Should Adult Patients Drink Fluids Before Discharge From Ambulatory Surgery?

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We studied 726 consenting patients to determine whether withholding oral fluids from adult ambulatory surgical patients before discharge would decrease the incidence of postoperative nausea and vomiting (PONV) and shorten the duration of stay in the ambulatory surgery unit (ASU). Patients were randomly assigned to the drinking or nondrinking group. Both groups received a standard regimen of general anesthesia, fluid replacement, and analgesia. In the ASU, patients in the drinking group were given mandatory oral fluids to drink before discharge. Nausea and pain were assessed by using a visual analog scale 15, 30, 60, 90, 105, 120, 150, and 180 min postoperatively. The time to drink, sit up, void, and ambulate, and the time until discharge were recorded. Patients were interviewed by telephone 24 h postoperatively. There was no significant difference in the frequency of PONV between the drinking and the nondrinking groups either in the hospital or after discharge. Patients in the drinking group required more time to begin ambulating (105 ± 38 vs 98 ± 34 min; $P < 0.02$) and to void (112 ± 40 vs 105 ± 37 min; $P < 0.01$). Patients in the drinking group also stayed in the ASU longer (85 ± 49 vs 81 ± 47 min; $P < 0.03$). Time to postanesthetic discharge was also significantly longer in the drinking group than the nondrinking group (106 ± 40 vs 98 ± 36 min; $P < 0.015$). A similar percentage of patients in both groups were "very satisfied" with their ambulatory surgical care. There was no difference in postoperative complications and need for medical help. Withholding early postoperative oral fluids facilitated earlier ambulation and decreased the stay in the ASU but did not decrease the incidence of PONV. Thus, in this ambulatory surgical population, there does not seem to be justification to require drinking before discharge. **Implications:** To answer the question of whether adult outpatients should drink before discharge after minor surgical procedures, 726 patients were randomized to either drink approximately 150 mL of liquid or not to drink. Neither drinking nor nondrinking worsened postoperative nausea or vomiting or prolonged hospital stay. Therefore, patients should be allowed to choose whether they drink before discharge.

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Postoperative nausea and vomiting (PONV) is one of the most common problems in ambulatory surgical patients (1–3), causing unanticipated admission and readmission after discharge. Although new antiemetic and anesthetic drugs such as propofol have decreased the incidence of PONV, it is still prevalent (4). Patients who experience PONV after surgery suffer substantial distress and impairment (2,5). Furthermore, delayed discharge from the ambulatory surgical unit (ASU) and possible admission and readmission of patients increase the cost of healthcare.

PONV is a complex reflex that has afferent, humoral, and motor components and involves many different transmitters, peptides, and hormones. PONV can be produced by stimulation from the gastrointestinal tract or from more than one site (6). The first postoperative oral intake might precipitate vomiting (7–9) and increase the incidence of PONV (10). PONV may be reduced in pediatric patients by restricting oral fluids before discharge (2,11,12). Therefore, cessation of drinking has been suggested as a discharge criterion for home readiness after ambulatory surgery (13).

The purpose of this study was to determine whether withholding oral fluids from adult ambulatory surgical patients before discharge would decrease the incidence of PONV and shorten the duration of stay in the ASU. We also determined the satisfaction of the patients who did not drink after ambulatory anesthesia and the rates of complications in the drinking and nondrinking groups.

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Methods

With approval from the hospital ethics committee, informed consent was obtained from 726 ASA physical status I and II ambulatory surgical patients between 18 and 60 yr of age scheduled to undergo dilation and curettage of the uterus, diagnostic laparoscopy of the uterus and lysis of adhesions, arthroscopic procedures, and minor superficial procedures. All patients fasted overnight. Patients who had a history of diabetes, epilepsy, dyspepsia/reflux, bleeding disorder, renal impairment, asthma, motion sickness, or previous PONV or who were morbidly obese (body mass index >35) were excluded from the study. Patients were selected for the drinking group or the nondrinking group by using a random number table. Both groups received a standard regimen of general anesthesia, fluid replacement, and analgesia. Anesthesiologists were blinded to the treatment assignment of patients, all of whom were monitored for blood pressure, electrocardiogram, oxygen saturation, and capnography and gas analysis when appropriate. Anesthesia was induced with fentanyl 1.5 μg/kg or alfentanil 8–10 μg/kg IV and propofol 2–3 mg/kg. Anesthesia was maintained with 33% O_2 in 66% N_2O and end-tidal isoflurane 0.5%–1% titrated to ensure an adequate depth of anesthesia. An oropharyngeal or laryngeal mask airway was used as needed. For patients requiring endotracheal intubation, muscle relaxation was achieved with mivacurium or vecuronium, and normocarbia was achieved by mechanical ventilation. The residual neuromuscular block was reversed with neostigmine 50 μg/kg and glycopyrrolate 8 μg/kg IV.

