PRE-OPERATIVE INTRAVENOUS FLUID SUPPLEMENTS: A SIMPLE AND INEXPENSIVE METHOD TO REDUCE POST-OPERATIVE NAUSEA AND VOMITING AMONG PATIENTS UNDERWENT LAPAROSCOPIC CHOLECYSTECTOMY

Amer M. Amireh MD FRCS, Yaser A. Al-Ghoul MD**, Ibraheem A. Jabir MD***

ABASTRACT

Objective: The aim of this study is to explore the effect of supplemental pre-operative fluids on the incidence of nausea and vomiting that occur post-operatively.

Methods: We studied sixty patients, ASA I-II, undergoing laparoscopic cholecystectomy. Patients were randomly divided into groups A and B; group A (n=30 patients) received no intravenous fluids pre-operatively, whereas group B (n=30 patients) received supplemental fluids (10ml/kg of lactated Ringer's solution) one hour before induction of anaesthesia.

Results: During the first twenty four hours post-operatively, nausea and vomiting occurred in 21 patients (70%) ofrom group A and only in 8 patients (27%) from group B (supplemental fluid group).

Conclusion: Post-operative nausea and vomiting can be reduced by the use of pre-operative supplemental lactated Ringer's solution, which is a cheap and safe therapy.

Key words: Fluid therapy, Hypovolemia, Post-operative nausea, Vomiting

JRMS December 2009; 16(3): 31-35

Introduction

Today, the incidence of postoperative nausea and vomiting (PONV) still appears to be about 38%,[1,2] before the 1960s, when older inhalational anaesthetic agents were widely used, the incidence of PONV was as high as 60%.[3] Despite better anaesthetic techniques along with new generation of anti-emetics and shorter acting anaesthetic drugs the rate was only reduced to 30%,[3] and still it reaches up to 79% in high risk patients.[1,2] The benefit of routine prophylactic anti-emetic treatment has been questioned because anti-emetics may have side effects.[1] Even mild PONV can delay hospital discharge (in fact it is the leading cause of unexpected admission following planned day case surgery),[4] decrease patients' satisfaction and increase use of resources.[5] Avoiding PONV is important to patients, more so than avoiding postoperative pain.[6]

It has been suggested that good oxygenation of patients postoperatively reduces the incidence of nausea and vomiting preventing the subtle intestinal

From the Departments of:
*General Surgery, King Hussein Medical Centre, (KHMC), Amman- Jordan
**Anaesthesia, (KHMC)
Correspondence should be addressed to Dr. A. M Amireh, (KHMC), E-mail: aamireh@hotmail.com
Manuscript received August 26, 2006. Accepted April 5, 2007

ischemia caused by surgery or anaesthesia.[4,7-10] However, if the patient is in low perfusion state, oxygen alone may not be beneficial.[9] Fasting for long periods and bowel preparations without adequate preoperative fluid replacement for surgical patients make them hypovolemic and more prone to postoperative nausea and vomiting.[9]

We performed a prospective, randomized, double blinded study to test the hypothesis of supplemental administration of fluid (lactated Ringer's solution) preoperatively will decrease the incidence of post-operative nausea and vomiting in patients who undergo laparoscopic cholecystectomy.

Lactated Ringer's solution (Hartmann's) is an isotonic intravenous solution, Oone liter of Llactated Ringer's solution contains:

- 130mEq of sodium ion.
- 109mEq of chloride ion.
- 28mEq of lactate.
- 4mEq of potassium ion.
- 3mEq of calcium ion.

Methods

We studied 60 patients who underwent laparoscopic cholecystectomy at Princess Haya Al-Hussein Hospital inAqaba between August 2003 and May 2004. All patients were ASA I-II, were aged 20-81 years and had no previous cardiovascular, hepatic, renal, gastrointestinal or neurological disorders. Patients were asked to fast for 6-8 hours and were operated upon first on the list. Patients who experienced nausea or vomiting on the morning of operation were excluded as well as patients who were delayed till the afternoon for any reason; also patients who already were on anti-emetic drugs were excluded.

