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Effect of supplemental pre-operative fluid on postoperative nausea and vomiting among patients undergoing laparoscopic cholecystectomy

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Abstract: *Postoperative nausea and vomiting continues to be a common and distressing complication of surgery. The purpose of this study was to determine the effect of preoperative volume loading with Ringer lactate solution on the incidence of PONV after laparoscopic cholecystectomy.* ***Materials and methods:*** *Among sixty patients, aged 18-65 years, scheduled to undergo elective laparoscopic cholecystectomy were randomized into two groups. Group A received intravenous ringer lactate of 2ml/kg/hr, whereas Group B received intravenous ringer lactate of 12ml/kg/hr. Rest of the anaesthesia protocol was similar in both groups. Parameters compared included intraoperative hemodynamics, incidence of postoperative nausea and vomiting during 0-5 hours and 6-24 hours in the postoperative period.* ***Results:****There was a significant reduction in the SBP in the Group A compared to the Group B after induction of anaesthesia. The drop in the mean SBP was 16% in Group A compared with 10.01% drop in the Group B on induction of anaesthesia.In the 0-5 interval the number of patients experienced no nausea and no vomiting in Group A were 6(20%) and in Group B were 16(53%). There was a statistical significant difference between the two groups. In the 0-5hrs the incidence of nausea was 33% in Group A and 30% in Group B and the incidence of vomiting was 47% and 16% in Group A and Group B respectively. In the 5-24 interval the number of patients experienced no nausea and no vomiting in Group A were 8(27%) and in Group B were 20(67%). There was a statistical significant difference between the two groups. In the 5-24hrs the incidence of nausea was 40% in Group A and 23% in Group B and the incidence of vomiting was 13% and 0% in Group A and Group B respectively. The incidence of rescue antiemetic in the 0-5hrs in Group A was 47% and Group B was 17% and in the 6-24 hrs in Group A was 47% and Group B was 17%. There was statistical difference between the groups p (<0.05).* ***Conclusion:****The postoperative nausea and vomiting can be reduced by the use of preoperative supplement of ringer lactate solution, which is a safe, cheap and cost effective therapy.*

Keywords*-Post operative nausea and vomiting****,*** *Ringer lactate, cost effective*

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I.Introduction

Years have gone by, but postoperative nausea and vomiting (PONV) remains one of the most common post-operative complaints of anaesthesia. Prevention of postoperative nausea and vomiting (PONV) is always the centre of attention in postoperative patients as it causes unnecessary discomfort to the patient, increases the cost and other consequences.[1]

Even mild PONV can delay hospital discharge (in fact it is the leading cause of unexpected admission following planned day case surgery), decrease patient's satisfaction and increase use of resources[4].While the incidence of postoperative nausea and vomiting (PONV) varies considerably in both the inpatient and outpatient setting. The studies indicate that the incidence of nausea ranges from 22% to 38% and the incidence of vomiting ranges from 12% to 26%. The incidence of PONV in high-risk patients is much higher (60–70%).Post-discharge nausea and vomiting (PDNV) defined from 24 h post-discharge up to 72 h has an incidence of up to 55%. It appears that the risk factors for PDNV are different from those for PONV.[2]

Many factors have been associated with PONV, including anesthetic techniques, anesthetic agents, narcotics, pain, types of surgical procedures, anxiety, sex, obesity, prior history of PONV &motion sickness.[5]

Hypovolemia after overnight fasting is believed to exacerbate postoperative nausea and vomiting (PONV)[7]. However, if the patient is in low perfusion state, oxygen alone may not be beneficial. Fasting for long periods and bowel preparations without adequate preoperative fluid replacement for surgical patients make them hypovolemic and more prone to postoperative nausea and vomiting. Several studies have been done on the

prevention of postoperative nausea and vomiting. However, only limited work has been done to determine the correlation between preoperative fluid therapy and the well-being of patients in the postoperative period.[11]

Because of this effect of IV fluid therapy on PONV and being as a cost effective &harmless method in surgery, its use has been recommended [8]. We hypothesized supplementing preoperative intravenous fluids decrease the incidence of postoperative nausea and vomiting.

