

Comparative Study between Ondansetron, Isopropyl Alcohol Inhalation and Super Hydration in Treatment of Postoperative Emesis after Laparoscopic Appendectomy

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ABSTRACT

Introduction: PONV affect 35% of the postoperative patients especially those who had general anesthesia. And affect 65% of patients who had laparoscopic abdominal surgery. Ondansetron is one of most effective drugs used to control those complications. Yet its complication limits its use in large scales. Isopropyl alcohol inhalation and super hydration now compete ondansetron in its action and they are safer.

Aim of the work: To compare and evaluate the antiemetic effect and the safety of ondansetron, inhalational isopropyl alcohol and super hydration on adult patients after laparoscopic appendectomy.

Patients and methods: This prospective double-blind study done on 240 patients admitted to surgical I.C.U after laparoscopic appendectomy. Those who had preoperative Koivuranta vomiting score of more than 3 enrolled in our study. Every group contains 80 patients. Patients of group A received ondansetron 4 mg intravenous immediately once reached to I.C.U and another same dose after 6 hours while patients of group B received isopropyl alcohol 70% inhalation every 15 min for 4 times then repeated after 6 hours. The last group C received intravenous normal saline at rate of 20 ml/kg over 30 minute and repeated by the same dose after 6 hours. The duration of the study was 24 hours post-operatively. As PONV is self-limited within 24 hours. Results: no significant difference was found between the three drugs as regard control of all parameters (0,1,2,3 and 4) of severity of PONV between the studied groups in the studied durations. As regards number of patients had no experience of N&V, number of patients had mild, moderate, frequent and/or severe continuous N&V. No significant difference in the number of patients discharged from ICU, accepted all kind of oral fluid, semisolid diet and soft diet and no significant difference in the number of patients had vomiting after oral fluid, semisolid diet and soft diet, No significant difference in patient's and nurse's satisfaction. While there was significant less postoperative complication in patients of group B and C compared to patients of group A.

Conclusion: Inhalational isopropyl alcohol and super hydration had the same antiemetic effect as ondansetron with significant less complication if used after laparoscopic appendectomy.

Keywords: Ondansetron; Isopropyl alcohol; Laparoscopic appendectomy; Super hydration

INTRODUCTION

Post-operative nausea and vomiting (PONV) are the most common symptoms affecting patients after surgery especially those given general anesthesia with incidence of 35%. The

laparoscopic abdominal surgery characterized by higher incidence of PONV (65%) as inflation the abdominal cavity with carbon dioxide with strictly minimal systemic absorption sensitize the chemoreceptor trigger zone for post-operative

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vomiting. Many studies done trying to control PONV but still the ideal antiemetic drug not yet found [1-3]. Nausea is the sensation associated with the awareness of the urge to vomit. Vomiting is the forceful expulsion of upper gastrointestinal contents *via* the mouth, brought about by powerful sustained contraction of the abdominal muscles [4-8]. Both are protective reflexes against the absorption of toxins (which trigger chemoreceptors in the gastrointestinal tract) but both can also occur in response to olfactory, visual, vestibular and psychogenic stimuli. It is associated with gastrointestinal relaxation, retroperistalsis in the duodenum, increased salivation, pallor and tachycardia. Vomiting and retching (repeated attempts to vomit without stomach contents being expelled) are brainstem reflexes. Vomiting begins with deep breaths, closure of the glottis and elevation of the soft palate. The diaphragm then contracts strongly and the abdominal muscles contract to raise the intragastric pressure. This causes forceful ejection of gastric contents up the esophagus and out of the mouth [8-11].

The exact nature of vomiting pathways is also not fully understood but a number of pathophysiological mechanisms known to cause nausea or vomiting have been identified. The main coordinator is the vomiting center, a collection of neurons located in the medulla oblongata. This receives inputs from:

- The chemoreceptor trigger zone (CTZ) in the area postrema
- The vestibular system (which is associated with motion sickness and the nausea of middle ear diseases)
- The higher cortical centers within the central nervous system
- The vagus nerve (which brings signals from the gastrointestinal tract)
- The spin reticular system (which promotes nausea associated with physical injury)
- The nucleus tractus solitarius (which completes the reflex arc of the gag reflex).

