Safety and Feasibility of Early Oral Hydration in the Postanesthesia Care Unit After Laparoscopic Cholecystectomy: A Prospective, Randomized, and Controlled Study

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Purpose: *To assess the safety and feasibility of early oral hydration (EOH) in the postanesthesia care unit (PACU) after laparoscopic cholecystectomy.*
Design: *Prospective, randomized, controlled trial.*
Methods: *Patients were randomly assigned to the EOH group or the conventional oral hydration (COH) group. Outcomes were the incidence of nausea and vomiting, thirst scale, incidence of oropharyngeal discomfort, and patient satisfaction.*
Findings: *Compared with the COH group, the EOH group had lower incidence of nausea before and after the first drink in the ward ($P < .05$); lower incidence of vomiting before and after the first drink in the ward ($P < .05$); lower thirst scale when patients were transferred out of the PACU ($P < .05$) and at 6 hours postoperatively ($P < .05$); and greater patient satisfaction on postoperative day 1 ($P < .05$).*
Conclusions: *Early oral hydration in the PACU following laparoscopic cholecystectomy was safe and well-tolerated.*

Keywords: *oral hydration, postanesthetic care, RCT, laparoscopic cholecystectomy.*

POSTOPERATIVELY, PATIENTS OFTEN RECEIVE nothing by mouth for several hours or days under conventional protocols. In our setting, patients were allowed to drink from 4 to 6 hours postoperatively. As the enhanced recovery after surgery model has been popularized in recent years, oral

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hydration up to 2 hours before surgery has been recommended[1] and minimizing discontinuation of oral hydration has been encouraged.[2] The administration of oral hydration 2 hours after the completion of cesarean section under regional anesthesia is reportedly safe and well tolerated.[3] Even earlier than 2 hours in the postoperative period, oral hydration did not increase the occurrence of postoperative nausea and vomiting (PONV) or inhibit gastric peristalsis.[4,5] Not only that, it has become accepted that early oral hydration (EOH) in the postoperative period can promote early recovery and prevent postoperative ileus.[6,7]

Patients often first arrive in the postanesthesia care unit (PACU) after surgery. Yin et al[8] found that nondigestive tract surgical patients who received oral hydration in the PACU had a decreased risk of vomiting. However, it remains uncertain whether EOH in the PACU is possible after abdominal surgeries. Hence, to further assess the safety and feasibility of EOH in the PACU, we chose laparoscopic cholecystectomy patients in this study because the operation had minimal impact on gastrointestinal function.

Methods

Design and Participants

This was a prospective, randomized, controlled trial. The study was approved by the Institutional Review Board of West China Hospital, Sichuan University. Patients in the PACU who had undergone elective laparoscopic cholecystectomy from February 2015 to August 2017 in West China Hospital, Sichuan University, were screened. Patients were included only if they had a desire to drink. Patients with intestinal obstruction, dysphagia, diabetes mellitus, history of PONV, or an American Society of Anesthesiologist physical status III or above were excluded. The exit criterion was patient refusal to continue in the study. We interviewed patients and explained the study the day before surgery. Patients included were provided written informed consent in the next day.

Interventions

According to a computer-generated random number list concealed in opaque envelopes, patients were randomly assigned to the EOH group or the conventional oral hydration (COH) group. Both groups received plain water by mouth. Patients in the EOH group were administered water by nurses in the PACU if they were evaluated as fully conscious, with stable vital signs, grade 5 muscle strength, and well-recovered cough and swallowing reflex. Total water volume was restricted to 3 mL/kg. The first test volume of water administered was 1 to 5 mL. If this test volume did not result in any adverse event, such as coughing, patients were permitted to drink the remaining volume of water by themselves. Patients in the COH group could not drink water until 4 hours postoperatively. Follow-up and assessment of the outcomes were performed by specially assigned nurses who were blinded to the interventions.

