Original Paper

EFFECT OF PREOPERATIVE BOLUS SUPPLEMENTAL FLUID ON POSTOPERATIVE NAUSEA AND VOMITING-A PROSPECTIVE STUDY

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Abstract

Introduction: Current management of post operative nausea and vomiting (PONV) based on treatment rather than prevention. Effective well-tolerated anti-emetic would allow prevention of PONV and related consequences.

Objective: Study was aimed to determine the relationship between preoperative supplemental fluid bolus and incidence of PONV.

Methods: Ninety patients of different sex, age and weight, American society of Anesthesiologist (ASA) physical status I and II, scheduled for elective laparoscopic surgery under general anaesthesia; were enrolled in this prospective randomized study. Patients assigned into 3 groups. Group A received Hartmann's solution bolus (15ml/kg), group B-Hartmann's solution (1.5 ml/kg/hr) and group C-Hartmann's solution (1.5 +ml/kg/hr) for fasting period. But only in group C, additionally Inj Metoclopramide (0.15mg/kg) was administered intravenously before induction of anaesthesia. Identical anaesthetic technique followed in all groups. Incidences of PONV were recorded in first 24 hrs postoperative period.

Result: Vomiting was significantly lower in group A compare to B and C [04(13.3%) vs. 18(60%) and 10(33.3%), $p<0.01$]; nausea also lower, in group A compare to B and C [06(20%) vs. 14(46.7%) and 08(26.7%), $p>0.05$]; retching was significantly lower in group A compare with B & C [0(0%) vs. 06(20%) and 0(0%); $p<0.01$]. Nausea and vomiting was more in first 6 hrs of postoperative period. In 24 hrs postoperative period there was no difference in analgesic requirement (in mg), A vs. B & C (90.00±41.32 vs. 90.00±41.32 & 92.50±37.00; $p>0.05$). Also no difference is found in postoperative antiemetic requirement, A vs. B and C [02(6.7%) vs. 02(6.7%) & 02(6.7%); $p>0.05$].

Conclusion: Our study suggests well hydration reduce incidence of PONV. High bolus dose intravenous fluid therapy is simple, effective and well tolerated technique for prevention of PONV.

Key-words: Bolus supplemental fluid, Nausea, Vomiting

Introduction

Post operative nausea and vomiting are distressing and common occurrence after surgical procedure requiring general anaesthesia. Although Post Operative Nausea and Vomiting (PONV) rarely result in serious harm to the patient, but viewed as extremely unpleasant. The overall incidence of PONV for all surgeries has been estimated to be 25% to 30% and upto 70% in high risk group[1]. Laparoscopic surgery is in particular link with high incidence of PONV[2]. Several recent studies have identified dehydration and relative hypovolemia as a factor contributing to the incidence of PONV [1, 3, 4, 5, 6].

Efficacy of pharmacological agent to prevent PONV has been extensively studied.

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However all studies consistently found that medication including serotonin antagonist are not universally effective in prevention of PONV [7, 8].

Published literature has reported an inconclusive evidence of decreased incidence of PONV with preoperative fluid bolus[3,5,6]. Kathy and his colleague has showed preoperative fluid bolus in laparoscopic surgery has a significant role in reduction of PONV[9]. Thus this study was designed to evaluate the effect of preoperative supplemental fluid bolus on PONV.

Materials and methods

After approval by Institutional Ethical Committee, ninety patients of ASA physical status I and II, between 22-55 years and weight 39-85 kg were studied in Combined Military Hospital, Dhaka. All underwent elective laparoscopic surgery under general anaesthesia. Twenty four hours prior to surgery pre-anaesthetic check-up were done. The procedure of work explained to the patient and written informed consent was obtained from each patient. They were randomly divided into three groups. The randomization done by blind envelops method. Group-A (preoperative supplemental fluid bolus group), group-B (control group), group-C (prophylactic antiemetic group).Patient with history of significant PONV & motion sickness. Pregnant women, lactating mother, operation exceeding 2 hours, fasting more than 12 hours were excluded to avoid excessive dehydration.

Group-A received Hartmann's solution bolus of 15ml/kg, group-B received Hartmann's solution 1.5 ml/kg/hr for the period of fasting and group-C received Hartmann's solution 1.5 ml/kg/hr for the period of fasting and inj Metoclopramide 0.15mg/kg intravenously before induction of anaesthesia. During operation anaesthetic technique and fluid management were identical in all groups. Fluid administered in preoperative holding area. The anaesthesia provider, postoperative study investigator and PACU (Post Anaesthesia Care Unit) nurses were blinded to the allocation to groups, as were the patients.

