The effect of preoperative oral carbohydrate-containing clear fluid on gastric emptying in patients undergoing abdominal surgery

Nguyen Thi Thuy Ngan[1], Nguyen Thi Thu Ha[2], Ta Minh Hien[2], Bui Thi Hanh[1], Vu Van Trinh[1]

1. Viet Duc University Hospital, 2. Ha Noi Medical University

Corresponding Author:
Nguyen Thi Thuy Ngan
Viet Duc University Hospital
40 Trang Thi, Hoan Kiem, Ha Noi
Mobile: +84913004524
Email: ngananes@gmail.com

Received date: 07/12/2022
Accepted date: 03/8/2023
Published date: 15/9/2023

Abstract

Introduction: Drinking carbohydrate-containing clear liquids until 2 hours before elective procedures improves patient satisfaction and reduces insulin resistance, but the likelihood of delayed gastric emptying, a risk factor of pulmonary aspiration in anesthesia, is unclear. Therefore, we designed a study to assess the effects of drinking carbohydrate-containing clear liquid until 2 hours before the elective gastrointestinal surgery on gastric emptying and gastric residual volume measured by ultrasonography.

Patients and Methods: Randomized controlled trial designs including 64 patients undergoing gastrointestinal surgery in Viet Duc University Hospital. The intervention group received 400 ml maltodextrin 12.5% in 2 hours prior to surgery, and the control group fasted overnight as usual.

Results: The residual fluid estimated by ultrasound in the intervention group and the intervention group were 25.70 ± 21.13 and 31.01 ± 26.74 in the controlled group ($p>0.05$). The gastric fluid collected by the nasogastric tube is not significantly different between the two groups (intervention group: 15.00 ± 23.34 ml; controlled group: 12.72 ± 22.43 ml). There was no aspiration case in both groups.

Conclusion: Taking carbohydrates- containing clear liquids until 2 hours before general anesthesia influences neither gastric emptying nor perioperative complications.

Keywords: Carbohydrate-containing clear liquids, gastric residual volume, gastric ultrasound.

Introduction

"Nothing by mouth from midnight" before elective surgery aims at gastric emptying time to avoid the risk of gastric regurgitation during anesthesia induction. However, prolonged fasting makes patients uncomfortable, increases insulin resistance, and delays recovery. Recent studies show that clear fluid has a gastric half-life time of 10 minutes and digested 95% after 90 minutes. Therefore, recent guidelines encourage patients

to drink clear fluids up to 2 hours before surgery. Maltodextrin is a water-soluble carbohydrate that has a short time in the stomach and is used as a preoperative nutrition product. We conducted this study to evaluate the effects of oral carbohydrate-containing clear fluid on gastric emptying in patients undergoing gastrointestinal surgery.

Patients and methods

Patient selection

Inclusion criteria: Patients from 18 years old, undergoing elective surgery, with ASA I to III, agreed to participate in the study.

Exclusion criteria: Patients with mental disorders, diseases leading to delayed gastric emptying (diabetes), or gastroectomy.

Cancellation criteria: Refusal to participate in the study or missing data

Study Method

Study design: A randomized controlled clinical intervention study in which 64 patients were randomly allocated into the control group and intervention group.

Variables: Age, BMI. Perla's score according to gastric ultrasound. Preoperative residual gastric volume was measured by ultrasound and nasogastric tube suction. Regurgitation during induction of anesthesia.

Some criteria and definitions have been used in the study:

Gastric volume measurement:

- Through suctioning the nasogastric tube with a 50ml syringe.

- Estimating gastric fluid volume by ultrasound: cross-sectional antral area (CSA). Perlas formula to estimate gastric fluid volume by ultrasound of the stomach.

V(mL) = 27 + 14.6 x CSA (in right lateral position) (cm2) - 1.28 x age (years)

- Perlas grading scale classification on ultrasound1

- Grade 0: An empty stomach is appreciated in both the semirecumbent and right lateral semirecumbent positions.
- Grade 1: An empty antrum is viewed in the semirecumbent position, but clear fluid is visible in the right lateral semirecumbent position.
- Grade 2: Clear fluid can be seen in both positions.