Outcomes

Primary outcomes were the incidence of PONV and thirst scale score. Thirst scale was represented by a 0- to 100-mm verbal numeric scale (0 indicated no thirst, and 100 indicated severe thirst). Patients gave a score according to their own feeling of thirst. Secondary outcomes were the incidence of oropharyngeal discomfort and patient satisfaction. Nausea and vomiting were recorded during the PACU stay and before and after the first drink on the ward. Thirst scale and incidence of oropharyngeal discomfort were assessed at three time points: when participants were transferred to the PACU, when they were transferred out of the PACU, and at 6 hours postoperatively. Patient satisfaction was assessed on postoperative day 1 on a scale of 0 to 10. A score of 10 was regarded as satisfaction.

Statistical Methods

Continuous variables were expressed as the mean ± SD. The Student t test was used to compare continuous variables. Categorical variables were expressed as the number of events (percentage). The χ^2 analysis was used for categorical variables. $P < .05$ was considered statistically significant. Data were analyzed with SPSS, version 18.0 (SPSS Inc, Chicago, IL).

Results

A total of 2,000 patients were screened, 86.8% of which (1,735 of 2,000) had a desire to drink while in the PACU. Hence, a final total of 1,735 patients were included in this study (Figure 1). The demographic, anesthetic, and surgical data are summarized in Table 1. There were no significant differences between groups in age, sex, weight, American Society of Anesthesiologist physical status, preoperative fasting duration, anesthetic duration, operation duration, or intraoperative fluid infusion volume. There were also no significant differences between the two groups in medications administered during anesthesia (Table 2).

Compared with COH group, nausea was experienced by fewer patients in EOH group before the first drink on the ward (53 of 868 in COH group vs 32 of 867 in EOH group; $P = .020$) as well as after the first drink on the ward (46 of 868 in COH group vs 23 of 867 in EOH group; $P = .005$). EOH group patients also had a lower incidence of vomiting before the first drink on the ward (29 of 868 in COH group vs 15 of 867 in EOH group; $P = .033$), as well as after the first drink on the ward (31 of 868 in COH group vs 14 of 867 in EOH group; $P = .010$) (Table 3).

The thirst scale results in EOH group were significantly lower than in COH group when patients were transferred out of the PACU (37.51 ± 28.44 in EOH group vs 61.31 ± 33.21 in COH group; $P = .000$) as well as at 6 hours postoperatively (67.70 ± 32.29 in EOH group vs 80.59 ± 27.55 in COH group; $P = .000$) (Table 4).

When transferred to the PACU, more patients in EOH group complained of oropharyngeal discomfort than patients in COH group (371 of 867 in EOH group vs 313 of 868 in COH group; $P = .004$), but after EOH in the PACU, the EOH group had no more incidence of oropharyngeal discomfort than the COH group patients when patients were transferred out of the PACU (203 of 867 in EOH group vs 221 of 868 in COH group; $P = .321$), as well as at 6 hours postoperatively (158 of 867 in EOH group vs 169 of 868 in COH group; $P = .507$) (Table 4).

On postoperative day 1, satisfaction was reported by 822 of 867 (94.8%) in the EOH group and 799 of 868 (92.1%) in the COH group ($P = .020$).