II. Materials and Methods

After the Institutional Ethics Committee's approval and written informed consent, 60 patients of theAmerican Society of Anaesthesiologists (ASA I and II)[8],18-70 years, scheduled to undergo elective laparoscopic cholecystectomy were recruited in this randomized double-blind controlled study conducted in the department of Anaesthesiology of a tertiary care teaching hospital in northeast India.

Based on the study conducted by Onyando AA et al[8] where sample size was calculated by using Open Epi software, version 3, in which Fleiss formulae for randomized control study was applied to determine the appropriate sample size for a power of 0.8 and significance level of 0.05. The minimum sample size was 60 patients, 30 patients in each group. Final sample size (n) =30. Using computer generated randomization table patients were allocated to Group A and Group B of 30 patients each with the help of web based sample size calculation technique. Group A received 2ml/kg/hr and Group B received 12ml/kg/hr of Ringer lactate intravenous fluid.

Postoperative nausea and vomiting were measured within 5and 24 hours after the patient was fully awake from anaesthesia and according to a scale designed byresearchers to simplify the grading of nausea and vomiting, which was used in study conducted by Al-Nema ZM et al[11].

Table 1:Scale of postoperative nausea and vomiting used in the current study.

0	No nausea or vomiting
1	Nausea without vomiting
2	<3 vomiting / day
3	>3 vomiting / day

All the patients were examined day before surgery, all were kept overnight fasting after 10 p.m. and received tablet alprazolam 0.5mg, tablet ranitidine 300mg as premedication in the night before surgery. Upon arrival of the patient in preanaesthetic checkup room in operation theatre, intravenous access was secured with 18G cannula and premedication was done with injection glycopyrolate(5 microgram/Kg) intramuscularly , injection metoclopramide (0.5mg/kg) and injection ranitidine (1mg/kg) intravenously, all the baseline parameters like pulse rate , systolic blood pressure , diastolic blood pressure were recorded. Then intravenous ringer lactate fluids were given for Group A (2ml/kg/hour) and for Group B (12ml/kg/hour) 1 hour before the surgical procedure.

In the operating room, baseline parameters like pulse rate, systolic blood pressure, diastolic blood pressure, oxygen saturation (SpO2), ECG will be recorded. After 3 minutes of pre-oxygenation with 100% oxygen patient was induced with injection propofol (2mg/kg), and intubated by using injection succinylcholine (2mg/kg) intravenously. Then anaesthesia was maintained under IPPV (intermittent positive pressure ventilation) with oxygen, nitrous oxide, isoflurane (0.8%)/ after muscle relaxation with injection atracurium (0.5mg/kg) intravenously, and basalintraoperative analgesia with injection tramadol hydrochloride (2mg/kg). Then muscle relaxation was maintained with injection atracurium (0.1mg/kg) every 15 minutes. At the end of surgery, the residual neuromuscular effect was reversed with neostigmine (50microgram/kg) and glycopyrolate (10microgram/kg). At the end of surgery patient was monitored for nausea and vomiting with other baseline parameters for a period of 30 minutes. Rescue antiemetic ondansetron 4mg IV was given patients who had score 2 and 3 according to pre designed scale[11]. Then patient was assessed during first 24 hours following surgery by independent blinded observer using a pre-designed scale[11] for Postoperative nausea and vomiting.

Data obtained were checked for completeness and consistency. Data were entered and analyzed using SPSS version.21. Descriptive statistics like age, weight were presented in terms of Mean and Standard deviation and categorical or nominal data like sex, ASA class etc. were presented as percentage. Association between intervention and postoperative outcome were analyzed using chi-square test for categorical outcome, and independent sample t-test for continuous outcome.

III. Results

The demographic profiles i.e. age, weight and duration of surgery and anaesthesia were similar and no statistically significant difference (p>0.05) was observed between the two groups(Table 1).

