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SHORT COMMUNICATION

Effects of oral rehydration therapy on gastric volume and pH in patients with preanesthetic H_2 antagonist

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Abstract Recent preanesthetic fasting practice allows patients to take clear fluids up to 2 h before surgery without taking any antacid for the prophylaxis of aspiration pneumonia; this practice is defined as oral rehydration therapy (ORT). It has been reported that with ORT the gastric volume may be significantly lower than that with a standard fasting regimen, although in a standard fasting regimen without preanesthetic antacid, gastric pH and volume values could be critical for causing aspiration pneumonia. In this study we compared gastric fluid status in patients with ORT and those with a standard fasting regimen; patients in both groups received a preanesthetic H_2 antagonist. One hundred and four patients were randomly assigned to either the ORT or standard fasting group, and all were given roxatidine 75 mg 2 h before surgery. After the induction of anesthesia, the gastric contents were collected via a gastric tube to measure gastric volume and pH. Neither gastric volume nor pH differed between the groups (ORT 9.6 ± 8.2 ml and 5.6 ± 1.7, respectively, vs. standard fasting 8.5 ± 6.8 ml and 5.5 ± 1.7, respectively). These data suggest that ORT may not reduce gastric volume in patients receiving a preanesthetic H_2 antagonist.

Keywords Oral rehydration therapy · H_2 antagonist · Gastric acidity

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It is widely recognized that aspiration pneumonia associated with anesthetic induction is one of the most critical complications of anesthesia and has a high mortality. Critical risk factors for such aspiration pneumonia in adults have been shown to be: (1) a gastric volume of more than 25 ml; and (2) a gastric pH of less than 2.5 [1]. Based on these facts, prolonged preoperative fasting combined with the use of an antacid such as an H_2 antagonist has been standard preanesthetic practice for the prophylaxis of perioperative aspiration pneumonia. However, since the introduction of the enhanced recovery after surgery (ERAS) protocol this preanesthetic management is now changing. In this protocol, the patient is allowed to take clear fluids up to 2 h before surgery without any anesthetic premedication (including antacid); this practice is defined as oral rehydration therapy (ORT) and is based on several guidelines [2–4].

Brady and colleagues [5] performed a systematic meta-analysis and reported that with ORT the gastric volume was significantly lower than that with a standard fasting regimen. However, a recent study in Japan showed no differences in this respect between ORT and a standard fasting regimen [6]. In the present study we compared gastric fluid status in patients with ORT and those with a standard fasting regimen; patients in both groups received a preanesthetic H_2 antagonist.

After gaining approval from our university Ethics Committee and obtaining informed consent from the patients, we enrolled 104 adult patients (age 20–80 years, American Society of Anesthesiologists physical status classification I or II) who were scheduled for elective surgery under general anesthesia. Patients were randomly assigned to the ORT group or the fasting group. We excluded patients with gastrointestinal obstruction, body mass index (BMI) more than 35 kg m^{-2}, renal dysfunction

(defined by creatinine clearance less than 20 ml min^{-1}), pregnancy, inability to take food orally, a history of gastroesophageal surgeries, and long-term medication with an H_2 antagonist [7]. Patients in both groups were allowed to take food or drink until 2100 hours on the night before the surgery, and all patients received oral roxatidine 75 mg at 2100 hours on the night before the surgery and 2 h before the induction of anesthesia. The ORT group patients who arrived in the operating room at 1100 hours or 1300 hours had been given 1000 or 1500 ml, respectively, of ORT solution (OS-1; Otsuka Pharmaceutical Factory, Tokushima, Japan) from 2100 hours to 2 h before the surgery. Patients in the fasting group started fasting at 2100 hours the night before surgery.

Anesthesia was induced with propofol 1.0–1.5 mg/kg, ketamine 0.5 mg/kg, and remifentanil 0.3–0.4 μg/kg/min, and was maintained with propofol 4–6 mg/kg/h and remifentanil 0.05–0.25 μg/kg/min. Muscle relaxation was obtained with rocuronium 0.6 mg/kg for endotracheal intubation and intermittent administration (10 mg) during surgery. After endotracheal intubation, a 16-Fr gastric tube (Argyle™ Salem Sump Tube; Japan Sherwood, Tokyo, Japan) was placed into the stomach, and its position was confirmed by auscultation of insufflations of air over the epigastrium. Gastric fluid was aspirated, using a 30-ml syringe, with the patient placed in five different positions (supine, Trendelenburg, reverse Trendelenburg, and right and left 20° semilateral positions) and with insufflation of 30-ml air plus upper-abdominal massage. The volume of gastric fluid was recorded, and the pH value was measured using a pH meter with 0.01 pH unit precision over the entire pH range (Ecoscan pH5 pH6; Iuchi Seieido, Osaka, Japan).