Patients were prospectively and randomly divided into two groups: group A patients received no preoperative intravenous fluid supplement, and group B patients were given preoperative intravenous supplemental fluid therapy of lactated Ringer's solution 10ml/kg of body weight. Randomization was performed by the nurse in the pre-operative holding area who picked one of a prearranged and sealed sixty similar envelopes, thirty of which contained the word 'conservative' and the rest contained the sentence 'IV lactated Ringer's solution'. The fluid was administered in the pre-operative holding area before induction of anesthesia.

The patient, the anesthesia provider, the post-operative study investigator and the nurses in recovery area and on the wards were unaware of the patient's group.

A standard anesthetic technique was followed for all patients who included the administration of Midazolam 2mg intravenously followed by Propofol 3mg/kg, fentanyl 1-3mcg/kg, and atracurium 0.5mg/kg. An endotracheal tube was placed and anaesthesia was maintained with sevoflurane 1-2% in 70% nitrous oxide and oxygen. End tidal CO_2 was maintained around 35-40 and SpO_2 above 95%. Nasogastric tube was also inserted for all patients and maintained on low suction throughout the procedure, and removed just before the end of anesthesia. Intraoperative fluid requirements were standardized for all patients (5ml/kg/hour of lactated Ringer's solution).

Monitoring of all patients was also standardized and included ECG, SpO_2, heart rate, blood pressure, capnography, tidal and minute volumes, and end-expiratory concentration of inhaled anaesthetic.

Incremental doses of analgesics, fentanyl 50-100mcg, or morphine 1-2mg were given according to clinical signs. Reversal of neuromuscular blockade was achieved at the end of operation using neostigmine 2.5mg and atropine 1mg.

All patients received 100% oxygen during recovery time, and were given post-operative analgesics as needed during their stay in the recovery room which was around one hour. They were then sent to the ward. No patient was discharged home the same day.

Patients were asked to rate their nausea on a 100mm visual analogue scale (VAS) at 15 minute intervals throughout recovery where 0 equalled no nausea and 100 was the worst imaginable nausea. A score of 50mm or above was considered significant.

Patients were followed up by the investigator to record severity of nausea and occurrence of vomiting after leaving the recovery room till the end of the first 24 hours post-operatively.

Chi-square test was used to examine for the presence of significant differences between the two groups in regard to the rate of nausea and vomiting they experienced protoperatively. Chi-square test was also used to test the difference in the rate of PONV history and smoking between the two groups. The t-test was used to investigate the difference between the two groups for age and weight factors. A probability value of <0.05 was considered statistically significant. Statistical analysis was carried out on SPSS software version 11.

Table I. characteristic of patients in groups A and B

	Group A n=30	Group B n=30	P Value
Age range (mean)	22-79(48)	20-81(46)	0.36
Weight range kg (mean)	50-85(70)	49-88(73)	0.09
Female: Male ratio	22:8	24:6	
History of PONV (%)	7(23%)	6(20%)	0.754
Smoking (%)	6(20%)	8(26%)	0.542

Table II. Duration of anaesthesia and intravenous fluids and drugs given to patients randomly assigned to groups A and B.

	Group A	Group B
Duration of anaesthesia; minutes range(mean)	60-150(102)	45-140(90)
Intravenous fluids:		
Preoperative; ml range(mean)	0	490-880(738)
Intraoperative; ml range(mean)	325-1025(590)	260-885(551)
Propofol; mg range(mean)	150-255(210)	147-264(221)
Intraoperative analgesics:		
Fentanyl; mcg range(mean)	150-270(212)	150-260(217)
Morphine; mcg range(mean)	0-12(7.5)	0-10(6.75)
Postoperative analgesic (0-1 hour):		
Fentanyl; mcg range(mean)	0-100(54)	0-100(45)
Morphine; mg range(mean)	0-10(5.25)	0-10(5.0)
Postoperative analgesic (1-24 hour)		
Morphine; mg range(mean)	0-15(9.5)	5-20(12.75)

Table III. Incidence of post-operative nausea and vomiting in groups A and B (A: no fluid supplement pre-operatively, B: supplemental fluid pre-operatively).

