## Original Research

# The Efficacy Of Preoperative Colloid Administration On Postoperative Nausea And Vomiting Among Patients Undergoing Laparoscopic Cholecystectomy

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**Abstract:**

**Background:**

Nausea and vomiting together are second most postoperative complications. Due to fewer adverse effects and less invasive nature of laparoscopic surgery in contrast to open surgery, the laparoscopic approach is trending however in the laparoscopic approach due to abdominal distention and pneumoperitoneum nausea and vomiting are more frequent.

**Materials and methods:** In this clinical trial study 72 patients 20 to 65 ages scheduled for elective cholecystectomy in 2019 in Shahid Mohammadi hospital. Patients were randomly assigned to 1 of 2 treatment groups the patients in group 1 or crystalloid group patients received 15 ml per kg ringer lactate and those in group 2 or colloid group received 7 ml per kg Voluven (hydroxyethyl starch). Number of patients experienced nausea and vomiting and severity was evaluated based on VAS in addition to other vital signs at 0 and 30 minutes and 1 and 4 hours postoperatively and then every 4 hours until 24 hours.

**Results:** The average age in the colloid group was 37.36±13.32 and in the crystalloid group was42.11±13.69 and the average age in the colloid group was 72.39±19.23 and in the crystalloid group was 71.75±17.65 and in this study there was not a significant difference between two groups in number and severity of nausea and vomiting.

**Conclusion:** In the current study there was not a significant difference in systolic blood pressure, diastolic blood pressure, mean arterial pressure, oxygen saturation, and mean heart rate as well as there was not a significant difference between in form of fluid usage and number of patients with nausea and vomiting and severity of these complications.

**Keywords:** Colloid, Nausea and Vomiting, Laparoscopic Cholecystectomy

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**Introduction**

Normally, nausea and vomiting occur in 50% to 80% of patients after surgery, and this complication causes a decrease in activity and dissatisfaction of the patient after surgery. Together, these two are the second common complaint expressed by patients (1). Due to less complications and less invasive nature, laparoscopic surgery is preferred over open surgery in several surgeries and nowadays the use of this surgical method is progressively increasing. On the other hand, the aim of laparoscopy is to reduce the length of hospitalization of patients and also this method will improve the economic situation and reduce additional hospital expenses and return the patient to a normal life more quickly (2). However, during laparoscopic surgeries, due to abdominal distention due to pneumoperitoneum, there is a higher possibility of nausea and vomiting, which can lead to increased hospitalization time and additional costs for patients. Therefore, in this regard, if we can control nausea and vomiting after it, we will be able to achieve this goal better (3). Of course, it should not be assumed that the complication of nausea and vomiting is only related to the surgical process. Because in addition to the type and process of surgery, the individual characteristics of the patient and issues related to the anesthesia method also play a significant role in this complication. In fact, the effective risk factors for this condition are divided into three groups. Preoperative risk factors include: adults, women, history of gastroesophageal reflux, gastric emptying disorder, obesity, intestinal obstruction, and chronic cholecystitis. Risk factors during surgery include: intubation, anesthetic drugs, gastric distention and type of surgery, and post-surgery risk factors include continued pain, sudden movement, and change in patient's condition, early start of diet and use of narcotic pain relievers (4). In most cases, nausea and vomiting are self-controlled, but in some cases, it can lead to severe complications such as aspiration, opening of wound sutures, esophageal rupture, subcutaneous emphysema, metabolic disorders such as metabolic alkalosis, hypokalemic, hyponatremia and pneumothorax (5-6) Although various drugs are recommended and used in high-risk patients for the prevention and treatment of nausea and vomiting, but the appropriate and desired answer has not yet been found. For example, dopamine antagonists, chlorpromazine, and metoclopramide, anticholinergics, antihistamines, and Dimenhydrinate have been used in this regard, and each has advantages and disadvantages. Today, various methods are used to control nausea and vomiting, including drug therapy and complementary and non-pharmacological treatments (in the form of an independent treatment method or together with standard treatments). Therefore, it seems that a cost-effective and, if possible, non-pharmacological method to reduce postoperative nausea and vomiting is needed. In fact, choosing a method to prevent nausea and vomiting should be based on safety, effectiveness of the method, risk factor, patient satisfaction and low cost (7). Since the lack of intravascular volume may be a factor for the occurrence of postoperative nausea and vomiting, providing intravascular volume can reduce the occurrence of this complication. In this field, studies have been conducted that have shown the ability of intravenous fluids before surgery to reduce the occurrence of nausea and vomiting. Also, studies have been conducted on the type of intravenous fluid used during the operation and its effect on nausea and vomiting after the operation, in some of them, the combination of colloids with crystalloids in restoring intravascular volume during surgery, with nausea and vomiting It has been accompanied by less, and in general, the condition of patients after surgery in the recovery room has been better compared to the use of crystalloid alone