Table 2: Distribution of patients characteristics

Parameters	Group A (mean±SD)	Group B (mean±SD)	P –value
Age (yrs)	39.70±13.54	38.15±12.39	0.40
Weight (kg)	63.33±10.91	63.70±11.31	0.58
Duration of Anaesthesia (mins)	64.20±20.89	64.93±17.44	0.30
Duration of surgery (mins)	56.33±20.56	56.92±16.65	0.31

(p<0.05 , considered significant)

There were 20(33%) males in both Group A and Group B and no. of females were 40 (67%) in Group A and Group B statistically (Fig 1), there was a significant difference in the distribution of sex in the two groups

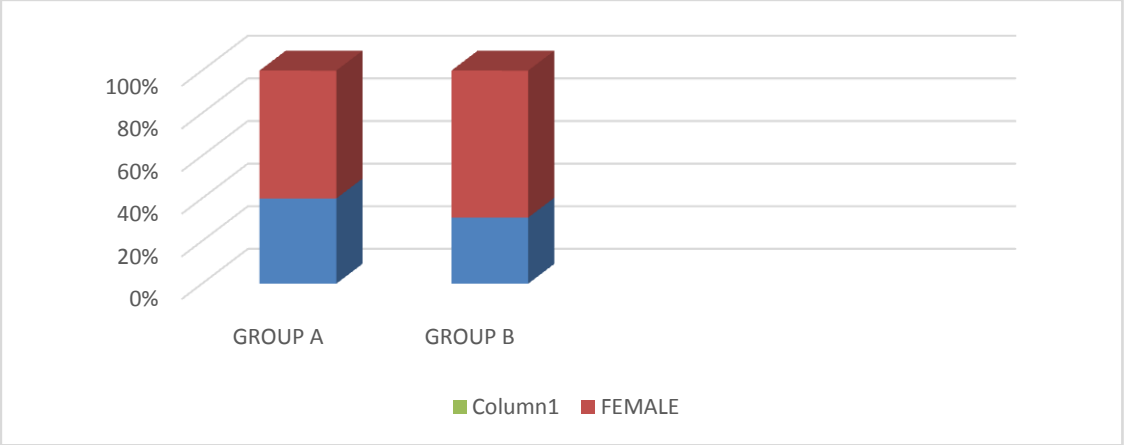

Fig 1.Sexwisedisribution of Patients

Majority of the patients in both the groups belong to ASA grade I with 20(66.7%) in Group A and 19(63.3%) in Group B (Fig 2). There was no statistical difference in the two groups in relation to their ASA class distribution (P>0.05).

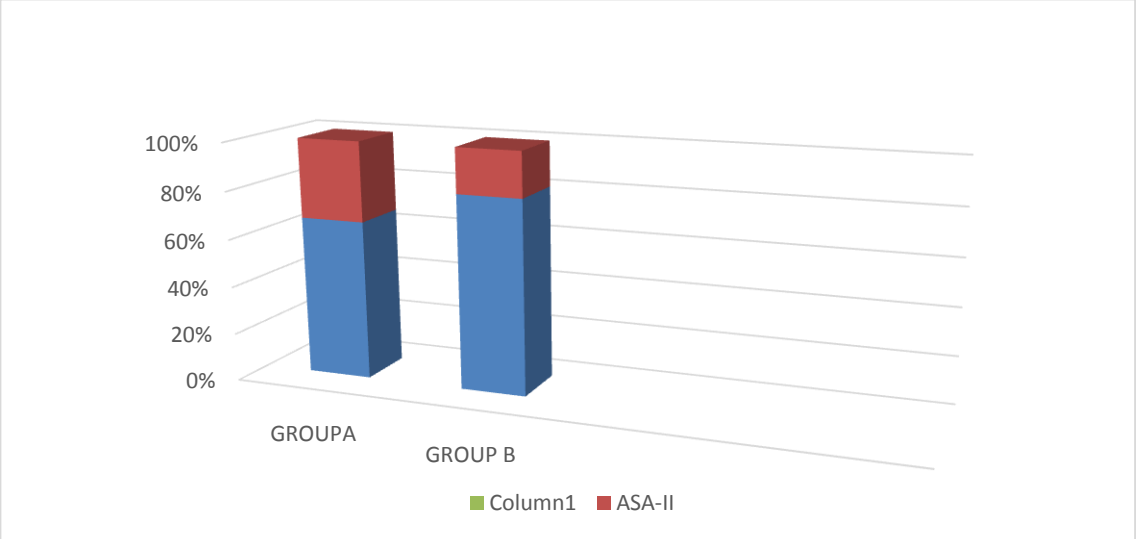

Fig 2: Distribution of patients in relation to ASA status

The average amount of pre-operative crystalloids administered to Group A was 127mls and to the Group B was 760mls. There was a significant difference in the amount of pre-operative fluids.(Table 2).