On the basis of a previous study, a sample size of at least 24 patients per group was needed to have a power of 90 %, an SD of 2.7 ml, and significance at the two-sided 5 % level [8]. We would expect a difference in gastric fluid volume of about 6.7 ml between the two groups. Data are expressed as means ± SD. Statistical analysis was performed using the unpaired *t*-test or the χ^2 test as appropriate, with $p < 0.05$ considered significant.

There were no significant differences between the groups with respect to sex, age, height, weight, and BMI (summarized in Table 1).

The gastric fluid volume did not differ significantly between the two groups (ORT group 9.6 ± 8.2 ml vs. fasting group 8.5 ± 6.8 ml, Fig. 1a). Also, no significant difference in gastric fluid pH was found between the groups (ORT group 5.6 ± 1.7 vs. fasting group 5.5 ± 1.7, Fig. 1b). There was no incidence of vomiting or aspiration in either group during the induction of anesthesia. There was no difference in the number of patients with critical factors for causing aspiration pneumonia between the groups (gastric volume more than 25 ml, 3 in the ORT group, 2 in the fasting group; gastric fluid pH less than 2.5, 3 in the ORT group, 3 in the fasting group).

In the present study, we found that ORT did not provide better gastric fluid status in patients with a preanesthetic H_2 antagonist, compared with the status in patients undergoing a prolonged fasting regimen with a preanesthetic H_2 antagonist, because no significant differences were found in the volume of gastric fluid or its acidity between the two groups. However, several reports [5, 9] have shown that ORT significantly reduced gastric fluid volume compared with that in a standard fasting regimen. In spite of these claims, we think ORT may not reduce gastric fluid volume

Table 1 Patient characteristics

	ORT group	Fasting group
Sex (M/F)	19/33	20/32
Age (years)	58.3 ± 14.5	59.3 ± 14.3
Height (cm)	156.4 ± 14.7	156.4 ± 17.5
Weight (kg)	62.0 ± 17.6	59.7 ± 17.4
BMI (kg/m^2)	24.0 ± 3.3	22.9 ± 3.3
ASA PS: I/II	8/44	6/46

Data: means ± SD

ORT oral rehydration therapy, *BMI* body mass index, *ASA PS* American Society of Anesthesiologists Physical Status

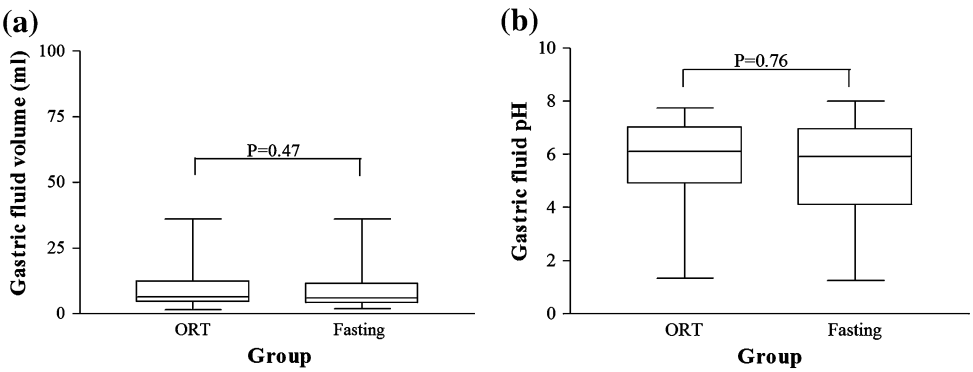

Fig. 1 **a** Gastric volume, **b** Gastric pH. *Plots* show medians, ranges, and interquartile ranges. *ORT* oral rehydration therapy

in patients with a preanesthetic H_2 antagonist, and there is one possible reason for this discrepancy. That is, it may be that the effect of H_2 antagonists might overcome that of ORT in reducing gastric volume.