The CTZ is rich in dopamine and 5-hydroxytryptamine receptors, in particular D2 and 5HT3. The CTZ is not protected by the blood brain barrier, so is particularly susceptible to circulating stimuli (e.g., drugs and toxins). It can be affected by anesthetic agents, opioids and humoral factors (e.g., 5HT) released during surgery. The vestibular system can stimulate PONV as a result of surgery involving the middle ear, or postoperative movement. Acetylcholine and histamine are involved in the transmission of signals from the vestibular system to the vomiting center [12,13].

Higher cortical centers (e.g. in the limbic system) can also be involved, especially if there is a history of marked PONV. The afferent vagus nerve relays information from mechanoreceptors in the muscular wall of the gut (which releases 5HT when distended or damaged during surgery) and from chemoreceptors in the mucosa of the upper gastrointestinal tract (triggered by noxious substances in the luminal environment) [14]. Sixty five percent of patients under went laparoscopic abdominal surgery experienced postoperative nausea and vomiting (PONV) especially in the first 24 hours postoperatively [14,15]. The risk factors increase with certain clinical parameters e.g. age (younger

age group are more common especially those between 14-25 years by 18%, sex (female are more common by 25% than male especially obese early menstruating one), obesity (6% increase risk of PONV), lengthy operation, use of volatile inhalation anesthetics, opioids, insertion of nasogastric tube, history of motion sickness, non-smoker, and postoperative unsatisfactory analgesia. There are multiple predictive clinical scoring systems for prediction of PONV e.g. Apefel [5] and Koivuranta [3] which considered the most common used.

Aim of the work: To compare and evaluate the antiemetic effect and the safety of ondansetron, inhalational isopropyl alcohol and super hydration on adult patients after laparoscopic appendectomy.

PATIENTS AND METHODS

This prospective double-blind study done on 240 patients admitted to surgical I.C.U of King Abdul-Aziz specialist hospital for post-operative care after laparoscopic appendectomy surgery between March 2019 till February 2020. A Koivuranta Score to Predict Postoperative Nausea and Vomiting done preoperatively for all the patients and only those who had score of more than 3 on Koivuranta vomiting score (had more than 60% chance to develop PONV) enrolled in our study. And randomly allocated in one of three groups group A, B or C. Inclusion criteria, those who had preoperative vomiting score (Koivuranta et al.) more than 3, age between more than 18-50 years, no history of any organic cardiac problems which may contraindicate super-hydration. King Abdul-Aziz research and ethical committee approved the project. A written consent for all the patients was taken. All patients received postoperatively in our surgical intensive care unit and monitored by our routine post-operative monitoring (electrocardiograph ECG, pulse oximeter, non-invasive blood pressure every 20-minute, core temperature and CVP manometer). All routine post-operative investigation done according to our protocol. Arterial blood gas (ABG), chest X ray, complete blood picture, complete chemical studies (liver function tests, kidney functions tests, serum electrolytes level and random blood sugar level). All patients were given post-operative analgesia in the form of Acetaminophen in dose of 500 mg intravenous every 4 hours to keep Visual analogue scale of pain below 4. If more analgesia needed acetaminophen dose was increased to one gram every 4 hours and diclofenac Sodium 37.5 mg IV bolus over 15 seconds every 6 hours as needed for pain

Maximum Dose: 150 mg per day. Opioids avoided in all patients. All patients were given anti-stress in form of omeprazole intravenous 40 mg once daily. Patients of group A included 80 patients and received ondansetron 4 mg intravenous immediately once reached to I.C.U and another same dose after 6 hours while patients of group B (also included 80 patients) received isopropyl alcohol 70% inhalation every 15 min for 4 times then repeated after 6 hours. The last group C (80 patients) received intravenous normal saline at rate of 20 ml/kg over 30 minute and repeated by the same dose after 6 hours. The duration of the study was only the first 24 hours

post-operative as PONV is self-limited condition spontaneously relieved after 24 hours (Table 1).

