Postoperative Nausea, Vomiting, and Retching in Orthopedic Patients: The Influence of Deep Breathing Exercise

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Abstract

Background: Post operative nausea, vomiting, and retching are recurrent symptoms and can lead to complications ranged from mild e.g. unpleasant sensation, to severe e.g. aspiration and postpone patients' discharge. Also, the use of antiemetics accompained by side effects so, we in a great need for adding a non-pharmacological measure to routine hospital care. **Aim:** Explore the infleuence of deep breathing exercise on nausea, vomiting, and retching in postoperative orthopedic patients. **Materials and methods:** A quasi-experimental study was conducted at recovery rooms and orthopedic wards at Menoufia University Hospital, Egypt. A convenient sample of 84 patients divided into two groups control and study 42 for each, who were adult, conscious, and under general anesthesia. Three tools were used for data collection; Tool I patient information form, Tool II glasgow coma scale, Tool III index of nausea, vomiting, and retching (INVR). **Results:** There was a statistically significant difference in total scores of INVR between both groups after 6 hours (U (p_1)=400.50* (<0.001*) and 12 hours U(p_2)=529.50* (<0.001*). **Conclusions:** It was concluded that deep breathing exercise decreases nausea, vomiting, and retching among study group patients after both 6 and 12 hours. **Recommendations:** Deep breathing exercise should be added to routine hospital post operative care, and further researches on larger sample to explore frequency of antiemetic drugs use among patients performing postoperative deep breathing exercise.

Key words: post operative, nausea, vomiting, retching, orthopedic patients, deep breathing exercise

Introduction

Patients undergoing orthopedic surgeries are exposed to distressing procedure because the complications that may occur from surgery and anesthesia which is essential for relieving pain during surgery or other **procedures (Dewi, Morika, & Dafriani, 2021)**. Despite significant advances in anesthesia, it is associated with complications such as postoperative nausea, vomiting and retching (PONVR) which is one of the common complaints that occurs in the recovery room or during the first 24-48 hours following surgery **(Ibrahim, Al Sebaee, & El-Deen, 2020).**

Nausea is a subjectively discomfort feeling with a desire to vomit not combined with expulsive muscular movement while, vomiting is the violent expulsion of even a small amount of gastric contents through the mouth **(Shaikh et al., 2016).** Retching is an involuntary attempt to vomit without expulsion of gastric content **(Kang et al., 2022).**

Incidence of PONVR in all patients receiving anesthesia remains between 20% and 30%, but this rate increases up to 80% in high-risk patients such as women or those with a history of PONVR **(Cronin et al., 2015).** In addition, young to middle-aged, non-smoker, and a history of motion sickness are considered independent risk factors (**Chen & Chang, 2020**). Furthermore, volatile anesthesia, intraoperative and postoperative opioid use, duration of anesthesia, that is closely linked to duration of surgery. Also, general anesthesia patients are exposed to PONVR more than local anesthesia patients **(Pierre & Whelan, 2013).**

Post operative nausea, vomiting and retching lead to patient dissatisfaction and discomfort. Uncontrolled PONVR can lead to dehydration, electrolyte imbalance, and risk of

aspiration pneumonia **(Suryono et al., 2020; Sites et al., 2014).** Moreover, in certain settings it can lead to postoperative complications especially in a patient that cannot tolerate elevated blood pressure or heart rate, central venous pressure or intrathoracic pressure. As well, it can lead to prolonged hospitalization, increased medical costs, and hospital readmission **(Sizemore et al., 2022).**

Due to complications from PONVR, antiemetic medications are used. The available antiemetic drugs have been proven safe in clinical trials, but they are combined with side-effects that range from mild (e.g., headache) to potentially severe (e.g., QT prolongation) **(Pierre & Whelan, 2013),** and as nonpharmacologic interventions can be effective, the combination of pharmacological and nonpharmacological measures is important to decrease the use of drugs **(Tinsley & Barone, 2013; Dewi, Morika, & Dafriani, 2021).**