Demographic data, including age, gender, height, and weight, were recorded, as were intraoperative anesthetic drugs and the type and duration of surgery. After surgery, all patients were taken to the postanesthesia care unit (PACU), where they remained until they fulfilled PACU discharge criteria (Aldrete score ≥9) (14). On arrival in the ASU, patients in the drinking group were given mandatory oral fluids (200 mL of apple juice, tea, or coffee) to drink. Another 100 mL of oral fluid was provided on the patient's demand. Patients were not required to consume the entire volume. There was no time limit set for the patients to consume these liquids.

Postoperatively, the amount of intraoperative and postoperative IV fluids given was recorded. Analgesia was provided with oral acetaminophen tablets for mild pain, oral acetaminophen with 30 mg codeine for moderate pain, and 2–4 mg morphine IV for severe pain. Prophylactic antiemetics were not given to any patients. When patients complained of nausea or vomiting, they were treated with 25–50 mg of dimenhydrinate IM or IV. Nausea and pain were assessed by using a visual analog scale (VAS) 15, 30, 60, 90, 105, 120, 150, and 180 min postoperatively. The modified Postanesthesia Discharge Scoring System (PADS), in which a numeric score of 0, 1, or 2 is given every 15 min for vital signs, ambulation, nausea and vomiting, pain, and bleeding, was used until a score ≥9 was achieved (9). The times required to resume drinking, sitting, voiding, and ambulating, and the time until discharge were also recorded. At 24 h postoperatively, patients were interviewed by telephone regarding nausea and vomiting during travel home or at home, and information relating to any medical assistance required (e.g., phoning hospital, returning to emergency room, contacting family physician). They were also asked about the time when they resumed drinking and eating and their satisfaction with their ambulatory surgical care. Nondrinking patients were asked whether they would go home without drinking after surgery in the future if withholding oral fluids resulted in less sickness.

Our original assumption was that the incidence of nausea and vomiting would be 20% in the drinking group. To observe a 40% decrease (i.e., from 20% to 12%) with an α level of 0.05 and a power of 80%, 706 patients—353 in each group—was needed. The data were analyzed by using unpaired t-tests or Wilcoxon's ranked sum test, where appropriate, for continuous variables, χ^2 or Fisher's exact test was used, where appropriate, for categorical variables. The reported P values were not adjusted for multiple comparisons. The analysis was completed by using SAS statistical software, version 6.12.

Results

A total of 726 patients were enrolled in the study—355 were assigned to the drinking group and 371 to the nondrinking group. In the drinking group, 33 patients ate food postoperatively; in the nondrinking group, 83 patients changed their minds and drank fluids—13 ate food postoperatively. Of the patients who completed the study, telephone interviews 24 h after surgery were successful with 635 patients (87.5%).

The demographic characteristics, clinical variables, frequency distribution of the intraoperative airway management techniques, and types of surgery were similar in the drinking and nondrinking groups (Table 1). There was no difference in the doses of intraoperative anesthetic drugs or postoperative medication between the two groups (Table 2). Patients in the drinking group consumed 150 ± 56 mL of liquid at 69 ± 29 min, whereas the elective drinkers in the nondrinking group consumed 143 ± 57 mL of liquid at 86 ± 44 min, respectively. The cumulative proportion and the number of patients with nausea or vomiting postoperatively in the PACU and the ASU did not differ significantly between the drinking and nondrinking groups (Table 3) (Figure 1).

Table 1. Characteristics of Patients and Procedures Performed

	Drinking group (n = 355)	Nondrinking group (n = 371)
Age (yr)	29.5 ± 9	29.3 ± 9
Body mass index (kg/m^2)	24 ± 5	24 ± 6
Gender (M/F)	26/329	26/345
NPO (h)	13.6 ± 2	13.3 ± 2
Intraoperative IV fluid received (mL)	328 ± 203	326 ± 197
Postoperative IV fluid received (mL)	349 ± 197	350 ± 182
Type of surgery		
Suction dilation and curettage	282 (79.4)	309 (83.3)
Arthroscopy[a]	34 (9.6)	26 (7.0)
Laparoscopy	28 (7.9)	30 (8.1)
Shoulder arthroplasty	4 (1.1)	1 (0.3)
Hysteroscopy	3 (0.8)	3 (0.8)
Nerve repair	3 (0.8)	0
Excision of lump	0	2 (0.5)
Hardware removal	1 (0.3)	0
Airway management		
No device	282 (79.4)	308 (83.0)
Orotracheal	47 (13.2)	37 (10.0)
Laryngeal mask	26 (7.3)	26 (7.0)

Values are expressed as mean ± SD or n (%).
NPO = nothing by mouth.
[a] Arthroscopy of knee, shoulder, elbow, or ankle.

