Effect of Intra-Operative Intravenous Crystalloid Infusion on Post-Operative Nausea and Vomiting after Diagnostic Gynaecological Laparoscopy- Comparison of 30 mL/Kg & 15 mL/Kg

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ABSTRACT

BACKGROUND
Laparoscopic procedures have the advantages of minimal incision, early recovery, lesser post-operative pain and early ambulation. However, they are associated with an increased incidence of post-operative nausea and vomiting (PONV), which is all the more frequent in gynaecological laparoscopic surgeries. In our study, we have evaluated the effectiveness of intra-operative intravenous crystalloid infusion on post-operative nausea and vomiting after diagnostic gynaecological laparoscopy.

METHODS
Informed consent was obtained and patients were randomly divided into two groups. Group 1 received 30 mL/Kg intravenous crystalloid infusion intra operatively and group 2 received 15 mL/Kg intravenous crystalloid infusion. Incidence of nausea, incidence of emesis (retching or vomiting), the amount of rescue antiemetic used, and the haemodynamic parameters were noted in the postoperative period for 12 hours for both the groups.

RESULTS
Incidence of PONV was much more in group 2 in 0, 1, 2, 3, 4, 6 hours post operatively and rescue antiemetic use was much more in group 2 in total 12 hours post-operative period. There was no statistically significant difference in hemodynamic parameters between Group 1 and Group 2.

CONCLUSIONS
Intra-operative administration of 30 mL/Kg of crystalloid infusion significantly reduces the incidence of PONV and rescue antiemetic use compared to 15 mL/Kg crystalloid infusion in diagnostic gynaecological laparoscopy. So, it can be used as a non-pharmacological method for prophylaxis of PONV.

KEY WORDS
Diagnostic Gynaecological Laparoscopy, Post-Operative Nausea and Vomiting, Intravenous Crystalloids, Antiemetics

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BACKGROUND

The Post-Operative Nausea Vomiting (PONV) is a broad entity which includes nausea, retching and vomiting and is one of the most common complaints reported in the postoperative period second only to postoperative pain[1,]. The incidence of PONV in patients undergoing gynaecological laparoscopy procedures is estimated to be in the range of 40-75%.[2,3,4] PONV can be a remarkably unpleasant experience and its prevention in high risk patients significantly improves postoperative ratings of wellbeing and satisfaction[4,5]. Most of the diagnostic gynaecological laparoscopic surgeries are done as day care surgeries, but an increased incidence of PONV may not only delay the discharge but can also lead to unexpected hospital admissions.[6] The causes of PONV are varied and multifactorial and can be patient related, surgery related or anaesthesia related.[7,8] Following laparoscopic surgeries, one of the reasons of PONV can be attributed to the gut ischemia, secondary to hypovolemia due to overnight fasting, pneumoperitoneum and tissue handling[4]. Current approaches for prevention and treatment of PONV include pharmacological methods which are not hundred percent effective and are associated with increased side effects.[9] Among Non-pharmacological methods, besides trans-cutaneous acupoint electrical stimulation (TAES), acupuncture and acupressure, peri-operative liberal intravenous fluid administration has been shown to reduce PONV.[9,10,11]

This study is designed to evaluate the effect of intra-operative intravenous crystalloid infusion at two different doses (30 mL/Kg and 15 mL/Kg) on the incidence of PONV, on patients undergoing diagnostic gynaecological laparoscopic surgery.

METHODS

This randomized, double blind, comparative study was conducted after institute ethical committee approval and a written informed consent from the patients. One hundred and sixty female patients were enrolled from ASA physical status 1 & 2, age between 18-60 years undergoing diagnostic laparoscopic gynaecological surgery under general anaesthesia. Patients with a history of hypertension, diabetes, motion sickness and those who received anti-emetic medication within 24 hours prior to surgery were excluded from the study. Patients with a haemoglobin level less than 10 gm% were also excluded from the study. Patients who experienced significant hypotension and excessive blood loss intra-operatively, or in whom surgery was extended for more than one hour, were dropped from the study and were not subjected to final statistical analysis. Previous studies have shown 17% lesser incidence of PONV in patients receiving liberal intravenous fluids. Taking a confidence level of 95% and with an intention of absolute precision to be within 10%, we needed to recruit 80 patients in each group.

Using sealed envelopes, the patients were randomly allocated into two groups, 1 and 2 by anaesthesia assistant-

- Group 1 (n =80) received 30 mL/Kg intra - operative intravenous crystalloid infusion
- Group 2 (n=80) received 15 mL/Kg intra operative intravenous crystalloid infusion.