Non-pharmacological managements that can be used to reduce PONVR include biofeedback, relaxation, hypnosis, guided imagery, distraction, and acupressure. In the current study deep breathing exercise was used which includes breathing in the abdomen slowly, rhythmically, and comfortably with eyes closed during inhalation. The effect of closing eye is to distract patient attention **(Suryono et al., 2020).**

Deep breathing exercise, easy nursing intervention, had a drastic improvement. It can decrease the intensity of PONVR **(Samami et al., 2022),** through relaxation of autonomic nervous system and vagus nerve that regulates gastrointestinal movements **(Ibrahim, Al Sebaee, & El-Deen, 2020).** Also, it can reduce stress, anxiety and amplify blood oxygenation **(Aybar, Kılıc, & Çınkır, 2020; Toussaint et al., 2021).** As deep breathing exercise is a safe, non-invasive, cheap, easy nursing procedure and effective in decreasing PONVR, it is crucial to add it to management guidelines for patients undergoing orthopedic surgeries at the post operative period.

Aim of the study

To explore the effect of deep breathing exercise on nausea, vomiting, and retching in postoperative orthopedic patients.

Research hypotheses

Nausea, vomiting, and retching will be decreaced among study group rather than control group after performing deep breathing exercise.

Materials and methods

Research design

It was accomplished using a quasi-experimental design.

Setting

The current study was conducted at recovery rooms and orthopedic wards at Menoufia University Hospital, Menoufia, Egypt.

Subjects

A convenient sample of 84 patients divided into control and study groups 42 for each with the following inclusion criteria; adult, postoperative patient, undergoing elective orthopedic surgeries receiving general anesthesia, and alert with glasgow coma scale (GCS)=13–15. The following were the exclusion criteria: unconscious patients, undergoing spinal or regional anesthesia, emergent orthopedic surgeries, complain of hypotension, and past history of severe respiratory and /or cardiac problems.

Sample size calculation

The sample size is 81 and it was calculated by Epi Info version 7.2.2 under the following statistical restriction; confidence level 95%, margin error 10%, population proportion 50% and population size 500. The researchers include 84 patients to be able to devide them into two groups (control and study group).

Tools of data collection:-

Data were collected using the following three tools:

Tool I Patient Information Form: It aimed to assess demographic characteristics and medical related data of the patients. It was developed by the researchers based on literature review **Ibrahim et al. (2020); Dewi et al. (2021).** It comprised two parts:

- **Part one:** It was concerned with the demographic characteristics of patients which

included patient's age, gender, educational level and occupation (4 Items).

- **Part two:** It was concerned with health related data of patients which included smoking status, blood pressure monitoring, type of surgery, type of anaesthesia, duration of anesthesia, starting postoperative oral intake, fluid volume during anesthesia, associated disease and medications (9 Items).

Tool II Glasgow coma scale:

It was adopted from Teasdale and Jennett (1974) to objectively and reliably assess the level of consciousness and check their eleigibility for participation. It was divided into three items: eye response, verbal response, and motor response. The responses are 'scored' from 1 for no response, up to normal values of 4 (eye-opening response), 5 (verbal response), and 6 (motor response). The total GCS ranged from 3-15, with 3 denoting the worst and 15 is the highest (3 Items).

Tool III Index of Nausea, Vomiting, and Retching (INVR):

It was adopted from Rhodes and **McDaniel (1999)** to evaluate nausea, vomiting, and retching. The INVR consists of eight items: a numeric value for each item ranging from 0 (the least degree of discomfort) to 4 (the most / worst discomfort). The patient's responses to each of the eight questions on the INVR were summed to determine the patient's overall symptoms. The Likert scale has three subscales: nausea (0–12), vomiting (0–12), and retching (0–8), giving it a total range of 0–32. Scores of 0 meant there was no NVR, 1–8 denoting mild NVR, 9–16 indicated moderate NVR, 17–24 meant there was a severe NVR, and the worst NVR at 25–32.

Validity and Reliability:-

A panel of five professionals in the disciplines of medical-surgical nursing and medical orthopedic surgery evaluated the content validity. The tools were revised by the experts for clarity, application, and completeness; minor adjustments were made, and the final form was created. Cronbach's Alpha test was used to gauge the tools' internal consistency and estimate their testing reliability. Tool III chronbach's Alpha test result was found to be 0.889, which indicates reliable tools.

