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Effect of Intraoperative Dextrose Infusion for Prevention of Postoperative Nausea and Vomiting in Diagnostic Gynecologic Laparoscopy

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Abstract

Objective: Laparoscopic procedures are accompanied with a high occurrence of nausea and vomiting after surgery. This study aimed to evaluate the effectiveness of prophylactic intraoperative infusion of dextrose 5% in the avoidance of postoperative nausea and vomiting (PONV).

Materials and Methods: In this randomized, double-blind, placebo-controlled clinical trial, 70 ASA class I women, aged 20-40 years scheduled for diagnostic laparoscopy for infertility were studied. Following induction of anesthesia, study group (n=35) received Ringer's solution 10 mL/kg/h with glucose 500 mg/kg (dextrose 5%) and placebo group (n=35) received Ringer's solution with normal saline 0.9% in the same volume intraoperatively. The incidence and severity of PONV according to a 4-point scale (0-3) in the post-anesthesia care unit (PACU) and during the first 24 postoperative hours, the first request for antiemetic, and overall antiemetic consumption were compared between 2 groups.

Results: The overall incidence of PONV was certainly lower in the study group compared with the placebo group (22.85% vs. 45.71%; $P=0.03$). Severity of PONV was significantly lower in the study group (1.14±0.32) compared to the placebo group (2.50±0.27) ($P=0.03$). There was a statistically significant difference between 2 groups regarding the first request for antiemetic after surgery (7.1±1.13 vs. 5.71±1.76 hours, $P=0.04$) and total dose of antiemetic (metoclopramide, 60 vs. 100 mg, $P=0.001$). There was no significant difference in perioperative blood sugar levels between 2 groups ($P=0.46$).

Conclusion: Intraoperative infusion of dextrose 5% was found to be an efficacious method in the prevention/reduction of PONV without any significant difference in postoperative blood sugar levels in patients undergoing diagnostic gynecologic laparoscopy.

Keywords: Gynecologic laparoscopy, PONV, Prophylaxis, Dextrose

Introduction

Postoperative nausea and vomiting (PONV) and post-discharge nausea and vomiting (PDNV) are the conventional painful and distressing conditions after surgery and anesthesia (1). The overall incidence of these complications is estimated to be more than 30% without prophylactic interventions. The incidence of PONV is as high as 70% to 80% in high-risk populations such as female sex, obese people, and young and non-smoker patients. Precedent history of PONV or motion sickness, longer time of surgery, and laparoscopic procedures especially gynecologic laparoscopy increase the incidence of PONV (54%-92%) (1-4). Some of the problems associated with PONV are aspiration pneumonia, dehydration, prolonged stay in post-anesthesia care unit (PACU) or hospitalization, wound dehiscence, increased medical costs, water and electrolyte disturbances, and acid –base imbalance (2-5).

Many antiemetic medications are available today. Antihistamines, metoclopramide, droperidol, and dexamethasone have been used for the prevention and treatment of the PONV; however they have many unsatisfactory adverse effects such as over sedation, hypotension, dry mouth and dysphoria (4-6). Dexamethasone, despite positive effects in reducing the PONV after laparoscopic surgery, may cause vaginal itching or/and irritation after intravenous bolus injection (2-4, 7). Ondansetron, a selective serotonin 5-hydroxytryptamin type 3 receptor antagonist is commonly used prophylactically to reduce PONV. However, it is relatively expensive and has been found to have some side effects including headache, constipation,

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elevated liver enzymes, and allergic reactions (8-10).

Other therapies for the prevention and treatment of PONV which have been examined in recent studies include the use of intravenous fluids and carbohydrates (11). Magner et al compared the intraoperative infusion of crystalloid 30 mL/kg with intravenous fluid 10 mL/kg in the incidence of PONV after gynecologic laparoscopic surgery (12). Haentjens et al compared the effects of intraoperative colloids with the effects of crystalloids on the PONV after breast surgery. Their results showed the type of fluid had a slight effect on the occurrence of PONV (13).

In recent studies, oral glucose has been used to treat symptoms of nausea and vomiting (12). These studies showed that the preoperative administration of oral glucose solutions decreased the incidence of PONV after thyroidectomy and laparoscopic cholecystectomy (14,15). Dabu-Bondoc et al examined the effect of postoperative intravenous dextrose administration (11). In the study of Patel et al, the administration of intravenous dextrose during emergence from anesthesia did not reduce the incidence of PONV (16).