Table 3: Pre-operative fluid requirements in both groups

Fluids(ml)	**Group A (mean±SD)**	**Group B (mean±SD)**	**P-value**
Preoperative IV fluids	127.8± 22.55	760± 135.82	0.003

($p<0.05$, considered significant)

There was a significant reduction in the SBP in the Group A compared to the Group B after induction of anaesthesia. The drop in the mean SBP was 16% in Group A compared with 10.01% drop in the Group B on induction of anaesthesia (Table 2). There was no significant change in the mean DBP and HR in both groups at induction of anaesthesia. At 45 and 85 minutes intra-operatively, the SBP in the Group A was significantly less than in the Group B. Over all the mean DBP and HR tended to be higher in the Group B than in the Group B reaching statistical significance at 65 and 85 minutes intra-operatively for DBP.

Table 4: Intraoperative Blood Pressure and Heart rate variability in both groups

Intraoperative period		**Group A (Mean)**	**Group B (Mean)**	**P- value**
5minutes after intubation	SBP	109.77	118.33	0.059
	DBP	63.53	68.05	0.104
	HR	78.73	80.87	0.478
25 minutes	SBP	108.97	118.17	0.052
	DBP	65.93	68.23	0.328
	HR	75.63	80.90	0.107
45 minutes	SBP	112.67	123.40	0.001
	DBP	71.43	71.47	0.994
	HR	76.33	81.03	0.124
65 minutes	SBP	113.41	126.77	0.073
	DBP	67.39	74.03	0.011
	HR	77.72	81.77	0.163
85 minutes	SBP	114.82	127.56	0.042
	DBP	67.82	74.19	0.015
	HR	79.46	81.78	0.461
105 minutes	SBP	116.96	130.06	0.062
	DBP	68.36	76.06	0.053
	HR	80.10	83.00	0.668

($p<0.05$, considered significant)

The distributionand incidence of post operative nausea and vomiting between Group A and Group B in the 0-5hrs and 5-24hrs interval. According to NV scale which was used in the study was done by Al-Nema ZM[11].(Table 3)

Table 5 Distribution of patients with respect to the incidence of PONV during 0-5 hours and 6-24hours in Group A and Group B

DURATION (in hr)	NV SCALE	Group A(30)		Group B(30)		P value
		No. of patients	%	No. of patients	%	
0-5	No nausea or No vomiting	6	20	16	53.3	0.001
	Nausea without vomiting	10	33.3	9	30	0.7
	Vomiting less than 3	9	30	4	13.3	0.1
	Vomiting more than 3	5	16.7	1	3.3	0.08
6-24	No nausea or No vomiting	8	26.7	20	66.7	0.004
	Nausea without vomiting	12	40	7	23.3	0.1
	Vomiting less than 3	6	20	3	10	0.2
	Vomiting more than 3	4	13.3	0	0	0.03

($p<0.05$, considered significant)

The number of patients needed rescue antiemeticondansetron 4mg IV in Group A were 14(47%) and in GroupB were 5(17%) in the 0-5hrs interval (Fig 3). There was statistical difference between the groups p (<0.05).

Table 6: Distribution of patients with respect to the incidence of rescue antiemetic in 0-5hrs

Duration (hrs)	Need for an antiemetic	Group A(30)		Group B		P value
		No. of patients	%	No. of patients	%	
0-5	No rescue antiemetic therapy	16	53.33	25	83.33	0.01
	Rescue antiemetic	14	46.67	5	16.67	

(p<0.05 , considered significant)

The number of patients needed rescue antiemetic in Group A were 11(36%) and in Group B were 4(13%) in the 6-24hrs interval (Table 4).There was statistical difference between the groups p (<0.05).