On arrival at operation theatre, baseline parameter like heart rate, NIBP (Non Invasive Blood Pressure), S_PO_2 were recorded. Same anaesthetic sequence of thiopental sodium (3-5mg/kg), Fentanyl (1-2 microgram/kg) & vecuronium (0.1 mg/kg) were given for induction of anaesthesia followed by intubation. Anaesthesia was maintained with Halothane 1% in 70% N_2O & O_2. Mechanical ventilation was controlled to maintain end tidal CO_2 between 35-40 mm Hg. Monitoring included SpO_2, capnography, heart rate, noninvasive blood pressure, ECG. Neuromuscular blockade was antagonized with neostigmine 50 microgram/kg plus atropine 20 microgram/kg.

Postoperative fluid given as Hartmann's solution 1.5 ml/kg/hr. Vomiting/nausea/retching were scored as yes/no. Rescue antiemetic administered on demand as inj Metoclopromide 10 mg intravenously(IV). Injection Tramadol 75 mg was given intramuscularly (IM), when patient complained of pain. Single assessor performed data collection. For this purpose, pre-structured questionnaires followed. The number and time of vomiting/nausea/ retching were recorded. Also number and time of rescue antiemetic treatment were recorded.

Data for categorical variables presented as proportions and percentages data for continuous variables presented as mean. Statistical analysis of all data compiled and analyzed for significance by analysis of variance (ANOVA) test and chi squared (X^2) test. $P < 0.05$(CI 95%) considered as significant.

Results

After exclusion, data from 90 patients were analyzed. Demographic data and duration of anaesthesia were summarized in Table-I. No significant differences were observed among groups.

Incidence of vomiting was significantly lower in group-A, compare to group-B and C [04 (13.3%) vs 18 (60%) and 10 (33.3%),

Table-I: Demographic data and duration of surgery.

Parameter	Group-A (n=30)	Group-B (n=30)	Group-C (n=30)	P value	Significance level
Age in years	35.67±11.18	30.87±6.66	36.20±12.30	> 0.05	NS
Body weight in kg	57.60 ± 8.66	57.00±7.56	60.67±8.72	> 0.05	NS
Duration of surgery in min	50.67±11.80	45.33±10.42	52.33±13.37	> 0.05	NS

Values are expressed as mean ±SD. One way ANOVA test were done to see the statistical significance.

NS: not significant p> 0.05(between groups) for age, body weight & duration of surgery.

p<0.01]; incidence of nausea also lower, though not significant in group A compare to group B and C [06 (20%) vs 14 (46.7%) and 08 (26.7%), p>0.05]; incidence of retching is significantly lower in group A, compared with group B and C[0 (0%) vs 06 (20%) and 0 (0%); p<0.01] . Also there were no significant difference in postoperative antiemetic use, among group A vs B and C [02 (6.7%) vs 02 (6.7%) and 02 (6.7%); p>0.05]. (Table-II)

Table–II: Postoperative nausea, vomiting and antiemetic use.

Parameter		Group-A (n=30)	Group-B (n=30)	Group-C (n=30)	P value	Significance level
Retching	yes	0(0%)	06(20%)	0(0%)	< 0.01	Sig
	no	30(100%)	24(80%)	30(100%)		
Nausea	yes	06(20%)	14(46.7%)	08(26.7%)	> 0.05	NS
	no	24(80%)	16(53.3%)	22(73.3%)		
Vomiting	yes	04(13.3%)	18(60%)	10(33.3%)	< 0.01	Sig
	no	26(86.7%)	12(40%)	20(66.7%)		
Antiemetic used	yes	02(6.7%)	02(6.7%)	02(6.7%)	> 0.05	NS
	no	28(93.3%)	28(93.3%)	28(93.3%)		

Values are expressed as number (percentage).χ2 (Chi –Squared) test were done to see the statistical significance

Sig: significant p<0.05(between groups) for vomiting and retching

NS: not significant p> 0.05(between groups) for nausea and antiemetic used

In 24hrs postoperative period, incidence of nausea & vomiting was more in 1st 6 hours (Table-III).

Table-III: Incidence of postoperative retching, nausea & vomiting in different groups.