During pre-anaesthetic check-up patients were explained about study protocol and an informed consent was taken. They did not receive any premedication and were kept fasting for 6 hours for solids and 2 hours for clear fluids. Anaesthesia was induced with injection fentanyl 2 µg/Kg and injection propofol 2 mg/Kg. Tracheal intubation was facilitated with injection atracurium 0.6 mg/Kg. Anaesthesia was maintained with sevoflurane and mixture of 60% nitrous oxide in oxygen. Intermittent boluses of atracurium were given to maintain adequate depth. Controlled ventilation was done with tidal volume of 8 mL/Kg and respiratory rate was adjusted to maintain $EtCO_2$ between 35 to 40 mm of Hg. Intra-abdominal pressure was maintained between 10-12 mm Hg. Group 1 received 30 mL/Kg crystalloid fluid intra operatively and Group 2 received 15 mL/Kg crystalloid fluid intraoperatively. For postoperative analgesia injection paracetamol (1 gm) was given as intravenous (iv) infusion fifteen minutes before completion of surgery and surgical ports were infiltrated with 0.25% bupivacaine at the completion of surgery. Reversal at the end of operation was done by injection neostigmine (0.05 mg/Kg) and injection glycopyrrolate. Duration of anaesthesia, duration of surgery and duration of pneumoperitoneum was noted. After extubation oxygenation was maintained by facemask with 6 l/min oxygen for 10 minutes. Patients were sent to post anaesthetic care unit where they received oxygen at a rate of 2 -3 l/min through nasal prongs for 2 hours. All patients were monitored 12 hours post operatively by anaesthesia residents blinded to the study group. Heart rate, NIBP, SpO2 and respiratory rate were recorded hourly for 4 hours and then 2 hourly up to 12 hours.

Definition of Outcome[3,7,11]

The primary outcomes of the study were incidence of nausea, incidence of emesis (retching or vomiting) and the amount of rescue antiemetic used

Grading of PONV [3,7,11]

0 = no nausea.
1= nausea only.
2 = retching/ 1 episode of vomiting.
3 = >1 episode of vomiting.

Grades of nausea and rescue antiemetic regimen were documented for all patients till 12 hours after anaesthesia. As the discomfort experienced due to nausea is subjective, rescue antiemetic was given only on occurrence of symptoms and not to demand. Rescue antiemetic in the form of Injection ondansetron 4 mg I.V. was given for grades 2 and for patients who progressed to grade 3, Injection metoclopramide 10 mg I.V. was added. Oral fluids were allowed after 4 hours.

Statistical Analysis

The data was analyzed using statistical software SPSS version 20 for windows. An initial descriptive statistics was carried out by frequency along with their percentages for categorical variables and Mean along with Standard deviation was given

for continuous variables. The data was checked for Normality by using Kolmogorov-Smirnov test. The comparison of mean was done by independent t test. Chi- square test was used to test the association between the groups. A p value <0.05 was considered statistically significant.

RESULTS

Variable	Group	Mean	Standard Deviation	p Value
Age (years)	Group 1	26.9	4.25	0.140
	Group 2	26.96	4.78	
Body weight (Kg)*	Group 1	54.84	4.939	0.063
	Group 2	56.26	4.684	
Duration of Anaesthesia (minutes)	Group 1	60.13	4.78	0.299
	Group 2	61.01	5.78	
Duration of Surgery (minutes)	Group 1	47.9	4.15	0.135
	Group 2	49.03	5.35	
Duration of pneumoperitoneum	Group 1	37.5	3.83	0.175
	Group 2	38.46	4.92	

Table 1. Comparison of Baseline Parameters of the Two Groups

The comparison has been done by independent t-test. P Value <0.05 is considered statistically significant.

Variable	Group	Frequency of PONV			p Value
		No nausea (Grade 0)	Nausea (Grade 1)	Vomiting (Grade 2 & 3)	
PONV 0 hr.	1*	93%	6%	1%	0.020
	2**	86%	14%	6%	
PONV 1 hr.	1	94%	5%	1%	0.015
	2	82%	11%	7%	
PONV 2 hr.	1	91%	8%	1%	0.031
	2	81%	11%	8%	
PONV 3 hr.	1	96%	3%	1%	0.043
	2	90%	6%	4%	
PONV 4 hr.	1	95%	5%	0	0.004
	2	80%	15%	5%	
PONV 6 hr.	1	97%	3%	0	0.028
	2	89%	9%	2%	
PONV 8 hr.	1	98%	2%	0	0.174
	2	95%	5%	0	
PONV 10 hr.	1	100%	0	0	0.516
	2	97%	3%	0	
PONV 12 hr.	1	100%	0	0	1.000
	2	100%	0	0	

Table 2. Comparison of PONV between Two Groups at Different Time Periods. (Chi-Square Test). p Value <0.05 is Considered Statistically Significant

*-Group 1- received 30 mL/Kg intra - operative intravenous crystalloid infusion
**-Group 2-received 15 mL/Kg intra operative intravenous crystalloid infusion.