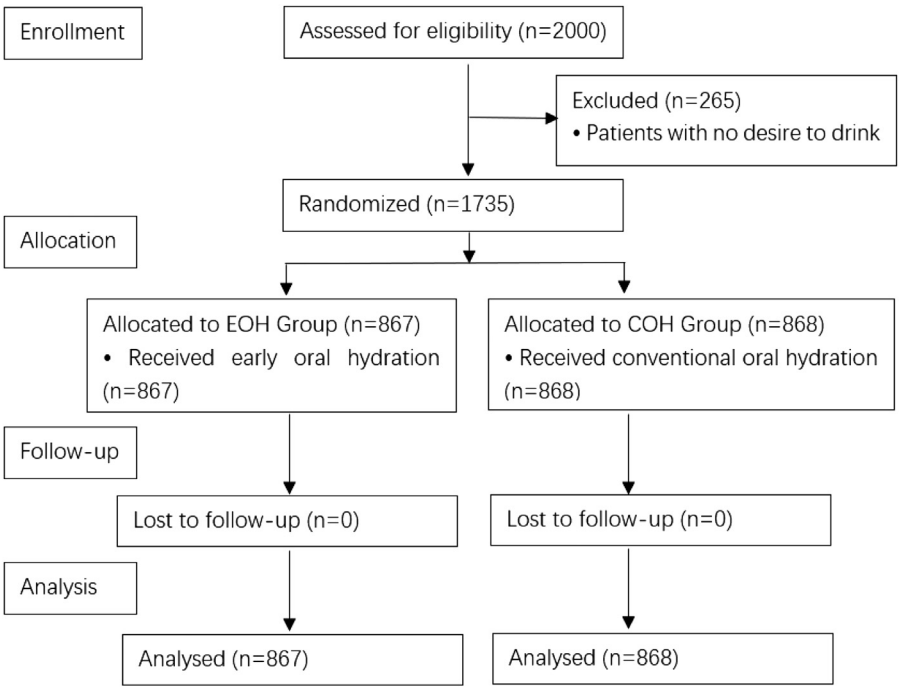

Figure 1. Flow diagram. EOH group, early oral hydration group; COH, conventional oral hydration group.

Table 1. Demographic, Anesthesia, and Surgical Information (N = 1,735)

	EOH Group (n = 867)	COH Group (n = 868)	P
Age (y); mean ± SD	46.10 ± 12.29	47.00 ± 12.08	.126
Sex (n, %)			
Male	311 (35.9)	299 (34.4)	.535
Female	556 (64.1)	569 (65.6)	
Weight (kg); mean ± SD	62.04 ± 10.50	62.08 ± 10.53	.932
Nonsmoking status, n (%)	570 (65.7)	591 (68.1)	.300
Anesthesia type, n (%)			
Intravenous-inhalation combined anesthesia	370 (42.7)	346 (39.9)	.234
Total intravenous anesthesia	497 (57.3)	522 (60.1)	
ASA physical status, n (%)			
I	47 (5.4)	42 (4.8)	.583
II	820 (94.6)	826 (95.2)	
Preoperative fasting duration (h); mean ± SD	14.88 ± 4.62	15.17 ± 4.24	.166
Operation duration (min); mean ± SD	47.41 ± 20.63	47.08 ± 21.29	.744
Anesthesia duration (min); mean ± SD	85.33 ± 26.52	84.34 ± 27.35	.445
Intraoperative fluid infusion volume (mL); mean ± SD	566.59 ± 251.25	582.36 ± 300.74	.236

EOH, early oral hydration; COH, conventional oral hydration group; ASA, American Society of Anesthesiologist.

Discussion

In most enhanced recovery after surgery protocols, patients are allowed to drink clear liquids or fluids containing carbohydrates 2 hours before surgery.[9-13] However, the actual fasting time used globally is much longer.[14-18] In our study, we also found that the average preoperative fasting time was approximately 15 hours. Almost all the patients who participated in this study had fasted from the night before the operative day. Therefore, 86.8% of patients desired a drink after surgery.

Table 2. Medications During Anesthesia (N = 1,735)

	EOH Group (n = 867), n (%)	COH Group (n = 868), n (%)	P
Propofol	867 (100)	868 (100)	—
Opioids	867 (100)	868 (100)	—
Tramadol	540 (62.3)	578 (66.6)	.061
Dezocine	17 (2.0)	20 (2.3)	.621
Sevoflurane	357 (41.2)	333 (38.4)	.231
Desflurane	13 (1.5)	13 (1.5)	.998
Midazolam	779 (89.9)	774 (89.2)	.644
Neostigmine	503 (58.0)	497 (57.3)	.749
Dexamethasone	57 (6.6)	59 (6.8)	.853
Antiemetics	778 (89.7)	770 (88.7)	.491

EOH, early oral hydration; COH, conventional oral hydration.

In our study, oral hydration under the guidance of nurses in the PACU obviously relieved thirst and improved patient satisfaction. This result was similar to that reported in a previous study by Yin et al[8] in which EOH patients undergoing nongastrointestinal surgery had a lower thirst scale score and greater satisfaction. Furthermore, we found a significant difference between the EOH and COH groups in oropharyngeal discomfort at the time that patients were transferred into the PACU. Oropharyngeal discomfort was likely to be induced by fasting or intubation and was often alleviated without intervention. However, this symptom was alleviated faster in the EOH group than the COH group when oral hydration was provided in the PACU. A previous study by Yin et al[8] also indicated the benefit of EOH in the PACU in alleviating oropharyngeal discomfort.