Time in hour (h)	Parameter	Group-A (n=30)	Group-B (n=30)	Group-C (n=30)	P value	Significance level
0-1 h postoperatively	Retching	00	06(20%)	00	>0.05	NS
	Nausea	06(20%)	10(33.33%)	08(26.66%)	<0.01	Sig
	Vomiting	02(6.6%)	10(33.33%)	06(20%)	<0.05	Sig
1-6 h postoperatively	Retching	00	00	00	-	-
	Nausea	05(16.66%)	20(66.66%)	14(46.66%)	<0.01	Sig
	Vomiting	03(10%)	13(43.33%)	08(26.66%)	<0.05	Sig
6-24 h postoperatively	Retching	00	00	00	-	-
	Nausea	00	04(13.33%)	02(6.66%)	>0.05	Sig
	Vomiting	00	03(10%)	02(6.66%)	>0.05	Sig

Values are expressed as number (percentage). χ2 (Chi –Squared) test were done to see the statistical significance

NS: not significant p> 0.05 between groups

Sig: significant p<0.05 between groups

Table-IV shows no significant difference among groups in postoperative analgesic (mg) requirement, A vs. B and C (90.00±41.32 vs. 90.00±41.32 and 92.50±37.00; p>0.05). No significant difference among groups in perioperative heart rate and mean arterial blood pressure (Table-V & VI). Also no significant difference in perioperative heart rate and mean arterial blood pressure among groups (Table-V & VI).

Table-IV: Intravenous fluids and post-op analgesic in different groups.

Parameter	Group-A (n=30)	Group-B (n=30)	Group-C (n=30)	P value	Significance level
Pre-op fluid (in ml)	1236.67±95.53	772.00±104.60	776.67±58.33	<0.001	Sig
Per-op fluid (in ml)	300.00±71.92	290.00±46.24	280.00±40.68	> 0.05	NS
Post-op Analgesic (in mg)	90.00±41.32	90.00 ±41.32	92.50±37.80	> 0.05	NS

Values are expressed as mean±SD, ANOVA test were done among the group A, B & C of preoperative, peroperative & postoperative values to see statistical significance

NS: not significant p> 0.05(between groups) for changes of mean arterial pressure

Sig: significant p<0.05(between groups) for preoperative & peroperative fluid

Pre-op: preoperative; Per-op: peroperative; Post-op: postoperative

Table-V: Changes of heart rate.

Parameter	Group-A (n=30)	Group-B (n=30)	Group-C (n=30)	P value	Significance level
Preoperative	83.70±7.11	85.30±8.90	81.90±7.82	> 0.05	NS
Per-operative	97.11±9.78	95.55±7.86	94.75±8.43	> 0.05	NS
Post-operative	85.10±8.35	87.50±6.90	83.80±7.62	> 0.05	NS

Values are expressed as mean±SD. One way ANOVA test were done to see the statistical significance.

NS: not significant p> 0.05(between groups) for changes of heart rate

Table-VI: Changes in mean arterial pressure.

Mean arterial pressure (mm Hg)	Group-A (n=30)	Group-B (n=30)	Group-C (n=30)	P value	Significance level
Preoperative	80±10.62	83±11.76	84±12.96	> 0.05	NS
Peroperative	85±10.19	90±10.64	89.92±8.81	> 0.05	NS
Postoperative	84±7.86	89±14.01	86±10.09	> 0.05	NS

Values are expressed as mean±SD, ANOVA test were done among the group A, B & C of preoperative, preoperative & postoperative values to see statistical significance.

NS: not significant p> 0.05(between groups) for changes of mean arterial pressure

Discussion

This prospective randomized clinical investigation has shown a beneficial effect of preoperative fluid bolus on PONV. This study found that preoperative supplementary fluid bolus therapy decrease the incidence of postoperative nausea and vomiting compared with control and prophylactic antiemetic group.

Mechanism by which supplemental fluid therapy reduces PONV remains unknown. Study suggests that dehydration may be precipitating factor in occurrence of PONV[3,5,6]. Perioperative hypoperfusion of gut mucosa and consequent ischemia might be one cause of PONV. Gut ischemia is common during anaesthesia and surgery, which result in release of serotonin; which is most potent trigger of nausea and vomiting. Mythen and Webb showed that perioperative plasma volume expansion reduced incidence of abnormal intramucosal pH in patients having elective cardiac surgery, and associated with improved outcome [4].

It also noted that patients who maintained normal intramucosal pH had a lower incidence of PONV. Consistent with these data administration of additional oxygen has decreased the incidence of PONV[7,10]. However, even supplemental oxygen fails to increase the tissue oxygenation during hypovolaemia. Thus correction of hypovolaemia is important in prevention of PONV. Most patients are hypovolaemic before induction of anaesthesia secondary to over night fasting. Supplemental fluid load before induction of anaesthesia likely decrease volume deficit, thereby promoting euvolaemia. A positive effect on splanchnic perfusion might inhibit the impending intestinal ischemia. Published literatures with effect of intraoperative fluid bolus on PONV has shown that well hydration reduce incidence of nausea & vomiting[11,12]. In all these studies, supplemental fluid was administered perioperatively.

