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The Effect of Ringer versus Haemacel Preload on Incidence of Postoperative Nausea and Vomiting

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ABSTRACT

Introduction: Postoperative nausea and vomiting (PONV) is the most common and unpleasant postoperative complication. There is much controversy on preoperative fluid therapy. The aim of this study was to examine the effect of crystalloid fluid (Ringer solution) versus colloid (Haemacel solution) on the incidence of postoperative nausea and vomiting in patients receiving spinal anesthesia.

Methods: In this double-blinded clinical trial, 46 patients were selected according to the inclusion and exclusion criteria. Patients were randomly allocated to one of two groups. The crystalloid group received Ringer solution at a volume of 7 ml/kg and colloid group received 7ml/kg of 3% Modified Gelatin (Haemacel) as a preoperative intravenous bolus. We used a Verbal Rating Scale (VRS) for assessing the nausea and vomiting occurrence. Data were analyzed using SPSS software ver.13 and χ^2 test and independent t-test.

Results: The result showed that the incidence of PONV was less frequent in both Ringer and Haemacel groups, but the incidence of vomiting and the intensity of nausea was not significantly different in any time point after anesthesia.

Conclusion: We conclude that preoperative fluid administration decreases the incidence of PONV, and both Crystalloids (Ringer) and colloids (haemacel) solution were found to be equivalent in prevention of PONV. Therefore using of either Ringer or haemacel solution is recommended for prevention of PONV.

Introduction

Postoperative nausea and vomiting (PONV) following surgery occurs in 40%–60% patients despite pharmacological prophylaxis.¹⁻⁴ It occurs in 70% to 80% in high risks patients without prophylaxis,⁵ indicating the importance of prevention of this stressful complication.⁶

As an unpleasant symptom, PONV is considered as the main concern in patients receiving anesthetics and surgeries.⁷⁻⁹ Furthermore, PONV causes many complications such as patient discomfort, patient dissatisfaction, unplanned readmission to the hospital, and delayed

discharge.¹⁰⁻¹² If not controlled, this problem may result in severe complications such as electrolytes imbalance, dehydration, bleeding, tension on sutures, aspiration pneumonia, airway compromise, emphysema, prolonged hospital stay, and increased economic cost of treatment.¹³⁻¹⁵ PONV may also lead to expanded nursing care, all factors that increase health care costs.^{16,17} The annual cost for the treatment of PONV in the United States is approximately one billion dollars.¹⁸ Hospital, and delayed discharge.¹⁰⁻¹² If not controlled, this problem may result in severe complications such as electrolytes

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imbalance, dehydration, bleeding, tension on sutures, aspiration pneumonia, airway compromise, emphysema, prolonged hospital stay, and increased economic cost of treatment.¹³⁻¹⁵ PONV may also lead to expanded nursing care, all factors that increase health care costs.^{16,17} The annual cost for the treatment of PONV in the United States is approximately one billion dollars.¹⁸

Moreover, surgical patients prefer to experience pain rather than suffer from PONV and even they would like to pay more money for an effective antiemetic treatments.¹⁹ For these reasons, PONV control is the main priority for patients receiving spinal anesthesia.¹⁰ And it is essential to prevent and control PONV as efficiently as possible.¹ In these situations, using of pharmacologic prophylaxis may increase the danger of adverse drug side effects for the patient along with increasing overall health care costs.²⁰

Preload rehydration is a recommended approach to reduce PONV but there is no consensus as to which type of fluid or volume is ideal for preventing of this complication.^{21,22} Also there are much controversy on preoperative fluid therapy and the results of the past studies investigating the effect of preoperative fluid therapy on postoperative complication seem contradictory,²³ in which different colloid and crystalloid have been proposed as preloading fluid for prevention of this complication.²⁴⁻²⁸

Furthermore, information regarding the effect of the various intravascular fluid replacement solutions remains unclear.²⁹ The choice of crystalloid or colloid as an optimal ideal strategy for fluid replacement therapy remains unresolved, and there is disagreement over the selection of colloid or crystalloid as the optimal approach for prevention of postoperative nausea and vomiting.^{30,31}

Some author has recommended the crystalloid solution,¹⁰ but there are fewer data on colloid preload. Because colloids enhance circulation volume more than crystalloid

solution, they may be more useful than crystalloids.³²

The aim of this study, therefore, was to examine the effect of crystalloid fluid (Ringer solution) versus colloid (Haemaccel solution) on the incidence of postoperative nausea and vomiting in patients receiving spinal anesthesia.