There was a lower incidence of PONV in our study compared with a previous study by Larsson and Lundberg,[19] as most patients were administered antiemetics or dexamethasone before being transferred to the PACU. Surgical factors can be associated with PONV. Emetogenic surgeries can include inner ear surgery, intracranial surgery, strabismus repair, and breast surgery. In this study, we limited participants to laparoscopic cholecystectomy patients. Independent risk factors for PONV include female gender, nonsmoking status, history of PONV, surgical duration, and use of opioids,

Table 3. Risk of Nausea and Vomiting (N = 1,735)

	EOH Group (n = 867), n (%)	COH Group (n = 868), n (%)	P
Risk of nausea, n (%)			
In PACU	54 (6.2)	70 (8.1)	.138
Before first drink on ward	32 (3.7)	53 (6.1)	.020*
After first drink on ward	23 (2.7)	46 (5.3)	.005*
Risk of vomiting, n (%)			
In PACU	2 (0.2)	5 (0.6)	.257
Before first drink on ward	15 (1.7)	29 (3.3)	.033*
After first drink on ward	14 (1.6)	31 (3.6)	.010*

EOH, early oral hydration; COH, conventional oral hydration; PACU, postanesthesia care unit.
*$P < .05$ was considered statistically significant.

volatile anesthetics, or large dose of neostigmine.[20] Because patients with a history of PONV were excluded from our study, all the rest of the aforementioned factors were not significantly different between the two groups (Tables 1 and 2). Therefore, we concluded that compared with COH, EOH under the guidance of nurses in the PACU may decrease the incidence of PONV in the ward.

We restricted the total intake of oral fluid in the PACU to avoid potential adverse events such as aspiration and vomiting. A previous study in which the amount of oral fluid was restricted to 0.5 mL/kg reported no adverse events.[8] Therefore, we increased the amount of fluid permitted in our study. According to patient demand, we provided the participants with a maximum of 3 mL/kg of plain water. Using this amount of water was safe and well tolerated in all patients.

Our study demonstrated the safety and feasibility of EOH in the PACU in laparoscopic cholecystectomy patients as was similar to a previous systematic review by Myles et al,[21] who suggested transitioning to oral fluids as soon as possible after major surgery. However, our study had some limitations. First, it was difficult to confirm the influence of EOH on postoperative recovery and duration of hospitalization. As the participants in the present study were laparoscopic cholecystectomy patients who had undergone a minimally invasive procedure, they typically stayed only 1 day in the hospital. However, another study reported that early enteral feeding benefitted the patients' recovery and shortened the duration of hospitalization.[22] Second, because of the minimally invasive nature of the laparoscopic cholecystectomy procedure, the present results may not apply to other major gastrointestinal surgeries.

Conclusions

EOH in the PACU was safe and well tolerated in laparoscopic cholecystectomy patients. EOH in the PACU helped to relieve the thirst, decreased the frequency with which PONV occurred, and enhanced patient satisfaction in the early postoperative period.

Table 4. Thirst Scale and Risk of Oropharyngeal Discomfort (N = 1,735)

	EOH Group (n = 867)	COH Group (n = 868)	P
Thirst scale (mean, SD)			
When patients transferred in PACU	58.68 ± 32.05	56.84 ± 36.09	.261
When patients transferred out to ward	37.51 ± 28.44	61.31 ± 33.21	.000*
At 6 h after operation	67.70 ± 32.29	80.59 ± 27.55	.000*
Risk of oropharyngeal discomfort, n (%)			
When patients transferred in PACU	371 (42.8)	313 (0.6)	.004*
When patients transferred out to ward	203 (23.4)	221 (3.3)	.321
At 6 h after operation	158 (18.2)	169 (3.6)	.507

EOH, early oral hydration; COH, conventional oral hydration group; PACU, postanesthesia care unit.
*$P < .05$ was considered statistically significant.

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