(8). In justifying the mentioned results, it can be said that due to the ischemia of the digestive tract wall, which is secondary to the reduction of intravascular volume (due to fasting and bleeding during the operation), nausea and vomiting occur and because colloids reduce the edema of the digestive tract wall. In comparison with crystalloids, digestive juices can improve tissue blood supply, they have the ability to prevent nausea and vomiting (9). Of course, despite the mentioned studies, the results reported from other researches (26) indicate an increase in the rate of nausea and vomiting in the use of colloids. Considering the existing contradictions and the need for more studies in this field, we decided to conduct a study aimed at investigating the effect of colloid on nausea and vomiting after laparoscopic surgery.

**Method**

In this clinical trial study, 72 patients aged 20-65 who referred to Shahid Mohammadi Hospital for elective laparoscopic cholecystectomy in 2019 underwent surgery. All patients had ASA I and II. After full explanation and written consent for their participation in this study, the patients were randomly divided into two groups. The patients were randomly assigned to each of the colloid or crystalloid groups based on a simple random number table. In the operating room, an 18-gauge angiocath was placed in the peripheral vein, and non-invasive blood pressure monitoring, electrocardiogram, capnography and pulse oximetry were performed. The anesthesia method used was the same for all patients, and in all of them, the fluid under consideration was injected 15 minutes before the start of general anesthesia. In the crystalloid group, 15 ml of Ringer's was injected per kilogram, and in the colloid group, 7 ml of Volvone (6% hydroxyethyl starch) was injected. General anesthesia after complete injection of the studied liquids, by midazolam 0.03 mg/kg, fentanyl 2 μg/kg and morphine 0.1 mg/kg as premedication, then lidocaine 0.5 mg/kg, propofol 1-2 mg/kg and atracurium 0.6 mg /kg was given as induction and after 3 minutes they were intubated. All patients received oxygen and propofol 100 μg/kg/min during surgery. The fluids received by the patients during surgery and anesthesia were the same and were 6 cc/kg/h of Ringer's solution. At the end of the surgery, after ensuring the patient's ability to protect the airway and obtain the necessary conditions, the tracheal tube was removed. In case of prolonged operation time of more than 2 hours or excessive bleeding or any unexpected event, the patients were removed from the study. After the operation, the severity of nausea and the frequency of vomiting were checked in both groups. Frequency of occurrence and severity of nausea based on visual measurement criteria (VAS-Scale Analogue Visual) were checked from the moment of entering the recovery department and then at 30 minutes and hours 1 and 4 and then every 4 hours until 20 hours (16). The frequency of vomiting was divided according to VAS as follows: 0: no vomiting, 1: vomiting once, 2: vomiting twice, and 3: vomiting more than twice. The mentioned information was checked in the aforementioned hours and the information obtained from the patients was recorded in the relevant checklist by the anesthesia resident who was not aware of the way the patients were divided. Also, mean arterial pressure and heart rate were recorded during zero, 10 and 60 minutes during the procedure. In case of intervals of less than 5 minutes, vomiting attacks were recorded as one episode. Patients with moderate to high nausea $\leq$ VAS 3 or vomiting $\geq$ 2 were treated with the anti-emetic drug metoclopramide in the amount of 10 mg intravenously, and if there was no response to this drug within 30 minutes, the drug ondansetron was used in the amount of 4 mg intravenously for treatment (16). Data analysis was done using spss software version

22 and using descriptive and inferential statistical tests at a significance level of p<0.05.