Whether perioperative administration of dextrose reduces PONV, is unclear. The aim of this study was to assess the influence of intraoperative infusion of dextrose 5% on the prevention of PONV in the patients undergoing diagnostic gynecologic laparoscopy.

Materials and Methods

This study was designed as a single-centre, controlled, double-blind trial and was registered in the national registry for clinical trials (http://www.irct.ir; identifier: IRCT201402047013N10)

Informed consent was obtained from all of the patients including 70 women aged 20-70 years and ASA (the American Society of Anesthesiologists) class I, who were scheduled for diagnostic laparoscopy for infertility from January 2014 to May 2015. Patients with vaginal bleeding, or those who had used steroids, narcotic or antiemetic medications in the past few days, those with the history of systemic diseases (cardiovascular, respiratory, hepatic, endocrine, etc), and history of PONV, motion sickness and digestive disease, and pregnant women were excluded from the study.

Using a computer-generated randomization method, patients were randomly allocated to 2 groups. The patients in the study group (n = 35) received Ringer's solution 10 mL/kg/h with glucose 500 mg/kg (dextrose 5%) and the patients in the placebo group (n = 35) were administered Ringer's solution with normal saline 0.9% in the same volume. The solutions were infused 5 minutes before the induction of anesthesia until the end of operation.

Patients were required to fast 8 hours before anesthesia, and no patient was hydrated orally or intravenously before the procedure. Standard monitoring including the pulse oximetry, non-invasive blood pressure (NIBP), electrocardiography (ECG), and capnography was established for all the patients. Anesthesia was induced by midazolam (0.05 mg/kg), fentanyl (2μg/kg), and propofol (1-2.5 mg/kg). Laryngeal mask airway (LMA) was introduced. Maintenance of Anesthesia was done with infusion of propofol (50-150 mg/kg/min) and bolus dose of atracurium (0.2-0.3 mg/kg). Controlled ventilation was applied to maintain end-tidal pressure CO2 (ET CO2) at the level of 35 ± 5 mm Hg. During the procedure, pneumoperitoneum was established for maintaining the intra-abdominal pressure (IAP) lower than 14 mm Hg. After completion of laparoscopy, reversal of the residual neuromuscular blockade was done with neostigmine and atropine and the patients were transferred to PACU.

Occurrence and severity of PONV by a 4-point scale (0 = no PONV; 1 = nausea; 2 = vomiting; and 3 = vomiting more than twice) (3) in the PACU and at 3, 6 and 24 hours after surgery were recorded. The first request for antiemetic (metoclopramide 5 mg as a single intravenous bolus dose for PONV score ≥2), and total dose of metoclopramide were recorded by the anesthesiologist who was blind to the study solutions. Blood sugar levels were measured before and 6 hours after the operation by a glucometer (Accu-Chek; Roche Diagnostics Gmb H, Mannheim, Germany). The prevalence of pain and dose of analgesics were recorded during 24 hours after surgery. The analgesic regimen for the patients with severe pain was tramadol (50 mg, intramuscularly administered) and for the patients with moderate pain was diclofenac sodium suppository (100 mg). Duration of laparoscopy and anesthesia, recovery time, and hospital stay period were also considered.

Two surgeons performed all the laparoscopies. One anesthesiologist who was informed of the study solutions, was responsible for the management and monitoring of anesthesia, and preparation of study solutions. Another anesthesiologist who was blind to the study solutions, was responsible for the post-operative management and recording of the study parameters.

Sample size was estimated according to a similar previous study (14), with consideration of the incidence of PONV in the study group (12.68%) and in the placebo group (40.91%). A power analysis indicated that overall 70 patients would be necessary to ascertain a 30% reduced incidence of PONV with $\alpha = 0.05$ and power of 80% ($\beta = 0.80$). All values were represented as mean ± SD, or numbers (%). Data were analyzed by SPSS version 17.0 (SPSS, Chicago, IL, USA) using independent samples *t*-test and Chi square test or Fishers' exact test. A *P* value lower than 0.05 was considered statistically significant.