Table 2. Intraoperative and Postoperative Medications

	Drinking group	Nondrinking group
Intraoperative		
Propofol (mg)	187 ± 49 (355)	187 ± 58 (371)
Fentanyl (μg)	72 ± 40 (296)	69 ± 36 (315)
Alfentanil (μg)	579 ± 157 (48)	598 ± 174 (51)
Postoperative		
Acetaminophen (tablets)	2.0 ± 0.0 (22)	1.9 ± 0.2 (31)
Acetaminophen with 30 mg of codeine (tablets)	1.8 ± 0.4 (131)	1.8 ± 0.4 (147)
Dimenhydrinate (mg)	32 ± 12 (28)	32 ± 16 (32)
Morphine (mg)	5.8 ± 3.9 (51)	5.6 ± 3.8 (45)

Values are expressed as mean ± SD (n).

Table 3. Frequency of Nausea, Vomiting, and Other Complications and Duration of Stay in the PACU and the ASU

	Drinking group (n = 355)	Nondrinking group (n = 371)	Relative risk (95% CI)	P value
PACU				
Nausea	28 (7.9)	35 (9.4)	1.20 (0.74–1.92)	0.46
Vomiting	6 (1.7)	5 (1.4)	0.80 (0.25–2.59)	0.71
Complications[a]	17 (4.8)	16 (4.3)	0.90 (0.46–1.75)	0.76
Duration of stay (min)	52 ± 21	49 ± 19		0.10
ASU				
Nausea	29 (8.2)	31 (8.4)	1.02 (0.63–1.66)	0.93
Vomiting	6 (1.7)	8 (2.2)	1.28 (0.45–3.64)	0.65
Complications[a]	26 (7.3)	31 (8.4)	1.14 (0.69–1.88)	0.61
Duration of stay (min)	85 ± 49	81 ± 47		0.028
Discharge	137 ± 56	130 ± 53		0.024
Sit	72 ± 41	68 ± 36		0.31
PADS ≥9	106 ± 40	98 ± 36		0.015
Walk	105 ± 38	98 ± 34		0.022
Void	112 ± 40	105 ± 37		0.016

[a] Complications include dizziness, bleeding, excessive pain, low blood pressure, cough, urinary retention, skin rash, seizure, and bradycardia.
Values are expressed as mean ± SD or n (%).
PACU = postanesthesia care unit, ASU = ambulatory surgery unit, CI = confidence interval, PADS = Postanesthesia Discharge Scoring System.

The mean VAS scores for nausea was similar between the two groups. However, the drinking patients stayed in the ASU significantly longer than nondrinking patients (85 ± 49 vs 81 ± 47 min; $P = 0.03$) (Table 3). The cumulative frequency of patients reaching PADS score 9 in the postoperative period was similar in the drinking and nondrinking groups (Figure 1). Patients in the drinking group required a significantly longer time to reach PADS score 9 (106 ± 40 vs 98 ± 34 min; $P \leq 0.015$), to ambulate (105 ± 38 vs 98 ± 34 min; $P \leq 0.022$), and to void (112 ± 40 vs 105 ± 37 min; $P \leq 0.016$) than the patients in the nondrinking group (Table 3).

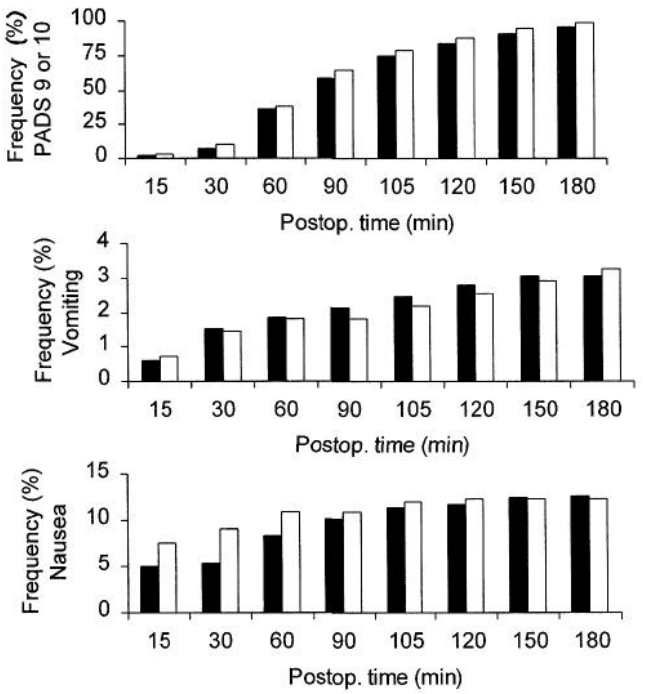

Figure 1. Cumulative frequency of patients with postanesthesia discharge score (PADS) ≥9, nausea, and vomiting. Black bars = drinking group, white bars = nondrinking group.