Table 1: Showed Koivuranta pre-operative vomiting score [6] for all patients in all groups.

History	Points
Duration of surgery is more than 60 minutes	Yes 1/no 0
Female sex	Yes 1/no 0
History of motion sickness	Yes 1/no 0
History of postoperative nausea and vomiting	Yes 1/no 0
Nonsmoker	Yes 1/no 0
Total score	5

The five strongest preoperative predictors of postoperative nausea and vomiting each having the same weight. And only patient with score more than 3/5 enrolled in our study. The severity of post-operative nausea and vomiting (PONV) were

recorded according to the parameters given in Table 2 and compared between patients of all groups every 8 hours for 24 hours.

Table 2: Parameters for evaluation of severity of postoperative N&V in our study.

Scale of post-operative severity	Patient's symptoms recorded	Score
No episode of nausea or vomiting (N&V)	Had no any experience or sensation of N&V or retching	0
mild episode of (N&V)	infrequent sensation of malaise and want to vomit but no vomiting happened and this considered one in our scale	I
moderate degree of (N&V)	<2 attacks of nausea and vomiting in 15 min and this considered two in our scale	II
Frequent N&V	mean 3 attacks of nausea and vomiting in 15 min and this considered three in our scale	III
Severe continuous N&V	>3 attacks of nausea and vomiting or continuous sensation of nausea or retching in 15 min and this considered four in our scale	IV

Also, the post-operative data and the intensive care unit length of stay related to PONV were recorded and compared for all

patients in all groups every 8 hours for 24 hours according to the given Table 3.

Table 3: Post-operative data and their clinical application in our study.

Post-operative data in our study	Clinical explanation of this data in our study
Number of patients discharged from ICU	Had no any experience of N&V or PONV doesn't affect their general condition or their serum electrolytes
Number of patients accepted clear oral fluid	Only in the first 8 hours and after approval from the surgical team
Number of patients accepted milk and semisolid diet	only in the second 8 hours and after approval from the surgical team
Number of patients accepted soft regular diet included milk	Only in the last 8 hours and after approval from the surgical team

Number of patients had any attack of vomiting after any oral fluid experience	Any N&V recorded which NOT affect the general condition or patient's electrolytes
Number of patients need another antiemetic drug to control vomiting after oral experience in any of the three studied periods	Any use of another antiemetic drugs to control the severity of the PONV after oral experience but with satisfactory general condition and patient's serum electrolytes
Patient's un-satisfaction	Un-satisfied patients considered in our study if the patient had continuous sensation of malaise, not wellbeing or moderate, to frequent nausea and/or severe vomiting. either immediately postoperative or after any oral intake
Nurse's satisfaction	nursing satisfaction considered in our study by easily application of the drug, and if patients had no experience of nausea or vomiting also it was recorded and compared between groups all over the studied duration

Any patient discharged from the ICU before the studied period followed in the regular ward in the hospital till the 24 hours completed. Complication reported at the end of the studied period and compared. Lung congestion diagnosed in our study by increase bronco-vascular marking in the lower lung zones in the chest X-ray. If central venous pressure recorded more than 14 cm H₂O this considered circulatory overload in our study and reported as complication and if associated with SPO₂ less than 90% furosemide 20 milligram intravenous stat given once. Any change in the normal sinus rhythms which recorded in our monitors considered arrhythmia. Any patients had altered level of conscious or severe electrolytes abnormality due to dehydration from severe continuous vomiting excluded from our study.

