formula has been used

$$n = \frac{[Z_{1-\alpha/2}\sqrt{2}\,P\,(1-P) + Z_{1-\beta}.\sqrt{\{P_1(1-P_1) + P_2\,(1-P_2)\}}]^2}{(P_1-P_2)^2}$$

where $P = (P_1+P_2)/2$

$Z_{\alpha/2}$ is the critical value of the Normal distribution at $\alpha/2$ (for a confidence level of ninety-five percent, α is 0.05 and the critical value is 1.96)

Z_{β} is the critical value of the normal distribution at β (for a power of eighty percent, β is 0.2 and the critical value is 0.842)

The estimated sample proportions for the two groups are denoted" by p1 & p2.

The sample size calculation was based on detecting a clinically significant 20% reduction in postoperative nausea and vomiting, with an α error of 5%. It was determined that 62 patients per group would be required.

Statistical analyses were conducted using SPSS 26.0. Continuous variables were described as mean ± standard deviation (SD) or median (interquartile range, IQR) for non-normally distributed data. Categorical variables were presented as frequencies and percentages.

For comparisons of categorical variables, the Chi-square test or Fisher's exact test was used as appropriate. Continuous variables among three groups were compared using ANOVA for normally distributed data. If significant differences were found (indicated by an F value), post hoc tests such as Tukey's or Tamhane's T2 were conducted to assess specific group differences. The Mann-Whitney U test was employed for additional pairwise comparisons of non-normally distributed continuous variables, while the Kruskal-Wallis test was used to compare continuous variables across multiple groups.

A p-value <0 05 was considered statistically significant for all tests conducted.

3. Results

In this investigation, 62 patients were treated as usual, 62 patients as usual plus WRIGLEYS extra sugar-free chewing gum, and 62 patients as usual plus bilateral p6 point acupressure using pressure right drug-free single-use pressure-sensitive wrist strips.

In this study, all groups were demographically comparable (Tables 1 and 2). APFEL score was comparable among the groups also (Table 3). Table 4 shows a highly significant decrease in Amsterdam's anxiety score in the chewing gum group (p<0.001), followed by a significant decrease in the acupressure "group (p=0.005). Table 5 shows that there was no significant change in nausea in all the groups. Table 6 shows that concerning vomiting both chewing gum and acupressure showed a significant decrease in the number of episodes in the first 6 hrs (p=0.013). More reduction was noted in the chewing-gum group as compared to" the acupressure group.

Regarding rescue antiemetics also, for nausea, there was no significant variance in rescue antiemetic usage among the groups. However, for vomiting, a substantial decrease was found. Group 2 (chewing gum) required significantly less (p=0.001) amount of anti emetics followed by Group 3(acupressure) (Tables 7 and 8).

Even though the demand for rescue antiemetic for nausea was not statistically significant it was noted that both chewing gum and acupressure group required less rescue antiemetic. And among them too, the patients in the chewing gum group required the least number of antiemetic followed by the acupressure group.

As assessed by patient satisfaction score at 72 hrs the subjects who chewed gum were more satisfied and this was found to be statistically significant. (Table 9)

4. Discussion

In this investigation, patients in the gum-chewing group were reported to have considerably decreased anxiety levels in the preoperative holding area, which was comparable to the results seen in prior studies done by Jiwanmall et al.,[10] Yu Jeong Bang et al.[11] The findings of our research average preoperative anxiety level was higher than what other studies had previously documented. Previous investigations have reported total APAIS mean values ranging from 8.31 to 14.5023.[12] The average APAIS value of the study participants was 18.78. We examine the following explanations for the discrepancies in our results. While preoperative anxiety was examined in outpatient clinics for pre-anesthetic screening a few days before surgery, anxiety was measured in our study right before entering the operating room. Second, since Yu Jeong Bang et al.[11] only included female patients in their study, but we included both male and female patients, the p-value in their study might not have been as significant as it was in ours.

It has been demonstrated that mastication in a stressful setting lowers corticosteroid and neurotropic factor levels by influencing the autonomic nervous system and the hypothalamic-pituitary-adrenal axis.[13] Gum also improves mood, reduces tension and anxiety, and raises alertness.[14]

From our study, we could also see that the p6 acupressure point also helped to relieve anxiety, but was not as effective as chewing gum. This could be because of the fact that the LI4 acupressure point is considered superior to the p6 acupressure point for relieving anxiety, as shown by the study done by Saeid Amini et al[15] on Iranian Army soldiers. P6 and L14 are known to act by their impact on Beta endorphins levels and its sympathoinhibitory properties.[16]

We also examined the occurrence of nausea across different time intervals post-operation. No significant differences in nausea frequencies were observed in either 0-6 or 6-12 hrs.