Pilot Study

Before data collection, a pilot study was conducted on 10% of the sample to check the tools' applicability and viability and make any necessary adjustments before conducting the main study. The study sample did not contain any of the patients who participated in the pilot research.

Data collection

Data were collected by researchers from June to October 2022. Data collection procedure goes through three phases:

Preparatory phase: The study was officially approved to move forward by responsible personell. Before beginning the study, the researchers inform the responsible physicians and nurses of the orthopedic wards and recovery rooms all information about the study. Patients who fulfilled the criteria of inclusion were recognized, and intervention and control groups were identified. Then, the study participants were interviewed individually before orthopedic surgery to explain the nature and purpose of the study. Informed consent was obtained from each participant. All study participants under general anesthetia, take medications like antibiotics, analgesics and anti-inflammatory. Moreover, the study participants received antiemetic as needed.

Implementation phase: Patients eligible for the study were teached deep breathing exercise technique by the researchers during the preoperative period. The teaching session took approximately ten minutes for each participant, followed by demonstration and patient application according to the guidelines. Then after surgery, the researchers used tool II " GCS" to make sure that all patients were alert followed by gathering the demographic and health related data using tool I. All patients received routine care of the hospital for prevention of NVR which is administration of

antiemetics as needed but, only the study group patients additionally perform deep breathing exercise to decrease NVR.

The study group patients were practiced deep breathing exercise as educated at the orthopedic ward preoperatively as follows: first, relax the shoulders while lying flat on the bed or in a semi-setting position; second, place one hand on the abdomen and the other hand on the chest; third, inhale deeply through the nose, paying close attention to the abdomen-hand movement with each breath while keeping the hand on the chest steady; fourth, purse lips, press the stomach gently, and slowly exhale breathing for a few seconds; fifth, block out all other sounds and ideas while being attentive and focused on the soothing words, images, and feelings; sixth, lower the motion of upper rib cage and primarily move the abdominal wall during inspiration and finally, repeat these steps several times as needed for 5 -10 min at atime. Also, repeat if nausea sensation appear. As well, the participants were instructed to stop the deep breathing exercise if there is any feeling of headache or drowsiness, or if blood pressure measurement reaches less than 110/65 mmHg.

Evaluation phase: Evaluation of PONV was conducted two times for each participant; the first time after 6 hours and the second time after 12 hours postoperative using INVR. The time spent to fill the tools ranged approximately from 15 to -20 min.

Ethical Considerations

Upon an explanation of the study's objectives, the relevant authorities at faculty of nursing, Menoufia University gave ethical approval with research number 851. The manager of Menoufia University Hospital granted official consent after being informed in detail about the study's purpose. Before beginning the data collection process, the patients were given a comprehensive explanation of the study' objectives and give their consent. Assurance was given for patients that their participation in the study was voluntary and that they can leave at any time without suffering consequences. Also,they received reassurances on the protection of their information. Respect was shown for cultures, and beliefs.

Statistical analysis of the data

Data were fed to the computer and analyzed using the IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Qualitative data were described using numbers and percents. The Shapiro-Wilk test was used to verify the normality of distribution. Quantitative data were described using mean and standard deviation. Significance of the obtained results was judged at the 5% level. The used tests were; Mann Whitney test for abnormally distributed quantitative variables, to compare between two studied groups , Chi-square test for categorical variables, to compare between different groups, Fisher's Exact correction used for correction of chi-square when more than 20% of the cells have expected count less than 5, McNemar and Marginal Homogeneity Test that used to analyze the significance between the different stages, Kruskal Wallis test used for abnormally distributed quantitative variables, to compare between more than two studied groups, and Wilcoxon signed ranks test for abnormally distributed quantitative variables, to compare between two periods.

Results:

Table (1) revealed that there was no statistically significant difference between both control and study groups regarding selected demographic and health related data with more than two thirds of both groups were non smoker (76.2%, 69.0%) respectively. Concerning duration of anesthesia, the majority of patients were 2 hours 95.2% in control group, and 100% in study group. More than half of patients didn't have associated diseases.