Statistical analysis

Data were fed to the computer using IBM SPSS software package version 21.0. Qualitative data were described using number and percent. Comparison between different groups regarding categorical variables was tested using Chi-square test.

Table 4: Showed demographic data of all patients in all groups.

	Group A (n=80)		Group B (n=80)		Group C (n=80)		p value
	No	%	No	%	No	%	
Age in years							
18-22 years	33	41.25	31	38.75	35	43.75	
23-35 years	25	31.25	27	33.75	23	28.75	
36-45 years	16	20	15	18.75	14	17.5	
46-50 years	6	7.5	7	8.75	8	10	0.98
Sex							
Male	24	30	22	27.5	25	31.25	
Female	56	70	58	72.5	55	68.75	0.86

Table 5 compared severity of vomiting between the studied groups in the first 8 hours and showed no significant difference

Chi-square test: It tests the association between qualitative nominal variables, it is performed mainly on frequencies. It determines whether the observed frequencies differ significantly from expected frequencies.

Sample size: Sample size was calculated based on a previous study and by using Med Calc statistical software. Assuming area under ROC to be 0.80, an alpha of 0.05 and power of study 90.0%. A typical advice is to reject the null hypothesis H₀ if the corresponding p-value smaller than 0.05.

A minimum sample size required was 240 patients will be required for this study, 80 patients in each group.

RESULTS

Table 4 represented the demographic data for all patients included in the study and showed no significant difference as regard the age and sex between the studied groups.

in all parameters of severity of PONV between the studied groups as regards number of patients had no experience of

PONV in group A compared to both groups B and C (50, 48 and 47 respectively) and those had mild episode of PONV in group A compared to both groups B and C (20, 19 and 22 respectively), those had moderate experience of PONV in group

A compared to both groups B and C (10, 13 and 11 respectively) and those had both frequent and severe continuous PONV all zero in all groups.

Table 5: Compared the score of severity of post-operative vomiting between the studied groups in the first 8 hours.

	Group A (n=80)		Group B (n=80)		Group C (n=80)		p value
	No	%	No	%	No	%	
No experience of nausea or vomiting (0)	50	62.5	48	60	47	58.75	0.698
Mild episode of nausea with no vomiting (I)	20	25	19	23.75	22	27.5	0.701
Moderate degree of N&V (II)	10	12.5	13	16.25	11	13.75	0.566
Frequent N&V (III)	0	0	0	0	0	0	-
Severe continuous N&V (IV)	0	0	0	0	0	0	-

Table 6 compared the post-operative data between the studied groups in the first 8 hours and showed no significant difference in number of patients accepted clear fluid, in group A compared to both groups B and C (53, 51 and 51 respectively) those had experience of vomiting after clear fluid in group A compared to both groups B and C (18, 17 and 16 respectively), patient's satisfaction in group A compared to both groups B and C (52,

50 and 53 respectively), patients unsatisfied due to either PONV in group A compared to both groups B and C (10, 13 and 11 respectively) or patients felt continuous malaise after clear fluids in group A compared to both groups B and C (18, 17 and 16 respectively) and nurse satisfaction in group A compared to both groups B and C (50, 48 and 47 respectively).

Table 6: Compared the post-operative data between the studied groups in the first 8th hours.

	Group A (n=80)		Group B (n=80)		Group C (n=80)		p value
	No	%	No	%	No	%	
Number of patients discharged from ICU	0	0	0	0	0	0	-
Accepting of clear oral fluid only	53	66.25	51	63.75	51	63.75	0.968
Vomiting episodes after clear oral fluid	18	22.5	17	21.25	16	20	0.798
Need of another antiemetic drug	0	0	0	0	0	0	-
Patients satisfaction	52	65	50	62.5	53	66.25	0.974
Patients unsatisfied due to- PONV 2-continuous malaise after oral intake	28	35	30	37.5	27	33.75	0.942
	10	12.5	13	16.25	11	13.75	0.425
	18	22.5	17	21.25	16	20	0.332
Nurse satisfaction	50	62.5	48	60	47	58.75	0.814

Table 7 compared severity of vomiting between the studied groups in the second 8 hours and showed no significant difference in all parameters of severity of PONV between the studied groups as regards number of patients had no experience of PONV in group A compared to both groups B and C (55, 54

and 53 respectively) and those had mild episode of PONV in group A compared to both groups B and C (20, 18 and 19 respectively), those had moderate experience of PONV in group A compared to both groups B and C (5, 8 and 8 respectively)

and those had frequent or severe continuous PONV all zero in all groups.