**Result**

72 patients aged 20 to 65 years (in two groups of 36) with ASA I, Π who were elective for laparoscopic cholecystectomy surgery in Bandar Abbas Shahid Mohammadi Hospital in 2019 were evaluated. In one group of patients receiving colloid and another group of patients receiving crystalloid.

The average age of patients in the colloid group is 37.36±13.32 years and in the crystalloid group the average age is 42.11±13.69 years. According to the independent t test, no significant difference was observed between the two groups in the age variable. (P = 0.140).

The average weight of patients in the colloid group is 72.39±19.23 kg and in the crystalloid group the average weight is 71.75±17.65 kg. According to the Mann-Whitney test, there was no significant difference between the two groups in the weight variable. (P = 0.986).

6 patients (16.7%) of the colloid group and 4 patients (11.1%) of the crystalloid group were male. According to chi-square test, there was no significant difference between the two groups in genetics. (P = 0.496)

At different times, there was no significant difference in mean systolic blood pressure between the two groups (P<0.05). Except in the first 10 minutes when a significant difference was observed (P=0.040). In the colloid group, according to Friedman's test, the average systolic blood pressure at different times did not show a significant difference. (P=0.062) in the crystalloid group, according to Friedman's test. Friedman's test shows a significant difference in mean systolic blood pressure at different times (P<0.001) (Table 1).

There was no significant difference in mean diastolic blood pressure between the two groups at different times of the study (P < 0.05). In the colloid group, according to the Friedman test, the average diastolic blood pressure at different times does not show a significant difference (P=0.819). In the crystalloid group, according to Friedman's test, the average diastolic blood pressure at different times does not show a significant difference. (P=0.576) (Table 2)

There was no significant difference in the average heart rate between the two groups at different times of the study (P < 0.05). In the colloid group, according to the Friedman test, the average heart rate at different times shows a significant difference (P<0.001). In the crystalloid group, according to the Friedman test, the average heart rate at different times shows a significant difference (P<0.001).

No significant difference was observed in the mean percentage of arterial oxygen saturation between the two groups at different times of the study (P < 0.05). In the colloid group, according to Friedman's test, the average percentage of arterial oxygen saturation at different times shows a significant difference (P<0.001). In the crystalloid group, according to Friedman's test, the average percentage of arterial oxygen saturation at different times does not show a significant difference (P=0.491).

No significant difference was observed in the presence of nausea between the two groups at different times of the study. (P < 0.05) (Table 3).

There was no significant difference in the mean intensity of nausea between the two groups at different times of the study. (P < 0.05). In the colloid group, according to the Friedman test, the average intensity of nausea at different times shows a significant difference (P<0.001). In the crystalloid group, according to the Friedman test, the average intensity of nausea at different times shows a significant difference (P<0.001).

There was no significant difference in the average number of vomiting between the two groups at different times of the study (P < 0.05). In the colloid group, according to the Friedman test, the average number of vomiting at

different times shows a significant difference (P<0.001). In the crystalloid group, according to the Friedman test, the average number of vomiting at different times shows a significant difference (P<0.001) (Table 4).

There was no significant difference in the average intensity of vomiting between the two groups at different times of the study (P < 0.05). In the keloid group, according to Friedman's test, the mean intensity of vomiting at different times shows a significant difference (P<0.001). In the crystalloid group, according to Friedman's test, the mean intensity of vomiting at different times shows a significant difference (P<0.001).

There was no significant difference in the consumption of ondansetron between the two groups at different times of the study (P < 0.05).