Although a potential weakness of our study is the lack of comparison with an ORT group without administration of an H_2 antagonist, previous reports [10–12] have demonstrated that mean gastric volume and pH in patients with ORT (none of whom received a preanesthetic H_2 antagonist) were approximately 25 ml and less than 2.5, respectively. In line with these reports, another study has shown that in patients undergoing prolonged fasting, the administration of preanesthetic H_2 antagonists significantly reduced gastric volume and gastric acidity, compared with fasting practice without a preanesthetic H_2 antagonist (group with H_2 antagonists, gastric volume, 9.7 ± 10.8 ml, pH, 5.54 ± 2.20; group without preanesthetic H_2 antagonists, gastric volume, 29.3 ± 22.8 ml, pH, 2.29 ± 1.84) [13]. These data indicate that patients receiving ORT may be exposed to the risk of aspiration pneumonia. Indeed, a report of the 4th National Audit Project of The Royal College of Anaesthetists [14] clearly showed that aspiration was still the primary airway event in approximately 17 % of anesthesia-related events and that it was the single most common cause of death in anesthesia events (primary event in 50 % of deaths). In addition, Auroy and colleagues [15] also reported that aspiration was the main cause of death related to respiratory complications during anesthesia (63 %) in France. Thus, we think that preanesthetic H_2 antagonists may be necessary for the prophylaxis of perioperative aspiration pneumonia in all patients, even in those with ORT. Further study will be required to elucidate the efficacy of H_2 antagonists with ORT.

In conclusion, the present data suggest that gastric status with ORT is similar to that with a standard fasting regimen when a preanesthetic H_2 antagonist is administered.

References

1. Hirota K, Kushikata T. Preanaesthetic H_2 antagonists for acid aspiration pneumonia prophylaxis. Is there evidence of tolerance? Br J Anaesth. 2003;90:576–9.
2. Smith I, Kranke P, Murat I, Smith A, O'Sullivan G, Søreide E, Spies C, in't Veld B, European Society of Anaesthesiology. Perioperative fasting in adults and children: guidelines from the European Society of Anaesthesiology. Eur J Anaesthesiol. 2011; 28:556–69.
3. American Society of Anesthesiologists Committee. Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures: an updated report by the American Society of Anesthesiologists Committee on Standards and Practice Parameters. Anesthesiology. 2011;114:495–511.
4. Ljungqvist O, Søreide E. Preoperative fasting. Br J Surg. 2003;90:400–6.
5. Brady M, Kinn S, Stuart P. Preoperative fasting for adults to prevent perioperative complications. Cochrane Database Syst Rev. 2003;4:CD004423.
6. Itou K, Fukuyama T, Sasabuchi Y, Yasuda H, Suzuki N, Hinenoya H, Kim C, Sanui M, Taniguchi H, Miyao H, Seo N, Takeuchi M, Iwao Y, Sakamoto A, Fujita Y, Suzuki T. Safety and efficacy of oral rehydration therapy until 2 h before surgery: a multicenter randomized controlled trial. J Anesth. 2012;26:20–7.
7. Hirota K, Kudo M, Kushikata T, Hashimoto H, Matsuki A. Regular use of H_2 blockers reduces the efficacy of roxatidine to control gastric pH and volume. Can J Anaesth. 2005;52:166–71.
8. Hirota K, Kudo M, Hashimoto H, Kushikata T. The efficacy of preanesthetic proton pump inhibitor treatment for patients on long-term H_2 antagonist therapy. Anesth Analg. 2005;101: 1038–41.
9. Agarwal A, Chari P, Singh H. Fluid deprivation before operation. The effect of a small drink. Anaesthesia. 1989;44:632–4.
10. Phillips S, Hutchinson S, Davidson T. Preoperative drinking does not affect gastric contents. Br J Anaesth. 1993;70:6–9.
11. Somwanshi M, Tripathi A, Singh B, Bajaj P. Effect of preoperative oral fluids on gastric volume and pH in postpartum patients. Middle East J Anesthesiol. 1995;13:197–203.
12. Maltby JR, Pytka S, Watson NC, Cowan RA, Fick GH. Drinking 300 mL of clear fluid two hours before surgery has no effect on gastric fluid volume and pH in fasting and non-fasting obese patients. Can J Anaesth. 2004;51:111–5.
13. Hashimoto H, Kushikata T, Kudo M, Hirota K. Does long-term medication with a proton pump inhibitor induce a tolerance to H_2 receptor antagonist? J Gastroenterol. 2007;42:275–8.
14. Cook T, Woodall N, Frerk C. Results of the second phase of NAP4: overall results and anaesthesia. In: Cook T, Woodall N, Frerk C, editors. 4th National Audit Project of The Royal College of Anaesthetists and The Difficult Airway Society: major complications of airway management in the United Kingdom. London: The Royal College of Anaesthetists and The Difficult Airway Society; 2011. p. 29–40.
15. Auroy Y, Benhamou D, Péquignot F, Bovet M, Jougla E, Lienhart A. Mortality related to anaesthesia in France: analysis of deaths related to airway complications. Anaesthesia. 2009;64: 366–70.