Table 7: Compared the score of severity of post-operative vomiting between the studied groups in the second 2nd 8 hours.

	Group A (n=80)		Group B (n=80)		Group C (n=80)		p value
	No	%	No	%	No	%	
No experience of nausea or vomiting (0)	55	68.75	54	67.5	53	66.25	0.825
Mild episode of nausea with no vomiting (I)	20	25	18	22.5	19	23.75	0.725
Moderate degree of N&V (II)	5	6.25	8	10	8	10	0.482
Frequent N&V (III)	0	0	0	0	0	0	-
Severe continuous N&V (IV)	0	0	0	0	0	0	-

Table 8 compared the post-operative data between the studied groups in the second 8 hours and showed no significant difference in number of patients discharged from the ICU in group A compared to both groups B and C (54, 51 and 53 respectively), number of patients accepted semisolid diet in group A compared to both groups B and C (66, 64 and 67 respectively), those had experience of vomiting after semisolid diet in group A compared to both groups B and C (9, 10 and 11

respectively), patient's satisfaction in group A compared to both groups B and C (66, 62 and 61 respectively), patients unsatisfied due to PONV in group A compared to both groups B and C (5, 8 and 8 respectively) or patients felt continuous malaise after semisolid diet in group A compared to both groups B and C (9, 14 and 11 respectively) and nurse satisfaction in group A compared to both groups B and C (55, 54 and 53 respectively).

Table 8: Compared the post-operative data between the studied groups in the second 2nd 8 hours.

	Group A (n=80)		Group B (n=80)		Group C (n=80)		p value
	No	%	No	%	No	%	
Number of patients discharged from ICU	54	67.5	51	63.75	53	66.25	0.685
Accepting of milk and all kind semisolid diet	66	82.5	64	80	67	83.75	0.785
Vomiting episodes after milk and semisolid diet	9	11.25	10	12.5	11	13.75	0.901
Need of another antiemetic drug	0	0	0	0	0	0	-
Patients satisfaction "No. of satisfied"	66	82.5	62	77.5	61	76.25	0.652
Patients unsatisfied	14	17.5	18	22.5	19	23.75	0.425
Cause of un-satisfaction							
1- PONV	5	6.25	4	5	8	10	0.698
2- continuous malaise after oral intake	9	11.25	14	17.5	11	13.75	0.458
Nurse satisfaction	55	68.75	54	67.5	53	66.25	0.682

Table 9 compared severity of vomiting between the studied groups in the last 8 hours and showed no significant difference in all parameters of severity of PONV between the studied groups as regards number of patients had no experience of

PONV in group A compared to both groups B and C (77, 75 and 76 respectively) and those had mild episode of PONV in group A compared to both groups B and C (3, 5 and 4

respectively), those had moderate, frequent and/or severe continuous experience of PONV are zero in all.

Table 9: Compared the score of severity of post-operative vomiting between the studied groups in third 3rd 8 hours.