	Group A n=30	Group B n=30	p-value
0-1 hour post-operatively:			
Nausea n (%)	12(40)	4 (13)	0.02
Vomiting n (%)	4 (13)	2(7)	0.09
1-24 h post-operatively:			
Nausea n (%)	17(57)	6(20)	0.004
Vomiting n (%)	5 (17)	2 (7)	0.212
0-24 h postoperatively:			
Nausea n (%)	21(70)	8(27)	0.000
Vomiting n (%)	9 (30)	3 (10)	0.052

Results

Patients' characteristics are shown in Table I. Duration of anesthesia and use of intra-operative intravenous fluids and drugs were almost similar in the two groups (Table II). The incidence of nausea and vomiting is shown in Table III.

The incidence of nausea was higher in group A (conservative) in both categories the 0-1 and 1-24 hours compared to group B (12 vs. 4 P=0.02 and 17 vs. 6 P=0.004 respectively), and was more significant over the whole 24 hours (21 vs. 8 P=0.000).

Though the frequency of vomiting was higher in the conservative group (A) 0-1 hr, 1-24 hrs and 0-24 hrs (4 vs. 2 P=0.09, 5 vs. 2 P=0.212 and 9 vs. 3 P=0.052 respectively) but the difference was not significant in any category.

Discussion

Many controversial articles have been published over the influence of perioperative fluids on PONV, where some papers supported their effect with significant decrease in PONV.[11-14] Other studies were unable to show a significant difference in the

early post-operative period, though some have showed a significant difference only three days postoperatively.[15-18] Apart from very few studies,[14,17] in all the other performed studies, supplemental fluid was administered intra-operatively. Yogendran *et al.*, who administered fluids before induction of anaesthesia, was unable to show a significant difference in the early post-operative period but also reported a decreased incidence of late post-operative nausea. [18] As in previous studies,[14] we saw a significant reduction in the incidence of post-operative nausea and vomiting as well as in the VAS scores during the 24 hours following anaesthesia.

In our study, although we used only 10ml/kg of preoperative fluid supplement and still we were able to identify a significant decrease in the rate of nausea within the first 24 hours from 57% to 20% (1-24hr, *P=0.004)* and from 70% to 27% (0-24hrs, *P=0.000)*. There was also a significant difference in the incidence of nausea up to one hour from 40% to 13% (*P=0.02)*, but this observation was not significant in the previous studies. As for vomiting, though there was a drop in the rate of vomiting in all categories (0-1 hour 13% to 7% *P=0.09*, 1-24 hours 17% to 7% *P=0.212*, and in 0-24 hours 30% to 10% *P=0.052)*, the drop was not significant.

Another noticeable observation in our study was that while the other studies were mainly of minor outpatient procedures, our study was on patients undergoing laparoscopic cholecystectomy, and were at higher risk of postoperative nausea and vomiting because they all underwent the procedure under general anesthesia, were mainly females, non-smokers and received postoperative opioids. These four factors themselves have been confirmed by Apfel and Stadler to be significant risk factors for postoperative nausea and vomiting.[2,19]

Many theories have been proposed to explain how fluid therapy reduces nausea, one theory suggested that perioperative hypo-perfusion of the gut mucosa and consequent ischemia might be one of the causes of post-operative nausea and vomiting.[18] Gut ischemia is common during anaesthesia and surgery, and results in release of serotonin, which is one of the most potent triggers of nausea and vomiting.[18]

Mythen and Webb showed that perioperative plasma volume expansion reduced the incidence of abnormal intramucosal pH in patients having elective cardiac surgery, and was associated with improved outcome.[10] It was also found that administration of additional oxygen decreases the incidence of post-operative nausea and vomiting.[7,8] However, even supplemental oxygen fails to increase tissue oxygenation during hypovolaemia.[7,8]

Most of our patients become hypovolaemic before induction of anaesthesia due to overnight fasting, especially in those with bowel preparation. *Euvolaemia* is often not re-established until the post-operative period. Supplemental fluid load before start of anaesthesia most likely decreases the volume deficit, thereby promoting *euvolaemia*. A positive effect on splanchnic perfusion might inhibit the impending intestinal ischemia.[20]

In conclusion, post-operative nausea and vomiting can be reduced by the use of pre-operative supplemental lactated Ringer's solution, which is a cheap and safe therapy.

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