**Discussion**

Nowadays, laparoscopic surgery is preferred over open surgery in several surgeries because of its less complications and less invasive nature. One of the applications of laparoscopy is cholecystectomy, which is currently chosen as the preferred method of treating acute cholecystitis due to fewer complications. Although laparoscopy is a new step in surgery, it still has its own side effects, including nausea and vomiting after surgery, which leads us to identify a suitable method to control it. Nausea and vomiting after surgery are very common, and sometimes doctors have to use several drugs to control it, and for this reason, efforts to find ways of prevention and control continue (12). In the present study, no significant difference was observed in the average systolic blood pressure between the two groups, but in the crystalloid group, the average systolic blood pressure showed a significant difference at different times, while it was not the case in the colloid, and this indicates less changes and pressure drop. It is less in the keloid group over time. Which is different from the study by Ko et al. (13) and the study by Siddik et al; in the present study, there was no significant difference in the average heart rate between the two groups. There was a significant difference in the average heart rate at different times in both groups, and in this sense there was no difference between the two groups. This is consistent with the study conducted by Sane and his colleagues (8), which can be due to control. The treatment team should be careful about the patients' vital signs. In the present study, no significant difference was observed in the mean percentage of arterial oxygen saturation between the two groups at different times of the study, which is expected since both groups were under strict monitoring and strict control of factors by the treatment team. In the present study, no significant difference was observed in the mean blood pressure between the two groups at different times of the study. This is consistent with the study conducted by Sane and his colleagues (8) and there was no significant difference between the two groups. This could be due to the fact that the subjects were less exposed to blood loss due to the type of operation and the main factors affecting blood pressure were controlled and the same. In this study, there was no significant difference in the presence of nausea between the two groups at different times of the study. Which is consistent with the study of Sane and his colleagues (8) and the study conducted by Chaudhary and colleagues (14) in which there was no significant difference between the two groups. And it is different from the study by Ko et al. (13) and the study by Siddik et al. (15) in which the incidence of nausea was lower in the keloid group. And it is not consistent with the study by Hayes et al. (16) in which people who received colloid had a higher incidence of nausea. This could be due to the fact that in the studies by Ko et al. (13) and the study by Siddik et al. (15) epidural and spinal anesthesia was used, which can affect the result. The type of colloid received (HES 10) was different from our study and this could affect our results. In

this study, no significant difference was observed in the average intensity of nausea between the two groups at different times of the study and in each group, a significant difference was shown in the comparison between different times of the same group. And the severity was variable in different time periods. This is not consistent with the study of Hayes et al. (16) in which the severity of nausea was higher in people receiving colloid. And the opinion of people of two communities should be the same in grading, because individual's opinion can have an impact on their grading. In our study, there was no significant difference in the average number of vomiting and its severity between the two groups at different times of the study. And in each group, it showed a significant difference in the comparison between different times of the same group. And the number was variable in different time periods. And in both groups, it was the highest at 4 hours after the operation. Which was done by Sane and his colleagues (8) and the study by Chaudhary and colleagues (14) and there was no significant difference between the two groups. And it is different from the study by Ko et al. (13) and the study by Siddik et al. (15) in which the incidence of vomiting was lower in the keloid group. Considering that the type of operation in their study was cesarean and the substance received (HES 10) was different and the amount of fluid received in the studies that was different in each of them can be justified in this study, no significant difference was observed in the consumption of ondansetron between the two groups at different times of the study. According to the study by S. Z. Ali et al. (17) and Chaudhary et al. (14) in which it was shown more The amount of fluid consumed is more effective than its type, and it is not different from the use of ondansetron, which is consistent with the fact that the amount of liquid consumed is a more important factor than its type.

**Conclusion**

In this study, there was no significant difference between systolic blood pressure, diastolic blood pressure, mean arterial blood pressure, percentage of oxygen saturation, and mean heart rate in the two investigated groups, and the results of this study also showed that there was a difference between the fluid used and the nausea and vomiting of the subjects. There is no significant relationship and it does not have a significant effect, and in addition, it has no effect on the severity of nausea and vomiting.

**Ethical Code:** IR.HUMS.REC.1398.224

**References**

1. Garrett K, et al., Managing nausea and vomiting current strategies. Critical care nurse, 2003. 23(1): p. 31-50.
2. Liu C-l, et al., Factors affecting conversion of laparoscopic cholecystectomy to open surgery. Archives of Surgery, 1996. 131(1): p. 98-101.
3. Mahoori A, Valizad Hassanloei M, Karami N, Moradi T. The effect of colloid use on postoperative nausea and vomiting following gynecologic laparoscopic surgery. Anesthesiology and Pain. 2016;6(4):75-82.
4. Sanei B, Moazeni Bistgani M, Reisi S. The efficacy of dexamethasone on post-cholecystectomy nausea and vomiting. KAUMS Journal (FEYZ). 2011;14(4):398-404.
5. Kranke P, Schuster F, Eberhart LH. Recent advances, trends and economic considerations in the risk assessment, prevention and treatment of postoperative nausea and vomiting. Expert opinion on pharmacotherapy. 2007;8(18):3217-35.
6. Kranke P, Eberhart LH. Possibilities and limitations in the pharmacological management of postoperative nausea and vomiting. European Journal of