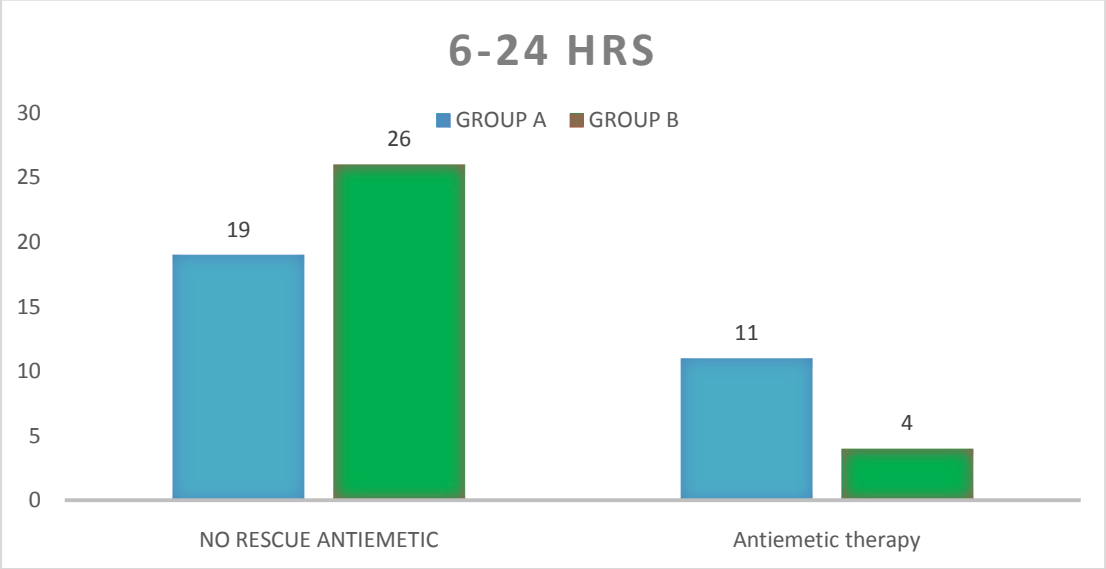

Fig 3: Distribution of patients with respect to the incidence of rescue antiemetic in both groups.

IV. Discussion

PONV continues to be a common and distressing complication of surgery. The purpose of this study was to determine the effect of preoperative volume loading with Ringer lactate solution on the incidence of PONV after laparoscopic cholecystectomy. Four important risk factors were mentioned as important predictors namely gender, non-smoking status, history of PONV or motion sickness and use of postoperative opioids[4]. It is mostly believed to be multifactorial in origin[2].

According to Tramer MR [16], post-operative nausea and vomiting (PONV) is a nuisance. The anaesthestist is usually blamed, despite PONV results from several factors, some related to anaesthesia, others to surgery, and some to the patients themselves. The importance of PONV is generally underestimated because it is self-limiting, never becomes chronic and almost never kills. However Rahman MH [12], states that PONV is unpleasant, associated with patient discomfort and dissatisfaction, and delayed discharge from the recovery room and prolonged hospital care

This prospective, randomized, double-blinded study has shown a beneficial effect of preoperative rapid infusion of 12 ml/kg/hr compared with 2ml/kg/hr of ringer lactate solution in reducing the incidence of PONV.

Both the groups are comparable with respect to their demographic profile such as age, weight, sex, duration of anaesthesia, and surgery, ASA status and presence of comorbidities (Table 2, Fig 1, Fig 2). We can therefore presume that the difference in effects between the two groups can be attributed to the fluids administered.

Our study (Table 5) shows the comparison of PONV score between group A and group B with duration of 0-5 hrs and 6-24 hrs. In 0-5 hrs the incidence of nausea/vomiting is 80% in group A out of which 33% (10 out of 30) had nausea without vomiting, 30% (9 out of 30) had vomiting less than 3 episodes and 16.7% (5 out of 30) had vomiting more than 3 episodes. The incidence of nausea/vomiting in group B is 46.7% out of which 30% (9 out of 30) had nausea without vomiting, 13.3% (4 out of 30) had vomiting less than 3 episodes and 3.3%

(1 out of 30) had vomiting more than 3 episodes. The incidence of early PONV (0-5 hrs) is significantly reduced in group B (P-0.001) which is consistent with several studies. The PONV score with duration of 6-24 hrs between group A and group B is 73.3% and 33.3% respectively out of which 40% (12 out of 30) had nausea without vomiting, 20% (6 out of 30) had vomiting less than 3 episodes and 13.3% (4 out of 30) had vomiting more than 3 episodes in group A and 23.3% (7 out of 30) had nausea without vomiting, 10% (3 out of 30) had vomiting less than 3 episodes and none (0 out of 30) had vomiting more than 3 episodes in group B. The incidence of late PONV (6-24 hrs) is significantly reduced in group B (P-0.004) which is consistent with several studies[3,7,8,10,11] that preoperative administration intravenous fluid bolus to replace the fluid deficit caused by preoperative fasting significantly decreased the incidence of PONV.