Figure (1) illustrated that administration of antiemetic medications decreased among study group patients rather than control group patients with a statistically significant difference χ^2 (p) =5.185* 0.023*

Table (2) reported that there was a statistically significant difference between both groups regarding all items of INVR after 6 hour and 12 hour postoperative except time and amount of vomiting after 12 hours between control and study group patients exhibits no statistically significant difference $U(p_2)$ =752.0(0.072), and 754.0(0.076) respectively.

Table (3): Concerning total score of INVR there was a statistically significant difference between 6 and 12 hours of control group $Z(p_0)$=4.390*(<0.001*). Similarly, study group

$Z(p_0)=3.235^*(0.001^*)$. Additionally, there was a statistically significant difference between total scores of both groups after 6 hours ($U(p_1)=400.50^*$ ($<0.001^*$) and after 12 hours $U(p_2)=529.50^*$ ($<0.001^*$) Table (3) illustrated.

Figure (2) There was a statistically significant difference between control and study groups toward overall INVR after 6 hours $\chi^2(p_1)=26.058^*$ ($<0.001^*$) and $\chi^2(p_2)=14.239^*$ ($<0.001^*$) after 12 hours. As well, in study groups 69% showed none INVR, compared to 31% in control group after 6 hours and 0% in study group compared to 14.3% in control group showed severe INVR. But, after 12 hours, 83.3% in study group compared to 47.6% in control group represents none INVR figure (2) displayed.

Table (4) showed that in study group non-smoker patients represent higher incidence of INVR than smoker after 6 hours and 12 hours U(p) =128.50*(0.046*), 143.00 (0.056) respectively. Concerning type of surgery, in control group there was a statistically significant difference after 6 and after 12 hours with hip replacement represents the lowest mean and SD = (1.27 ± 2.83, 0.64 ± 1.43), but in study group there was no statistically difference in type of surgeries. Regarding duration of anesthesia there was no statistically significant difference in both control and study groups. As regards associated diseases, patients with DM exhibits higher mean and SD scores in both control and study groups after 6 and 12 hours with mean±SD = ((10.17 ± 7.54), (4.48 ± 4.49)), ((1.56 ± 2.47), (0.88 ± 1.99)) respectively.

Table (1): Demographic and health related characteristics of the patients under study (n= 84)

	Control (n = 42)		Study (n = 42)		χ^2	P
	No.	%	No.	%		
Gender						
Male	24	57.1	20	47.6	0.764	0.382
Female	18	42.9	22	52.4		
Age (years)						
18<30	10	23.8	10	23.8		
30<40	12	28.6	16	38.1	2.095	0.553
40<60	11	26.2	6	14.3		
> 60	9	21.4	10	23.8		
Level of education						
Illiterate	16	38.1	15	35.7		
Read and write	8	19.0	10	23.8	0.557	0.906
Secondary	9	21.4	7	16.7		
University	9	21.4	10	23.8		
Occupation						
House wife	11	26.2	15	35.7		
Manual work	13	31.0	8	19.0	3.499	0.321
Administrative work	4	9.5	8	19.0		
No work	14	33.3	11	26.2		
Smoking						
Smoker	10	23.8	13	31.0	0.539	0.463
Non-smoker	32	76.2	29	69.0		
Type of surgery						
knee replacement	14	33.3	7	16.7		
Hip replacement	11	26.2	8	19.0		
Fracture fixation	10	23.8	14	33.3	5.274	0.153
Anterior Cruciate Ligament surgery (ACL)	7	16.7	13	31.0		
Duration of anesthesia:						
2 hrs	40	95.2	42	100.0	2.049	$^{FE}p=$ 0.494
3 hrs	2	4.8	0	0.0		
Associated diseases:						
No	23	54.8	25	59.5		
HTN	6	14.3	10	23.8	3.649	$^{FE}p=$ 0.282
DM	10	23.8	4	9.5		
HTN, DM	3	7.1	3	7.1		

χ^2: **Chi square test** FE**: Fisher Exact** p: p value for comparing between the two studied groups
*: Statistically significant at $p \leq 0.05$