There was a significantly higher response rate to the telephone interview in the nondrinking group than in the drinking group (90% vs 85%; $P < 0.03$). The incidence of nausea and vomiting during travel home or during the first 24 h postoperatively was not different between the drinking and nondrinking groups (Table 4). There was no difference in time to return to drinking and eating between the two groups (Table 4). The proportion of patient satisfaction with the ambulatory surgical care was similar in the drinking and nondrinking groups. No patient in the drinking group was dissatisfied or very dissatisfied, but one patient in the nondrinking group was very dissatisfied (Table 4). In the nondrinking group, 64.4% patients said that, in the future, they would go home without drinking after surgery. There were no differences in the postoperative complications or in the need for medical help (Table 4). No unanticipated admission or readmission was reported.

Repeating the analysis to exclude patients who ate postoperatively from the drinking group and those who drank or ate from the nondrinking group revealed results similar to those reported above. Similar analysis for patients undergoing dilation and curettage showed that there were very similar results between the drinking and the nondrinking groups. For

Table 4. Results of the 24-Hour Postoperative Interview

	Drinking group (n = 301)	Nondrinking group (n = 334)	Relative risk (95% CI)
Nausea during travel home	44 (14.6)	46 (13.8)	0.94 (0.64–1.38)
Vomiting during travel home	11 (3.7)	6 (1.8)	0.49 (0.18–1.31)
Nausea at home	35 (11.6)	39 (11.7)	1.00 (0.65–1.54)
Vomiting at home	14 (4.7)	12 (3.6)	0.77 (0.36–1.64)
Time to drink (min)	256 ± 115	271 ± 104	
Time to eat (min)	306 ± 121	316 ± 123	
Patient satisfaction			
Very satisfied	260 (86.4)	294 (88.0)	
Satisfied	38 (12.6)	36 (10.8)	
Neither satisfied nor dissatisfied	3 (1.0)	3 (0.9)	
Dissatisfied	0	0	
Very dissatisfied	0	1 (0.3)	
Prepared to go home after surgery without drinking	151 (50.2)	215 (64.4)*	1.28 (1.12–1.47)
Medical help needed			
Phoned hospital	2 (0.7)	3 (0.9)	
Went to ER	0	0	
Contacted family doctor	3 (1.0)	3 (0.9)	

Values are expressed as mean ± SD or n (%).
CI = confidence interval, ER = emergency room.
* Significantly different from the drinking group ($P < 0.0004$).

the patients undergoing other surgical procedures, the time to discharge (182 ± 74 vs 159 ± 63 min; $P = 0.06$), to walk (139 ± 47 vs 123 ± 40 min; $P = 0.052$), and to void (150 ± 47 vs 134 ± 47 min; $P = 0.06$) tended to be different. When the elective drinkers who broke the protocol for the nondrinking group were compared with those in the drinking group and with those in the nondrinking group who followed the protocol, there were no differences in the incidences of PONV.

Discussion

In our randomized study of adult ambulatory surgical patients, withholding early postoperative oral fluids did not decrease the incidence of PONV during the stay in the ASU. Furthermore, there was no significant difference in the incidence of PONV in the first 24 h postoperatively. In a nonrandomized study of 200 ophthalmic patients, postoperative restriction of oral fluids did not decrease the incidence of vomiting (15). There was also no difference in PONV in a retrospective study of 50 patients undergoing cesarean section who did or did not receive oral fluid immediately (16). Our study showed that neither drinking nor not drinking had any effect in the incidence of PONV for those ambulatory patients who underwent minor surgical procedures.