	Group A (n=80)		Group B (n=80)		Group C (n=80)		p value
	No	%	No	%	No	%	
No experience of nausea or vomiting (0)	77	96.25	75	93.75	76	95	0.682
Mild episode of nausea with no vomiting (I)	3	3.75	5	6.25	4	5	0.465
Moderate degree of N&V (II)	0	0	0	0	0	0	-
Frequent N&V (III)	0	0	0	0	0	0	-
Severe continuous N&V (IV)	0	0	0	0	0	0	-

Table 10 compared the post-operative data between the studied groups in the last 8 hours and showed no significant difference in number of patients discharged from the ICU in group A compared to both groups B and C (80 patients for all), number of patients accepted regular soft diet in group A compared to both groups B and C (76, 77 and 75 respectively), those had experience of vomiting after semisolid diet in group A compared

to both groups B and C (10, 9 and 10 respectively), patient's satisfaction in group A compared to both groups B and C (70, 71 and 70 respectively), patients unsatisfied due to either PONV all are zero in all groups or patients felt continuous malaise after regular soft diet in group A compared to both groups B and C (10, 9 and 10 respectively) and nurse satisfaction in group A compared to both groups B and C (77, 75 and 76 respectively).

Table 10: Compared the post-operative data between the studied groups in the third 8th hours.

	Group A (n=80)		Group B (n=80)		Group C (n=80)		p value
	No	%	No	%	No	%	
Number of patients discharged from ICU	80	100	80	100	80	100	-
Accepting all kind of oral fluid and soft diet	76	95	77	96.25	75	93.75	0.963
Vomiting episodes after oral fluid and soft diet	10	12.5	9	11.25	10	12.5	0.785
Need of another antiemetic drug	0	0	0	0	0	0	-
Patients satisfaction	70	87.5	71	88.75	70	87.5	0.965
Patients unsatisfied	10	12.5	9	11.25	10	12.5	0.758
1- PONV	0	0	0	0	0	0	-
2- continuous malaise after oral intake	10	12.5	9	11.25	10	12.5	0.68
Nurse satisfaction	77	96.25	75	93.75	76	95	0.988

Table 11 compared the post-operative complications reported in patients in all groups in studied period and showed significant higher number of patients in group A had serious side effect in form of Headache, Bowel motions abnormality (diarrhea or/and constipation), Fatigue and malaise, Cardiac arrhythmias, Lung congestion and Elevated liver enzymes compared to patients of both group B and group C. While group C showed significant

higher number of patients had Lung congestion, Cough and circulatory overload (Central venous pressure CVP more than 14 cm/H₂O) compared to patients of both group A and group B. Group B patients had significant higher number on patients had cough compared to group A but significantly lower than patients of group C. Number of patients had urinary retention

was non significantly higher in group A compared to group C and was zero in group B.

Table 11: Compared the post-operative complications reported in patients in all groups in studied period.

Complication reported	Group A (n=80)		Group B (n=80)		Group C (n=80)		p value
	No	%	No	%	No	%	
Headache	23	28.75	3	3.75	4	5	0.0032*
Bowel motions abnormality (diarrhea or/and constipation)	19	23.75	2	2.5	3	3.75	0.0052*
Fatigue and malaise	13	16.25	3	3.75	2	2.5	0.016*
Cardiac arrhythmias	10	12.5	2	2.5	2	2.5	0.025*
Urinary retention	8	10	0	0	4	5	0.072
Lung congestion	0	0	2	2.5	23	28.75	0.006*
Cough	2	2.5	14	17.5	26	32.5	0.001*
Elevated liver enzymes	9	11.25	0	0	0	0	0.035*
CVP more than 14 cm/H ₂ O	0	0	0	0	28	35	0.011*

DISCUSSION

In our study we compared the usage of the ondansetron, inhalation of isopropyl alcohol and super hydration in controlling the PONV in spite of totally different mechanism of action. All patients in our study selected to be at high risk of developing PONV. As all of them had Koivuranta pre-operative vomiting score more than 3/5, Type of surgery selected as abdominal surgery characterized by higher percent of PONV than other surgeries, Being laparoscopic surgery with insufflation the abdominal cavity with carbon dioxide who reach the blood by minimal concentration and sensitize CTZ and The higher percent of female patients in our sample (more than 60% in all groups in all groups). All these factors put our sample as reliable sample to study PONV.