Materials and methods

Following approval by the Research Ethics Committee (Zanjan University of Medical Sciences, Zanjan, Iran), we selected patients who met the inclusion criteria. Patients were included in this study only if they met the following criteria:

- 1- The patient was willing and able to sign the patient informed consent form.
- 2- Patients who scheduled to undergo spinal anesthesia.
- 3- Patients aged 18–45 years.

Exclusion criteria included patients who had a history of coagulation disorder, cardio-respiratory disease, renal failure, hypertension, and excessive preoperative blood loss. The study was done at the Ayat Ollah Moosavi Hospital, a central teaching hospital in Zanjan city.

We invited the patients who met the inclusion criteria to participate in the study. Then, we obtained informed written consent from all patients who wanted to participate in the study.

Prospective power analysis according to the previous study showed that 25 patients in each group would give 80% power with $\alpha=0.05$ to distinguish 20% difference among two groups. We recruited 27 patients for each group by allowing for potential dropouts.¹⁰

A total 54 patients was selected according to the inclusion and exclusion criteria during the period of March 2014 to August 2014 (Figure 1). Our study was supervised by an anesthetist as a co-researcher. Patients were randomly allocated to one of two groups using a sealed envelope.

The crystalloid group received Ringer solution (Shahid Gazi Company, Tabriz, Iran) at a volume of 7 ml/kg and colloid group received 7ml/kg of 3% Modified Gelatin also known as Haemaccel (Samen drug company, Mashhad, Iran) as an preoperative intravenous bolus. All selected patients received these solutions before induction of anesthesia at the operating room.

All participants were not aware of group assignment. We used a standard Verbal Rating Scale (VRS) for assessing the nausea and vomiting occurrence. This scale consists of two parts. The first part assessed the vomiting occurrence (yes= patient had vomiting, no= patient had not vomiting) and the second part assessed the nausea intensity (0=no nausea, and 10=worst possible nausea). Patients' characteristics such as age, gender, type of surgery, and other relevant data were collected by a checklist. We used content validity for these instruments which ten faculty members of Zanjan University of Medical Sciences reviewed the instruments and we revised it by using their comments.

We used test-retest method for assuring the reliability of the instruments. The correlation between test retest results was 0.86.

A single data collector assessed the patients at 1 hours, 4 hours, and every 4 hours until 24 hours postoperatively. This person was not aware of group assignment too. In other word, this was a double-blinded study.

Data were analyzed by using SPSS software version 13. The χ^2 test and independent t-test were used for comparison of data between two groups. Means and standard deviation used for presenting the normally distributed data and medians and interquartile range was reported for data that was not normally distributed.

Results

In our study, two groups (Ringer group and Haemaccel group) were comparable for

participant characteristics such as age, marriage status, educational level, and the number of blocked segments. Therefore, there were not significant differences in these parameters ($P>0.05$) (Table 1).

The result showed that the incidence of postoperative nausea and vomiting was less frequent in both groups. The incidence of PONV was not significantly different at 1hours, 4 hours, and every 4 hours until 24 hours postoperatively between two groups ($P<0.05$). Also there was no significant difference in the intensity of nausea between two groups at any time point ($P<0.05$) (Table 2).

Discussion

Over the past years, as the risk of major mortality related to surgery has decreased, attention has moved to addressing causes that harmfully influence patient satisfaction and patient morbidity, for example postoperative nausea and vomiting.⁵

Post operative nausea and vomiting is not just a distressing and unpleasant experience, but may be a main factor in disturbing post-operative convalescence.³³

This study aimed to determine whether Haemaccel solution may have any advantage over Ringer solution on PONV. We did not find any such advantage and the incidence of nausea and vomiting did not decreased by using Haemaccel. Therefore, the effect of Haemaccel as a colloid solution is similar to ringer solution as a crystalloid solution.