Anaesthesiology (EJA). 2011;28(11):758-65.
7. Loewen PS, Marra CA, Zed PJ. 5-HT 3 receptor antagonistsvs traditional agents for the prophylaxis of postoperative nausea and vomiting. Canadian Journal of Anesthesia. 2000;47(10):1008-18.
8. Sane S, Mahoori A, Valizad Hassanloei M, Karami N, Moradi T. The effect of colloid use on postoperative nausea and vomiting following gynecologic laparoscopic surgery. JAP 2016; 7 (2) :75-82
9. Freiberger E, Sieber C, Pfeifer K. Physical activity, exercise, and sarcopenia–future challenges. Wiener Medizinische Wochenschrift. 2011;161(17-18):416-25.
10. Ali S, Taguchi A, Holtmann B, Kurz A. Effect of supplemental pre-operative fluid on postoperative nausea and vomiting. Anaesthesia. 2003;58(8):780-4.
11. Shahar Bar-Yosef. Complications of Laparoscopic Surgery.In: JOHN L. ATLEE BAB, MARK A. CHANEY, DONN M. DENNIS, JOHN ELLIS, JOEL M. GUNTER et al. COMPLICATIONS IN ANESTHESIA. 2nd ed. Philadelphia: Saunders; 2007.p: 831-835.
12. Norozi A, Fateh S, Rahbari E. The effect of gabapentin on controlling nausea and vomiting after laparoscopic cholecystectomy. J Arak Uni Med Sci 2012; 15 (4) :69-75
13. Ko J, Kim C, Cho H, Choi D. A randomized trial of crystalloid versus colloid solution for prevention of hypotension during spinal or low-dose combined spinal-epidural anesthesia for elective cesarean delivery. International journal of obstetric anesthesia. 2007;16(1):8-12
14. Chaudhary S, Sethi AK, Motiani P, Adatia C. Pre-operative intravenous fluid therapy with crystalloids or colloids on post-operative nausea & vomiting. Indian J Med Res. 2008 Jun;127(6):577-81.
15. Siddik SM, Aouad MT, Kai GE, Sfeir MM, Baraka AS. Hydroxyethylstarch 10% is superior to Ringer's solution for preloading before spinal anesthesia for Cesarean section. Canadian journal of anaesthesia. 2000;47(7):616-21.
16. Hayes I, Rathore R, Enohumah K, Mocanu E, Kumar D, McCaul C. The effect of crystalloid versus medium molecular weight colloid solution on post-operative nausea and vomiting after ambulatory gynecological surgery-a prospective randomized trial. BMC anesthesiology. 2012;12(1):15.
17. Ali S, Taguchi A, Holtmann B, Kurz A. Effect of supplemental pre-operative fluid on postoperative nausea and vomiting. Anaesthesia. 2003;58(8):780-4.

**Tables**

**Table 1: Systolic blood pressure changes between two groups at different times**

| Systolic blood pressure | | Groups | | | | P-value | Statistical Test |
|---|---|---|---|---|---|---|---|
| | | Colloid | | Crystalloid | | | |
| | | Mean | SD | Mean | SD | | |
| Time | Before the operation | 131.72 | 19.12 | 133.47 | 21.57 | 0.723 | Mann-Whitney |
| | 10 minutes | 130.75 | 20.63 | 121.39 | 19.57 | 0.040* | Mann-Whitney |
| | 60 minutes | 127.53 | 12.47 | 126.92 | 16.27 | 0.859 | Independent Test |
| | Enter recovery | 137.56 | 22.12 | 139.72 | 17.82 | 0.649 | Independent Test |
| | 30 minutes of recovery | 134.75 | 22.05 | 139.61 | 16.32 | 0.291 | Independent Test |
| | 60 minutes of recovery | 134.47 | 17.07 | 136.14 | 20.24 | 0.707 | Independent Test |
| P-value | | 0.062 | | <0.001* | | | |