However, concerning vomiting, there was a noteworthy distinction at 0-6 hours post-operation, with Group 2 (chewing gum) and Group 3 (acupressure) exhibiting significantly lower rates compared to Group 1 (p = 0.013). Group 2 i.e., the Chewing gum group showed the least vomiting, followed by Group 3 i.e. the acupressure Group. But, again there were no significant differences in vomiting frequencies among the groups at 6-12 hours post-operation.

The use of rescue antiemetics for nausea showed no significant variance in rescue antiemetic usage among the groups. However, for vomiting, a substantial reduction (p < 0.001) was found for Group 2 (chewing gum) and Group 3 (acupressure).

Even though the difference in rescue antiemetic requirement for nausea was not statistically significant it was noted that both chewing gum and acupressure group required less rescue antiemetic. Among them, too chewing gum group required the least number of antiemetic followed by the acupressure Group. And similar finding was seen for rescue antiemetics for vomiting.

The results mentioned above were in line with a study conducted by Oznur Bayraktar et al.,[17] which found that within the first six hours following surgery, patients who chewed gum experienced 5.09 times less vomiting than patients in the control group.

Chewing gum reduced vomiting in the group that chewed gum[18] in a meta-analysis study by Liu et al.,[18] which examined the impact of chewing gum on improvement in gastrointestinal motility in patients who had undergone colorectal surgery. These results corroborate the conclusions of our investigation. Chewing gum does not, according to certain research, interfere with bowel movements, nausea, or vomiting. In this context, it was discovered that chewing gum after surgery did not significantly improve problems, nausea, or bloating.[19]

Table 1: Demographic characteristics

	Group 1 Mean ± SD	Group 2 Mean ± SD	Group 3 Mean ± SD	p value
Age	44.74 ± 11.513	43.85 ± 11.642	42.73 ± 11.617	0.625
Height	163.47 ± 7.9	166.27 ± 14.575	165.66 ± 12.183	0.386
Weight	69.24 ± 13.229	71.71 ± 18.019	68.76 ± 15.348	0.532
BMI	25.7 ± 3.053	25.5 ± 2.486	24.74 ± 2.457	0.113
Duration of surgery	74.44 ± 12.217	70.32 ± 12.007	70.32 ± 12.075	0.095

One way ANOVA; BMI – Body mass index

Table 2: Sex distribution amongst patients

Sex	Group 1		Group 2		Group 3		p value
	Frequency	%	Frequency	%	Frequency	%	
Female	49	79.0%	39	62.9%	47	75.8%	
Male	13	21.0%	23	37.1%	15	24.2%	0.103
Total	62	100.0%	62	100.0%	62	100.0%	

Chi square test

Table 3: APFEL scores

APFEL score	Group 1		Group 2		Group 3		p value
	Frequency	%	Frequency	%	Frequency	%	
0	8	12.9%	8	12.9%	7	11.3%	
1	7	11.3%	15	24.2%	12	19.4%	
2	43	69.4%	36	58.1%	40	64.5%	0.705
3	4	6.5%	3	4.8%	3	4.8%	
Total	62	100.0%	62	100.0%	62	100.0%	

Table 4: Amsterdam anxiety score

Amsterdam anxiety score	Group 1 (N=62)	Group 2 (N=62)	Group 3 (N=62)	p value
Before	18.78 ± 0.43	18.78 ± 0.43	18.78 ± 0.43	0.971
After	18.82 ± 0.53	15.79 ± 0.41	17.79 ± 0.41	<0.001**
p value (before-after)	0.189	<0.001**	0.005	
Test used: One way ANOVA for the comparison of 3 groups; paired t test for the comparison from before-after intervention				

**signifies highly significant p value<0.001

Table 5: Comparison of Nausea between three groups

Nausea	Group 1		Group 2		Group 3		P - value
	Frequency	%	Frequency	%	Frequency	%	
Post Operative 0-6 hr							
No	47	75.8%	50	80.6%	47	75.8%	0.758
Yes	15	24.2%	12	19.4%	15	24.2%	
Post Operative 6-12 hr							
No	59	95.2%	62	100.0%	61	98.4%	0.167
Yes	3	4.8%	0	0.0%	1	1.6%	

Chi square test

Table 6: Comparison of vomiting between three groups

Vomiting	Group 1		Group 2		Group 3		p value
	Frequency	%	Frequency	%	Frequency	%	
Post operative 0-6 hr							
No	51	82.3%	60	96.8%	58	93.5%	0.013*
Yes	11	17.7%	2	3.2%	4	6.5%	
Post operative 6-12 hr							
No	59	95.2%	61	98.4%	62	100.0%	0.167
Yes	3	4.8%	1	1.6%	0	0.0%	