Results

Demographic data of the study groups are presented in Table 1. There were no significant differences between 2 groups in the patients' age, body weight, height, duration of surgery and anesthesia, and recovery and hospitalization time.

PONV scores were recorded at first in the PACU and

at 3, 6, and 24 hours after surgery. PONV variables are presented in Table 2 and Figure 1. In general, incidence of PONV was considerably lower in the study group (22.85% vs. 45.71%; $P=0.03$).The mean PONV scores in the study group were statistically lower than those in the placebo group ($P=0.03$). The highest difference according to the incidence of PONV ($P=0.009$) and scores ($P=0.015$) were at 3 hours after surgery. The time interval of the first request for antiemetic was longer in the study group ($P=0.04$). Total dose of metoclopramide was different between 2 groups ($P<0.001$).

Postoperative pain variables are presented in Table 3. Consumption of the tramadol was more in the placebo group ($P=0.01$). In contrast, dose of diclofenac suppository used was higher in the study group ($P=0.04$).

Perioperative changes in blood sugar levels were not different between 2 groups before surgery and 6 hours after surgery ($P=0.46$) (Table 4).

Discussion

Many patients develop PONV as a complication of the surgery and anesthesia. Most medications for prophylaxis and treatment of PONV have been reported to be associated with some undesirable side effects (1-10).

Oral glucose has widely been used for the treatment of nausea with unknown mechanism. Sugar has been thought upon, as high osmotic pressure reduces muscle contractions in the gastrointestinal tract (11). Tissue hypoperfusion may be an important etiological factor for PONV. Gastric mucosal hypoperfusion may occur due to hypovolemia after prolonged fasting. On the other hand, studies have shown that general anesthesia, increased intra-abdominal pressure due to pneumoperitoneum during laparoscopy, and surgical stimulation without any decrease in arterial pressure may cause mucosal hypoperfusion. Trendelenburg position (head-down) during gynecologic laparoscopy also intensifies regional hypoperfusion. Intravenous administration of fluid decreases the hypovolemia and hypoperfusion (12).

Few trials have investigated the effect of type and amount of perioperative intravenous fluid on PONV. Dabu-Bondoc et al reported that postoperative intravenous dextrose administration led to the reduction in antiemetic rescue medication requirements and recovery time after gynecologic laparoscopy and hysteroscopy (11). Magner et al showed that intraoperative infusion of the high volume of intravenous fluid was associated with reduced occurrence of PONV and antiemetic use in healthy women undergoing day-case laparoscopy. They explained intravenous fluid loading reduces PONV through increasing mesenteric perfusion without

Table 1. Demographic Data, Duration of Surgery and Anesthesia, and Stay in the PACU and Hospital in 2 Study Groups

	Study Group (n = 35)	Placebo Group (n = 35)	*P*
Age (y)	30.49±0.91	32.09±1.02	0.25
Weight (kg)	66.86±1.58	69.91±1.88	0.21
Height (cm)	160.80±0.48	169.29±0.56	0.05
Duration of surgery (min)	44.49±2.30	50.34±2.95	0.12
Duration of anesthesia (min)	54.57±2.47	61.34±3.10	0.09
Duration of recovery (min)	24.31±1.36	27.49±2.27	0.23
Duration of stay in hospital (h)	21.92±0.39	22.32±0.48	0.52

Data was presented as mean ± SD.

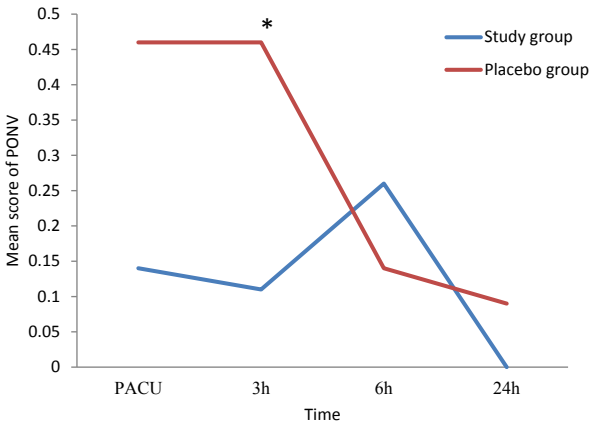

Figure 1. Mean Score of PONV.
*$P=0.015$ and $P>0.05$ at other times. Abbraviation: PONV, postoperative nausea and vomiting.