However, in pediatric ambulatory surgical patients, those who were required to drink clear liquids had a 50% higher incidence of PONV than did the elective drinkers, who were allowed, but not required, to drink (12). The discrepancies between our study and the pediatric study may be due to differences in study design and different populations, surgical procedures, and incidences of PONV. In our study, the drinking group was compared with the nondrinking group of adult ambulatory patients who had a relatively low incidence of PONV. In the pediatric study, mandatory drinkers were compared with elective drinkers who had a relatively high incidence of PONV. However, when making a comparison between the elective drinkers (patients assigned to nondrinking group who chose to drink postoperatively) and drinking group patients (mandatory drinkers) in our study, we did not find any difference in the incidence of PONV. One possible reason is that postoperative drinking might have different effects on PONV in adult and pediatric populations. This requires further study in different surgical populations.

The incidence of PONV is affected by a range of factors, such as the type of surgery, type of anesthesia, patient characteristics, and other factors (17). A 1957 study of 2200 patients undergoing various surgical procedures found that most of the vomiting occurred when the patients recovered consciousness, complained of thirst, and had a large drink of water or fruit juice (7). However, the study did not include a control population of patients who did not drink, so the conclusion that postoperative drinking increases the incidence of PONV cannot be arrived at based on these results. In our study, the incidence of nausea in surgical patients undergoing dilation and curettage decreased from the PACU to the ASU regardless of whether the patients drank. However, the incidence of nausea in the patients who underwent other surgical procedures was increased. Therefore, the effects of drinking on PONV may be caused by different surgical procedures, rather than by drinking fluids *per se.*

In our study, withholding early oral fluids slightly prolonged the duration of stay in the ASU. The time to arrive at a discharge score ≥9, the time to ambulate, and the time to void were statistically longer in the drinking group than in the nondrinking group. However, the small difference in time interval may not be of any clinical significance. In addition, these differences were not present in patients undergoing dilation and curettage but more apparent in patients undergoing other ambulatory surgical procedures. Therefore, the longer stay in the drinking group was more likely caused by the different surgical procedures than by drinking fluids. Another possibility is that drinking fluids prolonged the hospital stay in patients who underwent procedures other than dilation and curettage. Therefore, further study in different ambulatory surgical procedures with potentially higher incidences of PONV is required.

The ability to tolerate oral fluids as a clinical criterion for home readiness remains controversial (13,18). The ability to tolerate oral fluids, the ability to ambulate, and the level of hydration are considered unique to ambulatory surgical patients (19). Patients are required to tolerate oral liquids before discharge to ensure that they will be able to take their medication at home and to minimize the potential for readmission because of dehydration (20).

Should patients be required to drink before discharge after ambulatory surgery? Our study showed that drinking or nondrinking before discharge has similar effects on the incidence of PONV, and 99% of patients were satisfied regardless of whether they drank fluids in the early postoperative period. In the follow-up, 64.4% patients in nondrinking group intended to go home without drinking after surgery in the future, which suggests that the practice of withholding oral fluids would be acceptable to most ambulatory patients.

Children can be safely discharged after ambulatory surgery without drinking (12). The experience with approximately 20,000 pediatric ambulatory surgical patients in The Children's Hospital of Philadelphia further verified the safety of this practice (21). Our study confirms that adult ambulatory surgical patients do not suffer any adverse effects when drinking is

eliminated as a discharge criterion. No patient was readmitted for PONV or any other complication. However, the results were obtained in a relatively select group of patients in whom the baseline incidence of PONV was relatively low. Given the small difference in PONV, there does not seem to be a justification for requiring drinking in this population.

In a previous study, we found that a large infusion of fluid (20 mL/kg) perioperatively significantly reduced the incidence of thirst, nausea, dizziness, and drowsiness and thus expedited discharge (22). However, in this study, we found that oral fluid hydration postoperatively did not have the same advantage. The apparent contradiction in results was due to the difference in methodology of hydration and the amount of hydration. In our previous study, almost 10 times the amount of fluids was used. Furthermore, the fluids were given IV perioperatively, whereas the fluids in this study were given orally in the postoperative period.

Several aspects of the study design deserve special comment. First, the baseline incidence of PONV in this study population was relatively low. The low incidence of PONV limited us only to detect a 100% increase in PONV between the drinking and nondrinking groups for this current sample size of 726 patients. Another limitation is that the study population was a limited subset of potential ambulatory surgical patients. The results could be different in ambulatory surgical patients undergoing different surgical procedures.

In conclusion, withholding early postoperative oral fluids from adult ambulatory surgical patients does not decrease the incidence of PONV in ambulatory facilities and 24 h postoperatively. Eliminating oral fluid intake from the discharge criteria can slightly shorten the stay in the ASU without evidence of any adverse effects. Therefore, medical staff and nurses should be made aware that drinking may not be necessary before discharge for adult outpatients, and that the standard ASU discharge criterion should be modified to facilitate the discharge process after ambulatory surgery.

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