Using crystalloids and colloids solution as a preoperative intravenous fluid supplementation decreased the incidence of PONV. The incidence of PONV was 18.52% and 14.82% at 1 hour of postoperative time in Ringer and Haemaccel group respectively.

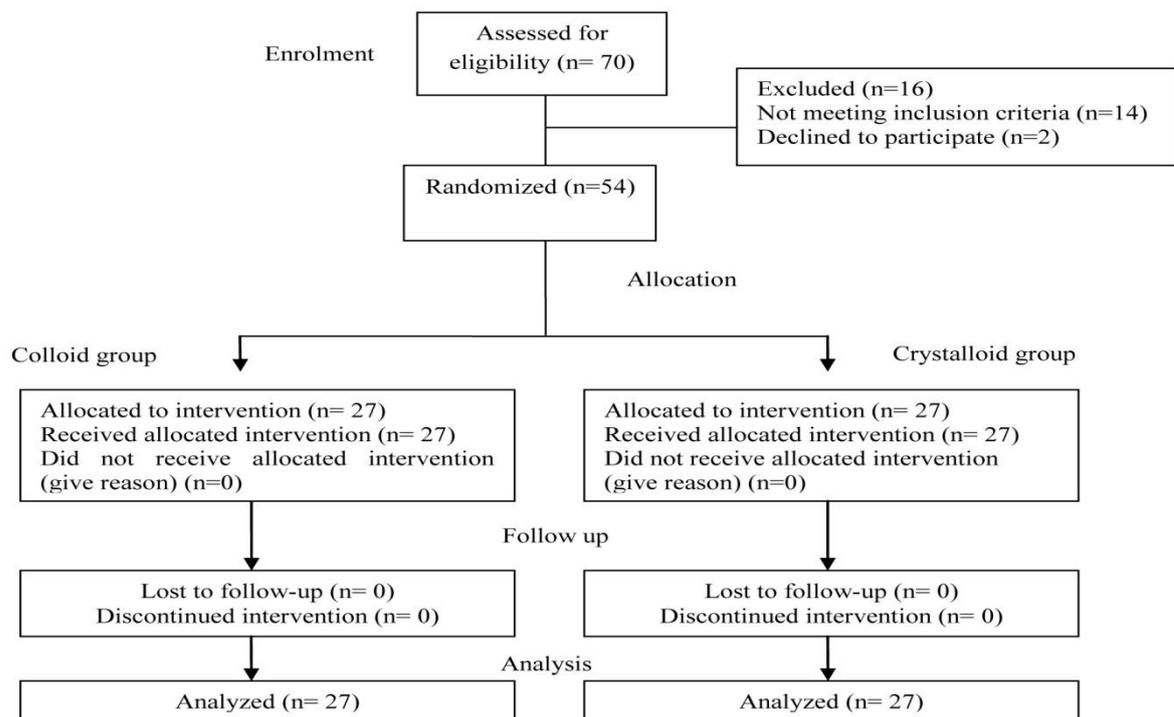


Figure 1. Consort flow diagram

Table 1. Demographic data of patients in Ringer and Haemaccel group (n=54).

Characteristics	Ringer group (n=27)	Haemaccel group (n=27)	Statistic indicators
Age (year)*	43.6 (10.7)	43.9 (8.7)	t=0.08, df=52, P=0.93
Height (cm)*	171 (11.3)	172 (6/4)	t=0.28, df=52, P=0.78
Weight (kg)*	75.3 (14.7)	75.7 (12.26)	t=-0.43, df=52, P=0.67
Educational level			
Under diploma	21	20	
Diploma	5	4	
Higher education	1	3	$\chi^2=1.14$, df=2, P=0.57
Marriage status			
Single	0	2	
Married	27	25	$\chi^2=2.08$, df=1, P=0.15
Smoking history			
Yes	6	9	
no	21	18	$\chi^2=1.73$, df=1, P=0.36
Fasting before anesthesia			
<6hours	4	3	
6-12hours	19	16	
>12hours	4	8	$\chi^2=1.73$, df=2, P=0.42
Past surgical history			
Yes	12	8	
no	14	19	$\chi^2=1.54$, df=1, P=0.21

*Values are Mean (SD).