Table 2. PONV Variables in 2 Study Groups

	Study Group (n = 35)	Placebo Group (n = 35)	*P* Value
Overall incidence of PONV, No. (%)	8(22.85)	16(45.71)	0.03
PACU	4(11.5)	9(25.7)	0. 08
3 h	3 (8.6)	12(34.3)	0.009
6 h	5(14.3)	4(11.5)	0.50
24 h	0(0)	2(5.8)	0.24
Overall mean score of PONV	1.14±0.32	2.50±0.27	0.03
Time of first antiemetic request (h)	7.10 ± 1.13	5.71±1.76	0.04
Need to antiemetic, No. (%)	6 (17.14)	14 (40)	0.03
Total dose of metoclopramid (mg)	60	100	<0.001

Abbreviation: PONV, postoperative nausea and vomiting.
Data was presented as mean ± SD or number (%).

Table 3. Postoperative Pain Parameters in 2 Study Groups

	Study Group, (n = 35)	Placebo Group, (n = 35)	*P* Value
Incidence of postoperative pain, No. (%)	32(91.42)	32 (91.42)	1.0
Request for analgesic, No (%)	32(91.42)	32 (91.42)	1.0
No request for analgesic (%)	3(8.60)	3 (8.60)	1.0
Tramadol requirement, No. (%)	5(14.30)	22 (62.90)	<0.01
Tramadol usage (mg)	7.14. ±1.50	34.14 ± 3.29	0.01
Diclofenac usage (mg)	115.0±10.67	96.30±3.70	0.04

Data was presented as mean ± SD or number (%).

Table 4. Blood Sugar Level in 2 Study Groups

	Study group, (n = 35)	Placebo group, (n = 35)	*P*
Preoperative (mg/dL)	89.26±1.25	81.57±1.05	<0.001
Postoperative (mg/dL)	93.40±1.38	86.51±1.24	<0.001
Perioperative changes (mg/dL)	4.94±0.91	4.94±0.57	0.46

Data was presented as mean ± SD.

changes in hemodynamic variables (12). Haentjens et al presented surgical procedures with the lowest blood loss and fluid shift; the type of fluid infusion (colloid vs. 0.9 % normal saline) had the lowest effect on the occurrence of PONV (13).

The actual mechanism of effect of glucose on PONV is not clear. Other studies have indicated that the occurrence of PONV and other postoperative complications depends on the postoperative insulin-resistance; a result of perioperative trauma. Prescription of very powerful solutions during perioperative period may diminish the outcome of night fasting, maintain hepatic glycogen, diminish the stress, and enhance the insulin-sensitivity of tissues (14,15). In our study, intraoperative infusion of intravenous glucose decreased the overall occurrence and severity of PONV and antiemetic usage during 24 postoperative hours. Severity of PONV in the PACU and 3 hours after procedure was lower in the study group compared to the placebo group. Our findings were consistent with their results.

Glucose levels were not different in the investigated groups. In the study of Libiszewski et al, changes in the level of blood sugar were not significantly different after preparation of patients with oral glucose solutions (14). In contrast, in the study of Patel et al, the patients who received the intravenous glucose during the emergence of anesthesia had greater blood sugar level than the placebo group after study, and a greater increase in blood glucose level in beginning and in the end of study (16).

In our study despite equal incidence of postoperative pain in two groups, consumption of analgesic and overall dose of them were significantly different. Tramadol was used more in the placebo group. Statistical analysis showed that PONV was higher in the placebo group. This suggests that there was a correlation between PONV and pain (15).

Limitations of the present study include: need to study the effects of glucose in high-risk patients, other operations, different techniques of anesthesia, and different volumes of glucose solutions. Further studies may clarify the mechanism of effects of glucose on PONV.

Conclusion

According to the results of present study, administration of intravenous dextrose during surgery decreases the frequency and severity of PONV, rescue antiemetic and duration of stay in PACU in the patients undergoing diagnostic gynecologic laparoscopy.

Competing Interests

Authors declare that they have no conflict of interests.

Ethical Issues

This study was approved by the Ethics Committee of Tabriz University of Medical Sciences (approval No.: 92164).

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