First 8 hours, our results showed no significant difference recorded between the three drugs as regards the control of the severity of PONV in the first 8 hours. All the three drugs used efficiently control PONV. As >55% of all patients in all groups had no any experience of PONV and no any patient in all groups had frequent or sever continuous vomiting, and approximately 25% of all patients in all groups had mild PONV, While <17% of all patients in all groups had moderate PONV with no significant difference between the groups. Number of patients accepted clear fluid was >63% of all patients in all groups with no significant difference between the groups. Even after clear oral fluid started only 22% of all patients in all groups had mild vomiting with no significant difference between the groups. While the rest showed good control to PONV after started clear fluid. Patient satisfaction exceeded >62% while nurse satisfaction exceeded >58% with no significant difference between the groups. Number of patients had either moderate

vomiting and/or felt malaise after clear fluid intake was approximately 37% of all patients in all groups with no significant difference between the groups. This could be explained by the efficiency of the three drugs to control PONV and no significant difference detected between them in spite that the three drugs had totally three different mechanism of action. As ondansetron selectively block serotonin receptors both centrally in CTZ of the area postrema and peripherally in the vagal nerve terminals in the GIT. While inhalation of isopropyl alcohol 70% block many receptors in the CTZ in unclear mechanism up till now. On the other hand's super hydration work by reperfusion of relative ischemic gut from fasting before surgery which may release cytokines cause postoperative vomiting.

In the second 8 hours, >66% of all patients had no any experience of vomiting with no significant difference between the groups and still no any patient had frequent or sever continuous vomiting with no significant difference between the groups. Number of patients accepted semisolid diet was >82% of all patients in all groups with no significant difference between the groups. Even after started semisolid oral diet and milk ingestion <14% of all patients in all groups had mild vomiting with no significant difference between the groups. While the rest showed good control to PONV after semisolid diet and milk. Patient satisfaction exceeded >75% of all patients in all groups while nurse satisfaction >66% with no significant difference between the groups. Number of patients had either moderate vomiting and/or felt malaise after semisolid diet was <24% of all patients in all groups with no significant difference between the groups. >62% of all patients in all groups discharged from the ICU with no significant difference between the groups.

Which prove the reliable sustained antiemetic effect of the three drugs with more or less the same efficacy without development of tolerance feature to any of them. Even the reliable antiemetic effect kept by the same efficacy with the same results for all the patients in the three groups after started semisolid diet and milk ingestion.

In the third 8 hours, >93% of all patients had no any experience of vomiting and still no any patient had moderate, frequent and sever continuous vomiting with no significant difference between the groups. Number of patients accepted soft diet was >93% of all patients in all groups with no significant difference between the groups. Even after started regular oral diet only <12% of all patients in all groups only had mild vomiting while the rest showed good control to PONV after oral fluid and soft diet with no significant difference between the groups. Patient satisfaction was exceeded >87% while nurse satisfaction was >93% with no significant difference between the groups. Number of patients had either moderate vomiting and/or felt malaise after soft diet was <12% of all patients in all groups with no significant difference between the groups. All patients in all groups discharged from the ICU with no significant difference between the groups. This prove that the three drugs are very effective in controlling PONV and had sustain action for long time with nearly same results and without any reported tolerance to any of them even after patients kept on oral fluid or started semisolid then soft diet still there was no significant changes reported between the three drugs another non pharmacological explanation for the results in this period (last 8 hours) that PONV considered a self-limited symptoms usually end within 16 hours. The pharmacological explanation of cough with isopropyl alcohol inhalation might be chemical irritation of the mucosal irritation of the respiratory tract to the inhaled steam of the alcohol or physical irritation to the lower temperature of the inhaled steam in the susceptible patients especially those with hyperactive airways as bronchial asthma or chronic obstructive pulmonary disease. While the pharmacological explanation of cough with super hydration is lung congestion from transient over load happened after infusion the 20 ml/Kg in only 30 min. This explanation supported by high CVP reported in almost the same number of patients who had cough. As physiologically the lung congestion is dependent on rate of infusion more than the amount of the fluid infused [15,16]. The side effect reported with ondansetron is well known common side effect of this drug. The use of isopropyl alcohol inhalation (IPA) in treatment of nausea and vomiting was studied before by many authors. Cotton et al. 2007 [17] compared the efficacy of inhaled isopropyl alcohol (IPA) with ondansetron for the control of PONV during a 24-hour period in 100 ASA class I-III women undergoing laparoscopic surgery and determined that using IPA after discharge from the post-anesthesia care unit is a valuable method to control PONV in the hospital and at home. The results of this study suggest that IPA is much faster than ondansetron for 50% relief of nausea. Beadle et al. in 2015 [18] studied the effect of Isopropyl Alcohol Nasal Inhalation for Nausea in the Emergency Department as Randomized Controlled Trial done on 84 patients and found that nasally inhaled isopropyl alcohol achieves increased nausea relief compared with placebo during a