Figure (1) Frequencies of administration of antiemetic drugs among both control and study group patients (n = 84)

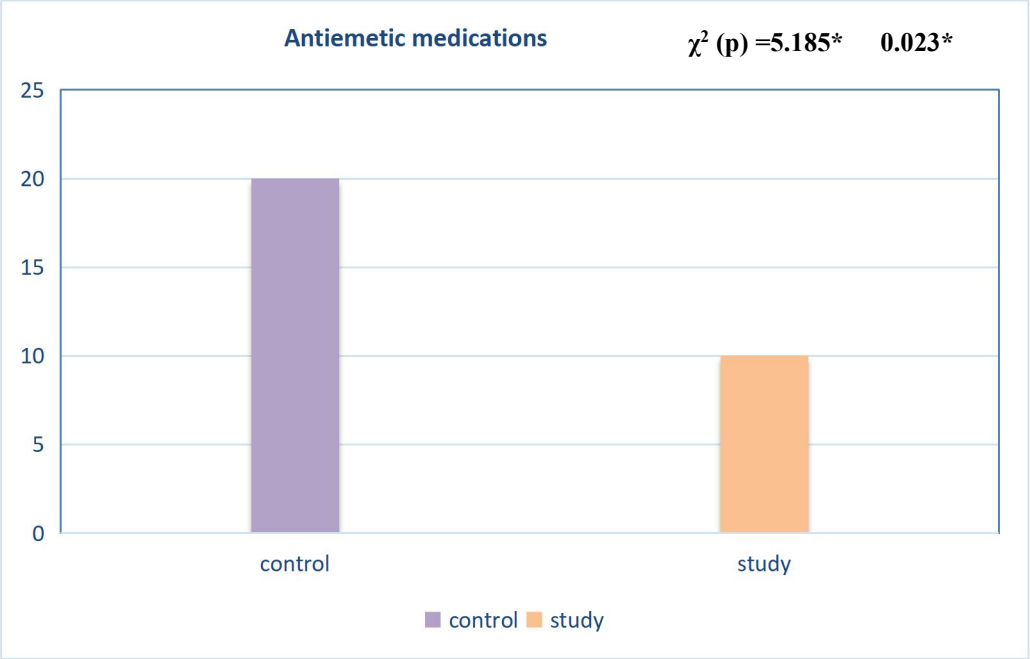


Table (2): Comparison between studied groups regarding Index nausea, vomiting and retching (INVR) at 6 and 12 hours post operative (n = 84)

	Control (n = 42)		Study (n = 42)		U(p_1)	U(p_2)
	After 6 hours	After 12 hours	After 6 hours	After 12 hours		
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD		
1. Times of vomiting	0.88 ± 1.04	0.29 ± 0.55	0.19 ± 0.40	0.10 ± 0.30	548.0* (<0.001*)	752.0 (0.072)
2. Distress from retching	1.0 ± 1.17	0.36 ± 0.69	0.14 ± 0.42	0.05 ± 0.22	502.0* (<0.001*)	709.0* (0.011*)
3. Distress from vomiting	0.95 ± 1.08	0.38 ± 0.76	0.10 ± 0.30	0.0 ± 0.0	461.0* (<0.001*)	693.0* (0.002*)
4. Duration of feeling nauseated or sick at stomach	1.07 ± 0.95	0.48 ± 0.51	0.14 ± 0.35	0.10 ± 0.30	393.0* (<0.001*)	546.0* (<0.001*)
5. Distress from nausea / sickness at stomach.	1.10 ± 0.98	0.45 ± 0.50	0.12 ± 0.33	0.07 ± 0.26	364.0* (<0.001*)	546.0* (<0.001*)
6. Amount of vomiting	0.83 ± 0.91	0.26 ± 0.50	0.21 ± 0.47	0.10 ± 0.30	537.50* (<0.001*)	754.0 (0.076)
7. Times of feeling nauseated or sick at stomach.	0.93 ± 0.87	0.45 ± 0.50	0.17 ± 0.44	0.10 ± 0.30	423.50* (<0.001*)	567.0* (<0.001*)
8. Times of retching or dry heaves without bringing anything up.	0.67 ± 0.72	0.26 ± 0.45	0.12 ± 0.33	0.05 ± 0.22	510.0* (<0.001*)	693.0* (0.007*)