Table 2. Comparison of postoperative nausea and vomiting between two groups

Variable	Ringer group	Haemaccel group	statistics
Incidence of vomiting at 1 hour			
Yes	4	5	$\chi^2=0.13$, df=1, P=0.71
no	23	22	
Incidence of vomiting at 4 hour			
Yes	2	2	$\chi^2=0.01$, df=1, P=1
no	25	25	
Incidence of vomiting at 8 hour			
Yes	2	2	$\chi^2=0.01$, df=1, P =1
no	25	25	
Incidence of vomiting at 12 hour			
Yes	1	0	$\chi^2=1.01$, df=1, P =0.31
no	26	27	
Incidence of vomiting at 16 hour			
Yes	1	1	$\chi^2=0.01$, df=1, P =1
no	26	26	
Incidence of vomiting at 20 hour			
Yes	1	0	$\chi^2=0.13$, df=1, P =0.31
no	26	27	
Incidence of vomiting at 24 hour			
Yes	1	0	$\chi^2=1.01$, df=1, P =0.31
no	26	27	
The intensity of nausea Mean (SD)	1.66 (2.54)	0.81 (1.61)	t=-1.46, df=52, P=0.14

Our findings are similar to Ngan Kee et al., who investigated preloading with 4% gelatin colloid solution (Gelofusine) with no preload (control group). They found that nausea was less frequent in the gelatin group (6 vs. 24%), but the other outcome was similar in gelatin and control groups.³²

While obeying to preoperative fasting strategies, patients routinely are hypovolemic in the operating room. So, many patients experience the hypovolemic episodes and it increases the incidence of nausea and vomiting after spinal anesthesia. Therefore preloading before spinal anesthesia is proposed as a one of the preventive strategy.³⁴

Various strategies have been proposed for prevention of PONV in patients receiving spinal anesthesia.^{8,35,36} Several studies supported the use of preoperative intravenous fluids for prophylaxis of PONV.^{17,37,38}

Holte et al.,³⁹ and Magner et al.,⁴⁰ reported an overall reduction in the occurrence of PONV by preloading intravenous solutions.

Volume preloading by different solutions can effectively prevent PONV induced by spinal anesthesia.^{29,41,42}

Since Ringer solution is most physiological fluid and its osmolality is very similar to plasma, most of the authors have used it as preloading fluid in their studies. Our results was consistent with Sujata et al.,¹³ work, in which they concluded that both crystalloids and colloids were equally effective in preventing PONV. Other researcher had selected modified Gelatin (haemaccel) as preloading fluid because its osmolality and PH are similar to plasma.⁴³

But the result of our study is not consistent with the findings of Christine et al.,⁴⁴ study in which the incidence of nausea and vomiting did not reduced by using intravenous crystalloid infusion. This

difference may be related to the solution type which used in these studies. We used Ringer solution but they administrated compound sodium lactate (CSL) as a crystalloid infusion.

In another study Capel Cardoso *et al.*, compared the incidence of hypotension in patients submitted to cesarean section under spinal anesthesia with crystalloid or colloid preload (modified gelatin). They showed that colloid (modified gelatin) was similar to crystalloid (lactate Ringer) in decreasing or preventing the incidence of hypotension.⁴⁵ It seems the difference between Capel Cardoso work and our study is that we used ringer solution instead of lactate Ringer.

In a study of patients undergoing laparoscopic cholecystectomy, Chaudhary *et al.*,¹³ did not show any significant differences on PONV between groups receiving Ringers lactate (as a crystalloid fluid) or Hydroxyethyl starch (as a colloid fluid) before the induction of anaesthesia.

Our finding is also similar to Kotake *et al.*,³² results who found that preload with gelatin 15ml/kg decreased the incidence of nausea and vomiting. In the other study Holte *et al.*,³⁹ showed that intravenous fluid administration improves postoperative symptoms such as nausea and vomiting and shorten time to reaching discharge criteria.

Conclusion

Preoperative fluid administration decreases the incidence of PONV. Both Crystalloids (Ringer) and colloids (Haemaccel) were found to be equally effective in prevention of PONV. Therefore, both Ringer and Haemaccel can be used for prevention of these symptoms.

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Ethical issues

None to be declared.

Conflict of interest

The authors declare no conflict of interest in this study.

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