Variable	Heart Rate			MAP			RR			SpO_2		
Time	Mean Rank		p value	Mean Rank		p value	Mean Rank		p value	Mean Rank		p Value
	Group 1	Group 2		Group 1	Group 2		Group 1	Group 2		Group 1	Group 2	
0 hour	82.96	78.04	0.501	86.26	74.74	0.113	77.68	83.14	0.466	80.23	80.77	0.932
1 hour	82.63	78.38	0.561	85.59	75.41	0.159	79.99	81.01	0.880	80.23	80.78	0.932
2 hour	82.63	78.38	0.588	85.58	75.43	0.160	80.61	80.39	0.976	80.78	81.17	0.826
3 hour	84.61	76.39	0.261	84.43	76.57	0.209	81.44	79.56	0.794	79.83	82.20	0.597
4 hour	87.58	73.42	0.052	85.23	75.77	0.278	81.50	79.50	0.779	78.80	80.33	0.954
6 hour	88.08	72.92	0.038*	83.97	75.63	0.191	82.24	78.76	0.627	80.68	79.68	0.786
8 hour	87.99	73.01	0.039*	85.38	75.63	0.335	80.16	80.84	0.925	81.33	79.24	0.669
10 hour	88.37	72.63	0.031*	85.50	75.50	0.175	79.73	81.27	0.829	81.49	79.51	0.732
12 hour	88.34	72.66	0.031*	85.06	75.94	0.169	78.31	82.69	0,531	77.04	83.96	0.213

Table 3. Comparison of the Haemodynamic Parameters of the Two Groups

*p < 0.05, hence significant difference of HR at 6, 8, 10 and 12 hours post-operatively. HR- Heart Rate, MAP- Mean arterial pressure, RR- Respiratory rate, SpO_2- Oxygen saturation.

Both the groups were comparable regarding patients' age, weight, duration of anaesthesia, surgery and pneumoperitoneum (table 1). Immediate post-operative period that is 0-hour, 1-hour, 2-hours, 3-hours, 4-hours and 6-hours, with the p values as 0.020, 0.015, 0.031, 0.043, 0.004, 0.028 respectively. However, at 8, 10 and 12 hours post-operatively the difference of PONV values between the two groups was statistically non-significant (table 2). On comparison of rescue antiemetic received by the two groups, chi-square test was used, as the data were categorical (figure-1). On analysis it was seen that rescue antiemetic was required only four times in Group 1 and twenty-six times in Group 2 during the 12 hours postoperative period and this difference was statistically significant (p value -0.00002) (figure-1).

Mean arterial pressure (MAP), heart rate (HR), respiratory rate (RR) and oxygen saturation were recorded in the immediate postoperative period and hourly for 4 hours and after that every 2 hourly until 12 hours (table 3). No significant difference was observed in MAP, RR and SpO2 measurements at different time periods between the two groups (p value > 0.05). However, a significantly higher HR was observed in group 1 in the immediate post-operative period i.e. at 0-hour, 1 hour, 2 hours, 3 hours and 4 hours.

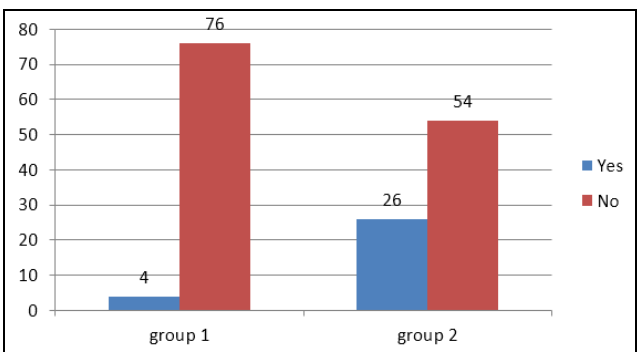

Figure 1. Comparison of the Frequency of Rescue Antiemetic Used between the Two Groups