SD: **Standard deviation** **U: Mann Whitney test**

p_1: p value for comparing between the two studied groups in **after 6 hours**

p_2: p value for comparing between the two studied groups in **after 12 hours**

*: Statistically significant at $p \leq 0.05$

Table (3): Comparison between both groups in total scores and total subitems of Index nausea, vomiting and retching (INVR) at 6 and 12 hours (n = 84)

	Control (n = 42)		Study (n = 42)		Test of sig.(p_1)	Test of sig. (p_2)
	After 6 hours	After 12 hours	After 6 hours	After 12 hours		
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD		
Vomiting						
Total score	2.67 ± 2.77	0.93 ± 1.74	0.50 ± 1.06	0.19± 0.59	U=468.00*	U=738.00*
% score	22.22 ±23.11	7.74±14.54	4.17 ± 8.87	1.59 ± 4.95	(<0.001*)	(<0.001*)
Z(p_0)	**4.409*(<0.001*)**		**2.565*(0.010*)**			
Retching						
Total score	1.67 ± 1.78	0.62 ± 1.10	0.26 ± 0.73	0.10 ± 0.43	U=496.00*	U=689.00*
% score	20.83 ±22.20	7.74 ± 13.79	3.27 ± 9.18	1.19 ± 5.39	(<0.001*)	(<0.001*)
Z(p_0)	**4.062*(<0.001*)**		**1.633 (0.102)**			
Nausea						
Total score	3.10 ±2.71	1.38±1.43	0.43 ± 1.09	11.51±11.92	U=360.50*	U=506.50*
% score	25.79 ±22.60	0.26±0.77	3.57 ± 9.04	2.18 ±6.39	(<0.001*)	(<0.001*)
Z(p_0)	**4.215*(<0.001*)**		**1.084 (0.279)**			
Total score (NVR)	7.43 ± 6.97	2.93±3.85	1.19±2.19	0.55 ± 1.58	U=400.50*	U=529.50*
% score	23.21±21.78	9.15±12.02	3.72±6.84	1.71 ± 4.94	(<0.001*)	(<0.001*)
Z(p_0)	**4.390*(<0.001*)**		**3.235*(0.001*)**			

SD: **Standard deviation**

U: Mann Whitney test Z: **Wilcoxon signed ranks test** χ^2: **Chi square test**

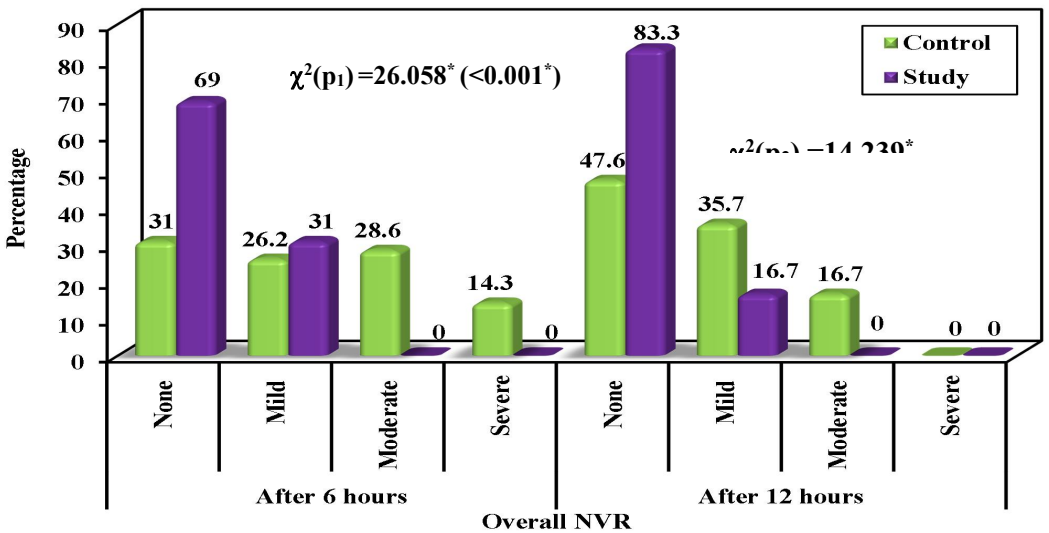
p_0: p value for comparing between **after 6 hours** and **after 12 hours**

p_1: p value for comparing between the two studied groups in **after 6 hours**

p_2: p value for comparing between the two studied groups in **after 12 hours**

*: Statistically significant at $p \leq 0.05$

Figure (2): Comparison between control and study groups in overall INVR (n= 84)