10-minute period. April et al. in 2018 [19] compare IPA versus oral ondansetron for treating nausea among emergency department (ED) patients not requiring immediate intravenous access. And concluded that among ED patients with acute nausea and not requiring immediate intravenous access, the use of IPA with or without oral ondansetron provides greater nausea relief than oral ondansetron alone. And lastly Hines S et al. in 2018 [20] did study on Aromatherapy for treatment of postoperative nausea and vomiting and concluded that Isopropyl alcohol was more effective than saline placebo for reducing postoperative nausea and vomiting but less effective than standard anti-emetic drugs. On the other hand, the data supporting the use of super-hydration in treatment of PONV is adult was much more than the use of IPA. Maharaj et al. in 2005 [21] did study on Eighty ASA grade I-III patients presenting for gynecologic laparoscopy patients were randomized to receive large (2 mL/kg per hour fasting) or small (3 mL/kg) volume infusions of compound sodium lactate solution over 20 min preoperatively. The group who received a higher volume of fluid did effectively reduces PONV and postoperative pain in high risk patients and they recommend the preoperative administration of 2 mL/kg of compound sodium lactate for every hour of fasting to patients with an increased PONV risk presenting for ambulatory surgery. Chohedri et al. in 2006 [22], Dagher et al. in 2009 [23], Sharma et al. in 2010 [24] and Sayed et al. in 2016 [25] all prove the effect of super-hydration preoperatively and early postoperatively in prevention of PONV. Lastly Korean Society of Anesthesiologists, in 2017 published a study done by Ismail et al. Department of Anesthesia, Assiut University Faculty of Medicine, Assiut, Egypt [26]. on 100 female patients titled Dexamethasone alone versus in combination with intra-operative super-hydration for postoperative nausea and vomiting prophylaxis in female patients undergoing laparoscopic cholecystectomy, in this study pre-induction with 5 mg Dexamethasone plus intraoperative 30 ml/kg Ringer's lactate solution was found to decrease PONV and pain during the first 24 h postoperatively compared to 5 mg Dexamethasone alone.

But still our study considered a unique in using super-hydration with IPA in adult and only postoperatively.

The main limitation points in our study were the small sample size beside the use of the three drugs only in postoperative laparoscopic appendectomy which considered a narrow spectrum of laparoscopic usage. Still more research work needed in larger sample size and a wide variety of laparoscopic surgeries especially gynecological, thoracic and other different abdominal laparoscopic surgeries before final conclusion. Moreover, the studied side effect of ondansetron in our study was not it's all side effects. We only selected the famous side effects and still more studies needed to involve all its known side effects in comparison with other antiemetics for determination of its safety if used with larger scale.

CONCLUSION

Inhalational isopropyl alcohol and super hydration had the same antiemetic effect as ondansetron with significant less complication if used after laparoscopic appendectomy.

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