Chi square test; *signifies significant p value<0.05

Table 7: Intergroup comparison of rescue antiemetic for nausea

Rescue antiemetic for Nausea	Group 1		Group 2		Group 3		p value
	Frequency	%	Frequency	%	Frequency	%	
Not given	58	93.5%	61	98.4%	59	95.2%	
Given	4	6.5%	1	1.6%	3	4.8%	0.401
Total	62	100.0%	62	100.0%	62	100.0%	

Chi square test

Table 8: Rescue emetic dosage

Rescue antiemetic (ondansetron 4mg) for Vomiting	Group 1		Group 2		Group 3		p value
	Frequency	%	Frequency	%	Frequency	%	
Not given	49	79.0%	60	96.8%	60	96.8%	
Given	13	21.0%	2	3.2%	2	3.2%	<0.001**
Total	62	100.0%	62	100.0%	62	100.0%	

**signifies highly significant p value<0.001
Chi square test

Table 9: Patient satisfaction score

Patient Satisfaction at 72hrs	Group 1	Group 2	Group 3	p value
1 - Dissatisfied	5 (8.1%)	3 (4.8%)	4 (6.5%)	
2 - Satisfied	19 (30.6%)	4 (6.5%)	14 (22.6%)	0.010*
3 - Highly Satisfied	38 (61.3%)	55 (88.7%)	44 (71.0%)	
Total	62 (100.0%)	62 (100.0%)	62 (100.0%)	

*signifies significant p value<0.05
Chi square test

In our study, we also calculated the patient satisfaction score at 72 hours on a telephonic basis. We noted that the Chewing Gum Group had the least number of dissatisfied patients, which was statistically significant. Chewing gum stimulates salivary secretion, which subsequently turn increases nitric oxide production and fights oral and intestinal infections. Additionally, it quenches post-operative thirst, reduces anxiety in patients, and enhances their general well-being. The cesphalic-vagal pathway, which consequently promotes the myoelectric action of the intestines, is activated by preventing the activation of gastrointestinal opioid receptors, so producing all of these effects.[20] The stimulation of the wrist-based Pericardium 6 [PC6] acupressure point is the main focus of the majority of non-pharmacological investigations on the decrease of nausea and vomiting. The antiemetic action is thought to be produced by stimulating the PC6 point on the pericardium meridian, which transmits signals to the brain and activates the neurological system.[21] Serotonin, dopamine, and endorphins are among the neurotransmitters released by the brain following stimulation. These compounds block chemicals that can induce nausea, which is thought to prevent nausea and vomiting.

The effectiveness of the PC6 acupressure point in preventing PONV, discomfort, and poor sleep quality has not been well-established in the literature. While some research indicates that stimulating the PC6 acupressure point lowers postoperative nausea and vomiting (PONV),[22] other studies find no connection between the two.

Both chewing gum and acupressure have been shown to minimize nausea, vomiting, and the need for rescue antiemetic medications; however, chewing gum has been shown to be more effective than acupressure. This can be because of the fact that it directly blocks the opioid receptors in the gastrointestinal tract, and enables the activation of the cephalic-vagal pathway.[20]

Secondly, compliance was observed to be more effective with chewing gum as no one had a problem with chewing. But on the other hand, people had poor compliance with wearing bands. They generally tend to displace the acupressure device from the exact location after which the band is rendered useless. This could be the reason for lower efficacy.

Additionally, chewing gum increases the release of pancreatic, duodenal, and stomach secretions; it quenches post-operative thirst; it fights infections in the mouth and intestines; and it lowers anxiety in patients, all of which contribute to improved patient outcomes.[20]

5. Limitations

The study had a small sample size and did not account for the effects of high and low pressure abdominal inflation on postoperative nausea, vomiting, and pain. Blinding of patients was not feasible due to the distinctly different mechanisms involved, and the use of chewing materials with the P6 band could have influenced the results.

The study focused solely on patients undergoing laparoscopic cholecystectomy, with an average operation and anesthesia duration of approximately 90 minutes, leaving the impact of chewing gum on PONV in longer procedures to be further investigated.

Additionally, the optimal duration for chewing gum remains unclear, and the mechanism by which chewing gum reduces PONV was not directly confirmed in our study.

6. Recommendation

Given the limited contemporary data available for comparative analysis of these techniques, more trials with larger sample sizes are needed.

7. Conclusion

Both chewing gum and acupressure significantly reduced postoperative nausea and vomiting (PONV) episodes in the first six hours and the need for rescue antiemetics, with chewing gum being superior. Chewing gum also reduced anxiety, increased patient satisfaction, and decreased postoperative sore throat incidence within 24 hours. Additionally, it improved Quality of Recovery-15 (QOR-15) and Visual Analog Scale (VAS) scores, enhancing overall well-being and reducing hospital stays. Neither method improved constipation. Overall, chewing gum showed more benefits than acupressure. As the first study of its kind, further trials with larger sample sizes are needed for more comprehensive analysis.

8. Sources of Funding

None.

9. Conflict of Interest

None.

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Author biography

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