χ^2: **Chi square test** *: Statistically significant at $p \leq 0.05$

p_1: p value for comparing between the two studied groups in **after 6 hours**

p_2: p value for comparing between the two studied groups in **after 12 hours**

Table (4): Relation between total score for INVR and different parameters (n= 84)

	Overall NVR			
	Control (n = 42)		Study (n = 42)	
	After 6 hours	After 12 hours	After 6 hours	After 12 hours
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Smoking				
Smoker	13.00 ± 6.22	5.80 ± 3.36	0.46 ± 1.66	0.00 ± 0.00
Non-smoker	5.69 ± 6.32	2.03 ± 3.58	1.52 ± 2.34	0.79 ± 1.86
U(p)	**67.500*(0.005*)**	**52.000*(0.001*)**	**128.50*(0.046*)**	**143.00 (0.056)**
Type of surgery				
knee replacement	11.36 ± 6.73	4.71 ± 3.79	1.29 ± 2.36	0.57 ± 0.98
Hip replacement	1.27 ± 2.83	0.64 ± 1.43	0.63 ± 1.19	0.13 ± 0.35
Fracture fixation	7.80 ± 5.47	1.70 ± 3.40	2.14 ± 2.98	1.00 ± 2.54
Anterior Cruciate Ligament surgery (ACL)	8.71 ± 8.24	4.71 ± 5.09	0.46 ± 1.13	0.31 ± 0.75
H (p)	**15.915*(0.001*)**	**10.019*(0.018*)**	**3.653 (0.301)**	**0.841 (0.840)**
Duration of anesthesia:				
2 hrs	7.45 ± 7.15	2.90 ± 3.94	1.19 ± 2.19	0.55 ± 1.58
3 hrs	7.00 ± 0.00	3.50 ± 0.71	–	–
U(p)	**39.0 (0.976)**	**24.000 (0.393)**	–	–
Associated diseases:				
No	3.40 ± 5.32	0.60 ± 1.26	1.50 ± 3.00	0.00 ± 0.00
Hypertension (HTN)	3.33 ± 3.14	2.17 ± 1.72	0.50 ± 1.08	0.10 ± 0.32
Diabetse Mellitus (DM)	10.17 ± 7.54	4.48 ± 4.49	1.56 ± 2.47	0.88 ± 1.99
HTN, DM	8.00 ± 1.00	0.33 ± 0.58	0.00 ± 0.00	0.00 ± 0.00
H(p)	**8.794*(0.032*)**	**8.479*(0.037*)**	**2.861 (0.414)**	**2.900 (0.407)**

SD: **Standard deviation**
U: Mann Whitney test H: H for **Kruskal Wallis test**
p: p value for comparison between the studied categories
*: Statistically significant at $p \leq 0.05$

Discussion

Recovery following anaesthesia is typically hampered by nausea, vomiting, and retching. Patients frequently rate PONVR as worse than postoperative pain. PONVR typically resolves or is treated without side effects, but it may postpone discharge from the recovery room. Retching or vomiting can also lead to esophageal rupture, aspiration, and pneumothorax, among other complications **(Feinleib et al., 2018).** The present study aimed to evaluate the effect of deep breathing exercise on nausea, vomiting, and retching in postoperative orthopedic patients.

The current study involves two groups with no statistically significant difference between them regarding selected demographic characteristics and health related data. Close results to a study by **Soliman et al., (2022)** who study the effect of progressive muscle relaxation on nausea and vomiting caused by chemotherapy study and reported that two groups were identical for education level, marital status, occupation, and residence. As well, the current study demonstrated that more than two thirds of both groups were non-smoker. The same result was presented by **Ibrahim et al., (2020)** after studing the effect of diaphragmatic breathing exercise on PONVR that approximately three-quarters of participants were nonsmokers.