The vomiting more than 3 episodes did not occur in group B (6-24 hrs) which is statistically significant (P-0.03). This finding is inconsistent with a study conducted by Al-Nema ZM et al[11]., The significance in our study may be due to the amount of intra venous fluid (12ml/kg/hr) given compared to the study conducted by the above author (2ml/kg/hr). Another study conducted by Yogendran et al[10]., showed a significant decrease incidence of late PONV.

The usage of antiemetic (Table 6) in 0-5 hrs was 46.6% (14 out of 30) and 16.67% (5 out of 30) in group A and group B respectively. The usage of antiemetic in 0-5 hrs is significantly reduced (P-0.01).

The usage of antiemetic (Fig 3) in 6-24 hrs was 36.6% (11 out of 30) and 13.33% (4 out of 30) in group A and group B respectively. The usage of antiemetic in 6-24 hrs is significantly reduced (P-0.03). Thus it shows the usage of antiemetic has significantly reduced in Group B compared to group A. similar findings has been recorded by several studies.[3,7,8,10,11].

Studies on the effect of preoperative volume loading on the incidence of PONV have not evaluated simultaneously its effect on the variation in intraoperative blood pressure and also its effect on the later PONV. In the present study the effect of preoperative volume loading on the variation in blood pressure was evident on induction of anaesthesia in which there was a higher drop (16%) in the mean systolic BP in the control group than in the experimental group (10%)(Table 4). Throughout surgery, there was a significant difference in the mean systolic BP between the two groups, being higher and more stable in the experimental group than in the control group. Pusch et al., showed that a large fall in systolic blood pressure during induction of general

Anaesthesia is associated with increased incidence of PONV [13]. Heidari et al ., showed that variation in the intraoperative blood pressure and heart rate is strongly associated with increasing levels of postoperative nausea.[14]

The exact mechanism of how preoperative volume loading decreases PONV remains unclear, still studies hypotheses that preoperative hypo-perfusion of the gut mucosa and consequent ischemia might be one of the causes of post-operative nausea and vomiting.Gut ischemia is common during anaesthesia and surgery, and results in release of serotonin, which is one of the most potent triggers of nausea and vomiting.[3]

Mythen and Webb showed that perioperative plasma volume expansion reduced the incidence of abnormal intramucosal pH in patients having elective cardiac surgery, and was associated with improved outcome.It was also found that administration of additional oxygen decreases the incidence of post-operative nausea and vomiting [15].The efficacy of routine use of prophylactic antiemetic remains controversial.Metoclopramide was given in all the patients at induction of anaesthesia as is routinely done by the anaesthetists, this may have influence results of the study, it is therefore suggested that similar future studies omit the routine administration of antiemetic at induction of anaesthesia. Children and adults with low muscle mass and heart disease are at increased risk of adverse effects.

Preoperative hydration to cover fluid deficit is simple, cost effective, devoid of side effects and a non-time consuming means of preventing the occurrence of postoperative nausea and vomiting thus enabling patients a more comfortable and faster postoperative recovery period with a shorter hospital stay.

V. Conclusion

Preoperative volume loading and hydration effectively reduces the incidence of PONV and consequently antiemetic requirement in high risk patients. Preoperative preloading of fluid is associated with less hypotension at induction of anaesthesia and a more stable systolic blood pressure during surgery.The postoperative nausea and vomiting can be reduced by the use of preoperative supplement of ringer lactate solution, which is a safe, cheap and cost effective therapy. The preoperative fluid administration will be possible to avoid the side effects that the use of antiemetic brings about in the processes of treatment.Prevention rather than the treatment should be the aim.

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