The published material on the influence of perioperative fluids on the PONV is inconclusive. Studies using preoperative fluid bolus are discussed below:

In 1995 Yogendran and his colleagues investigated the impact of perioperative fluid status on adverse clinical outcomes in ambulatory surgery. The incidence of nausea, vomiting, thirst, drowsiness, and dizziness were significantly lower in high-infusion group. They recommended perioperative hydration of 20 ml/kg for patients undergoing general anesthesia for short ambulatory surgery[5]. In 2003 Ali and his colleagues in a prospective, double-blind, randomised controlled trial, studied effects of pre-operative fluid load on post-operative nausea and vomiting. They found no significant difference between the haemodynamic variables during intra- and post-operative period. But they observed postoperative antiemetic requirement were less in patients those received supplemental fluid preoperatively. They suggested supplemental pre-operative fluid for reducing post-operative nausea and vomiting[6]. In Jun 2004 Heshmati and his colleagues studied effect of intraoperative high intravenous fluid therapy on PONV.

They also concluded that well hydration reduces the incidence of nausea and vomiting and high IV fluid therapy is a simple, effective, safe and well-tolerated technique for prevention of postoperative nausea and vomiting[11]. In 2005 Susan and colleagues, studied effect of preoperative fluid bolus of 1 liter on PONV. Similarly they also suggested that administering a liter of saline fluid bolus decreases the incidence of nausea and vomiting [3].

In 2009 Kathy with his colleagues and Ahamed with his colleagues also studied effect of preoperative supplemental fluid bolus on PONV in patients undergoing laparoscopic procedure[9,13]. They studied in different institution but both study showed significant reduction on incidence of PONV.

Our finding is consistent with these studies. Difference exists between our study and those of previous investigator who had comparable study group is of propofol infusion, heterogeneous surgical approach,

different fluid volume of fluid administration, opiod administration, variation in blinding method. Our study had some limitations too, our patients were only ASA I and II. Large volume of fluid load may have detrimental effect on some patients, therefore not applicable in all patients especially with impaired cardiovascular function, which needs further study. Also tissue oxygenation, mucosal perfusion and emetogenic mediator release were not measured, thus the mechanism remains speculative and warrant for further research on this issue.

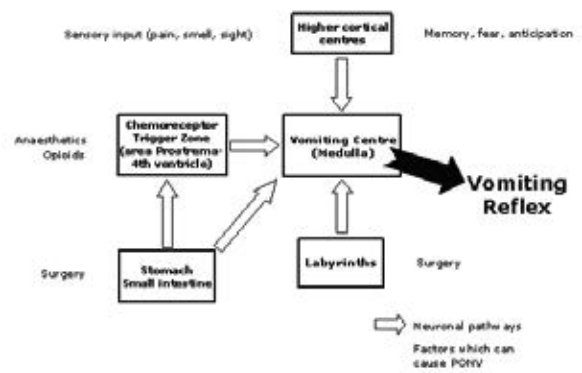

Fig-1: Schematic representation of the factors involved in causing PONV

Postoperative nausea & vomiting is multifactorial (Fig-I). Many studies have investigated the relative importance of patients, surgical and anesthetic factors in the incidence of PONV[14]. Aanesthesiologists have little if any to control over those surgical factors. However they do have control over many other factors that influence PONV. Crystalloid fluid administration may be a simple, inexpensive, non-pharmacological therapy that could reduce the incidence of PONV, thus avoiding drug related side effects.

Conclusion

It is clear that problem of PONV is significant in terms of medical care, financial issue, and patient's satisfaction. So dealing with the problem in cost effective and evidence-based approach would be ideal. Prevention rather than treatment of PONV should be the aim. But the side-effects profile of the available antiemetic is such that routine use in prevention of PONV is unjustified. As emesis is not caused by a single mechanism at a specific site, remedies with various combinations of anti-emetic and different mechanisms of action may be promising. Preemptive measures that may prevent postoperative emesis include hydrating patient, minimizing narcotic and inhalational agent, not using nitrous oxide. Anaesthetist may consider regional anaesthesia, anaesthesia with propofol, intraoperative gastric suctioning. The usefulness of multimodal therapy, particularly in high risk cases, has been emphasized recently. We have shown that use of fluid bolus as a preventive therapy is effective and may form an important part of multimodal prevention, while being cost-effective.

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