Concerning duration of anesthesia, the majority of patients were two hours. The same result is showed by **Rathna et al., (2018)** in a study entitled "Efficacy of single parenteral dose of palonosetron versus dexamethasone for prevention of postoperative nausea and vomiting in patients undergoing laparoscopic surgeries under general anaesthesia" that the total study participants under general anesthesia, and the majority of them lasted its effect equal to two hours. In contrast, the result of **Yeo et al., (2018)** mentioned in a study entitled

"aprepitant prophylaxis effectively reduces preventing postoperative nausea and vomiting in patients receiving opioid based intravenous patient-controlled analgesia" that it was more than two hours.

Relying on the results of the current study, it was found that the incidence of PONVR after 6 hours was higher than the incidence after 12 hours in both groups. It is believed that stress from general aesthesia and surgery may increase the risk. Similarly to **Wang et al., (2020)** who explore risk factors of PONVR after total hip or total knee replacement. Moreover, it was revealed that deep breathing has a positive effect on reduction of PONVR. As there was a statistically significant difference between total scores of both groups at 6 hours and at 12 hours like the literature **Aitken, Marshall, Chaboyer, (2019)**. Also, it is in agreement with **Ibrahim et al., (2020)** declared that there was a highly statistically significant difference between participants' mean scores of nausea, retching, and vomiting before and after performing diaphragmatic breathing exercise.

Also, in the same line with the reported results of a study by **Larios-Jiménez et al. (2019)** entitled "Efficacy of relaxation techniques in the reduction of tension, anxiety and stress perceived by patients with cancer under chemotherapy treatment" that diaphragmatic breathing was effective in decreasing nausea, vomiting, insomnia, pain, anxiety and stress among patients administered chemotherapy. Additionally, the frequency of antiemetic drug administration decreased among study group patients which results from decreasing the frequency of PONVR. Similarly, to the results of **Karsten et al., (2020)** who revealed that antiemetic requirements decreased among treatment group rather than control group patients.

The study findings supports the evidence that deep breathing exercises reduce the incidence of NVR because stimulation of the vagus nerve leads to relaxation of the autonomic nervous system, regulations of gastrointestinal movements, and decreases anxiety. In addition, it relaxes spastic contraction of respiratory and abdominal muscles during the nausea, vomiting, and retching **(Russell et al., 2014; Chen et al., 2017; Aybar et al., 2020).**

As regards the incidence of PONVR, it is increased among the non-smoker patients of the study group after 6 hours and after 12 hours as showen in table (4), a fact like other studies that prove that incidence of PONVR increased among non-smoker patients **(Chen & Chang, 2020; Kundu et al., 2022).** This may be due to an enzyme induction that postulates antiemetic effect. Concerning type of surgery, total knee replacement represents the highest mean score. This is in line with **Wang et al., (2020).**

According the total score of PONVR, there was a statistically significant difference between control and study group after 6 hours and after 12 hours. This supports the evidence that deep breathing decreases the incidence of nausea and vomiting. This like a reported findings of **Aybar, Kılıc, & Çınkır, (2020)** who found that the intervention group patients had lower episodes of NVR following breathing exercise than the control group with a statistically significant difference.

As PONVR associated with devastating complications like aspiration, dehiscence of wound, increased cardiovascular demand and increased intracranial pressure **Aitken, Marshall, Chaboyer, 2019),** there is a great need to decrease it. Because the findings of the study supports the evidence that PONVR decreased after deep breathing, it is important to involve it to the routine hospital care postoperatively because it is a safe non pharmacological measure.

Conclusions:

It was concluded that deep breathing exercise decreases nausea, vomiting and retching among study group patients after both 6 hours and 12 hours.

Recommendations:

1) Deep breathing exercise should be added to routine hospital post operative care.

2) Further researches on larger sample to explore frequency of use of antiemetic drugs among patients performing postoperative deep breathing exercise.

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