**Table 2: Diastolic blood pressure changes between two groups at different times**

| Diastolic blood pressure | | Groups | | | | P-value | Statistical Test |
|---|---|---|---|---|---|---|---|
| | | Colloid | | Crystalloid | | | |
| | | Mean | SD | Mean | SD | | |
| Time | Before the operation | 83.08 | 21.38 | 81 | 12.29 | 0.723 | Mann-Whitney |
| | 10 minutes | 83.08 | 15.42 | 78.67 | 14.14 | 0.209 | Independent Test |
| | 60 minutes | 80.39 | 11.56 | 84.81 | 12.83 | 0.129 | Independent Test |
| | Enter recovery | 83.50 | 16.03 | 83.92 | 13.98 | 0.907 | Independent Test |
| | 30 minutes of recovery | 82.69 | 14.45 | 84.06 | 10.35 | 0.647 | Independent Test |
| | 60 minutes of recovery | 82.14 | 13.21 | 82.03 | 11.23 | 0.969 | Independent Test |
| P-value | | 0.819 | | 0.576 | | | |

**Table 3: The frequency and percentage of nausea between two groups at different times**

| Nausea | | Groups | | | | P-value |
|---|---|---|---|---|---|---|
| | | Colloid | | Crystalloid | | |
| | | n | % | n | % | |
| Enter recovery | Yes | 0 | 0 | 3 | 8.3 | 0.239 |
| | NO | 36 | 100 | 33 | 91.7 | |
| 30 min | Yes | 1 | 2.8 | 1 | 2.8 | <0.99 |
| | NO | 35 | 97.2 | 35 | 97.2 | |
| 1 h | Yes | 3 | 8.3 | 3 | 8.3 | <0.99 |
| | NO | 33 | 91.7 | 33 | 91.7 | |
| 4 h | Yes | 15 | 41.7 | 14 | 38.9 | 0.810 |
| | NO | 21 | 58.3 | 22 | 61.1 | |
| 8 h | Yes | 11 | 30.06 | 9 | 25 | 0.599 |
| | NO | 25 | 69.4 | 27 | 75 | |
| 12 h | Yes | 6 | 16.7 | 8 | 22.2 | 0.551 |
| | NO | 30 | 83.3 | 28 | 77.8 | |
| 16 h | Yes | 3 | 8.3 | 7 | 19.4 | 0.173 |
| | NO | 33 | 91.7 | 29 | 80.6 | |
| 20 h | Yes | 7 | 19.4 | 5 | 13.9 | 0.527 |
| | NO | 29 | 80.6 | 31 | 86.1 | |

**Table 4: Changes in the number of vomiting between the two groups at different times**

| Number of vomiting | | Groups | | | | P-value | Statistical Test |
|---|---|---|---|---|---|---|---|
| | | Colloid | | Crystalloid | | | |
| | | Mean | SD | Mean | SD | | |
| Time | Enter recovery | 0 | 0 | 0.06 | 0.23 | 0.154 | Mann-Whitney |
| | 30 min | 0.03 | 0.17 | 0.03 | 0.17 | <0.99 | Mann-Whitney |
| | 1 h | 0.03 | 0.17 | 0.11 | 0.40 | 0.3 | Mann-Whitney |
| | 4 h | 0.69 | 0.95 | 0.75 | 1.05 | 0.969 | Mann-Whitney |
| | 8 h | 0.42 | 0.91 | 0.39 | 0.87 | 0.967 | Mann-Whitney |
| | 12 h | 0.17 | 0.56 | 0.28 | 0.78 | 0.680 | Mann-Whitney |
| | 16 h | 0.17 | 0.56 | 0.03 | 0.17 | 0.164 | Mann-Whitney |
| | 20 h | 0.08 | 0.50 | 0.08 | 0.28 | 0.328 | Mann-Whitney |
| P-value | | <0.001* | | <0.001* | | | |