DISCUSSION

Various pathologic gynaecologic conditions are diagnosed and treated using laparoscopy which is very frequently performed as day care surgery. Of the two major concerns of pain and PONV in the postoperative period, PONV is the leading cause of delayed discharge and unexpected admission following an ambulatory surgery.[2,5] Carbon di oxide insufflations, bowel manipulation, intra operative use of inhalation agents, opioids, glycopyrrolate, female sex and gynaecological surgery are the risk factors which contribute to an increased incidence of PONV in these patients.[6] It is obvious that PONV has the potential to eliminate the advantage of laparoscopic procedure if not dealt effectively.[2] So prevention of PONV gets a high priority in these patients similar to that of alleviating post-operative pain.

It is well documented that the incidence of PONV is influenced by age, body mass index, full stomach and delayed gastric emptying.[12,13] In the present study the patients of both the groups were demographically comparable, all the patients had fasted overnight and patients with a history of emesis before surgery and motion sickness were excluded to eliminate the confounding effect of these factors. The aetiology of PONV following laparoscopic surgery may be influenced by duration of surgery, duration of anaesthesia, duration of CO_2 insufflation and anaesthetic technique.[3,7,13,14] The anaesthetic

technique and the drugs used in the two groups were kept same. Similarly, the duration of anaesthesia, surgery and CO_2 insufflation were comparable in both the groups. Hypotension due to induction of anaesthesia is a causative factor of PONV, which suggests that tissue hypo-perfusion may be an etiological factor for PONV. This can be minimized by oxygen supplementation[15] and preventing hypotension. Dehydration and hypotension decreases intestinal perfusion and can cause GI intolerance, leading to PONV.[16,17] Gastric mucosal hypo-perfusion due to overnight fasting, is an important factor for PONV.[16] It may be due to release of serotonin, because of the decreased intestinal perfusion.[18] PONV can be reduced by transfusing liberal peri-operative intravenous fluid.[19]

In the present study the oxygen saturation and mean arterial blood pressure were comparable in both the groups during the study period. Patients were given an oxygen supplementation in the post-operative period and there were no episodes of peri-operative fall in MAP or oxygen saturation. Mucosal perfusion can be compromised during laparoscopic surgery by general anaesthesia, raised intra-abdominal pressure and by surgical stimulation without changes in measured haemodynamic parameters. Gynaecological laparoscopic surgeries are frequently performed in head down position, increasing regional hypo-perfusion.[16,17,18] Liberal I.V. fluid administration during laparoscopic surgery decreases gut mucosal hypo-perfusion and thus, the incidence of PONV.[19,20]

Dabu-Bandoc et al[21] and Yavuz et al[17] have investigated the effect of I.V. fluid administration on PONV in patients undergoing laparoscopic surgeries and their results are in favor to our findings. In a quantitative review, Apfel et al[9] observed that dehydration due to bowel preparation and pre-operative fasting significantly reduces organ perfusion, specifically intestinal perfusion, increasing incidences of PONV. Liberal peri-operative IV fluids decrease the incidence, as well as the requirement of antiemetic rescue management for PONV. Dagher et al[22] evaluated the effect of intravenous crystalloid infusion on post-operative nausea and vomiting after thyroidectomy. The authors concluded that liberal intravenous fluid administration did not reduce the incidence of nausea, vomiting and antiemetic use when compared with restricted fluid in such patients, which is in contrast to the results of the present study. This conflict further strengthens the point that pneumoperitoneum created during laparoscopic procedures probably induces intestinal ischemia and stimulates the mechanoreceptors in the gut and this increases the risk of vomiting.

The incidence rate of PONV showed a significant difference only in the initial six hours of the procedures i.e. the early post-operative period. This is probably due to the short half-life of the crystalloids. This corroborates the findings of Menjie et al.[23] who showed that the incidence of PONV is significantly decreased in the early and middle phase of the post-operative period with liberal fluid administration but not in the late phase of the post-operative period.

Limitations

This study was carried out in patients undergoing only gynaecological laparoscopy and does not reflect the outcome of other laparoscopic procedures. Liberal fluid administration may not be possible for all patients as it may have detrimental effects. Also tissue oxygenation, mucosal perfusion and emetogenic mediator release were not measured in this study.

CONCLUSIONS

Intra-operative administration of liberal crystalloid infusion (30 mL/Kg) significantly reduces the incidence of postoperative nausea and vomiting (PONV) as well as the requirement of rescue antiemetic in the early post-operative period following diagnostic gynaecological laparoscopy.

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