- Risk of regurgitation, according to Perlas1

- Low risk: estimated gastric fluid volume < 1,5ml/kg.
- High risk: estimated gastric fluid volume > 1,5ml/kg.

- Regurgitation during anesthesia is defined as fluid in the throat at laryngoscopy.

Procedures

Preparation: A pack of 50 gr maltodextrin (mixing with 400ml water).

Ultrasound machine with a convex probe and video laryngoscope.

Performance:

- Intervention group: Drink clear fluid with carbohydrates (Maltodextrin solution 12.5%) as required from 9 p.m. the night before surgery to 6 a.m. on the surgical day morning (if it is the first case) or drink 400ml up to 2 hours before anesthesia.

- Controlled group: Nothing by mouth from 22 hours the day before surgery.

- Patients in the operation room were monitored according to standard and had the pyloric antral ultrasound to estimate residual gastric volume done by a certificated anesthesiologist. The probe was located at the epigastric area, in the midline, to find the image of the pyloric antrum in the supine position, then on the right side (figure 1) to measure the pyloric antral cross-sectional area (Figures 2 and 3).

- During the intubation with a video-laryngoscope, the gastric content in the throat was determined and double-checked by an anesthesiologist and nurse anesthetist for both groups.

- Inserting and checking the correct placement of the nasogastric tube in the stomach. Using a 50ml syringe to suction in 10 minutes to withdraw gastric fluid. All data were recorded.

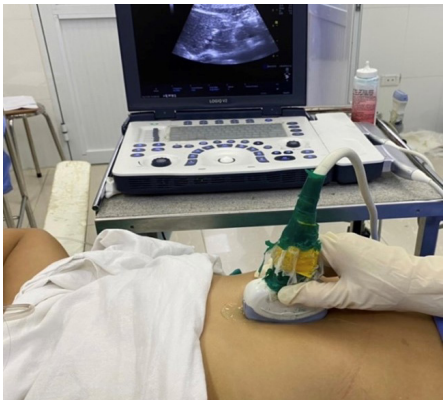

Fig.1: Probe position to check gastric volume in the supine position

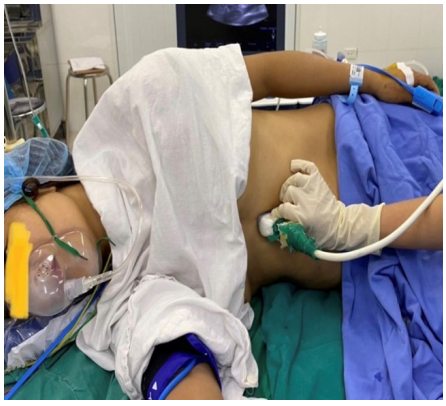

Fig.2: Ultrasound to scan for gastric fluid on the right side

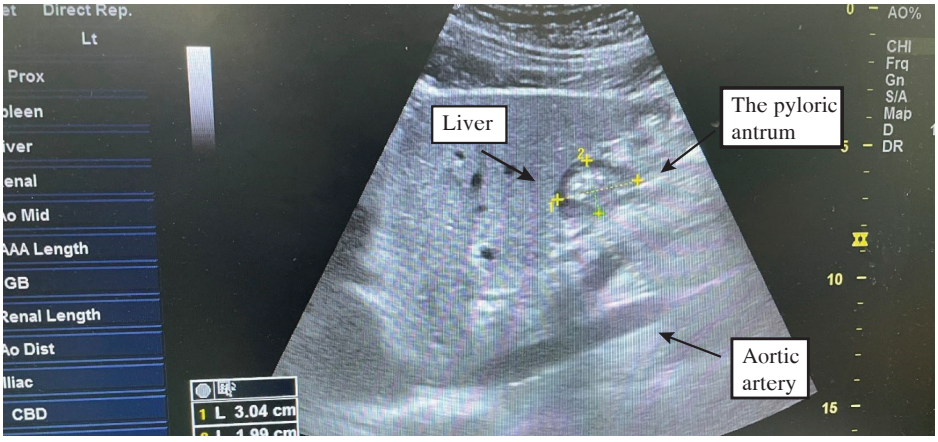

Fig.3: The pyloric antral ultrasound

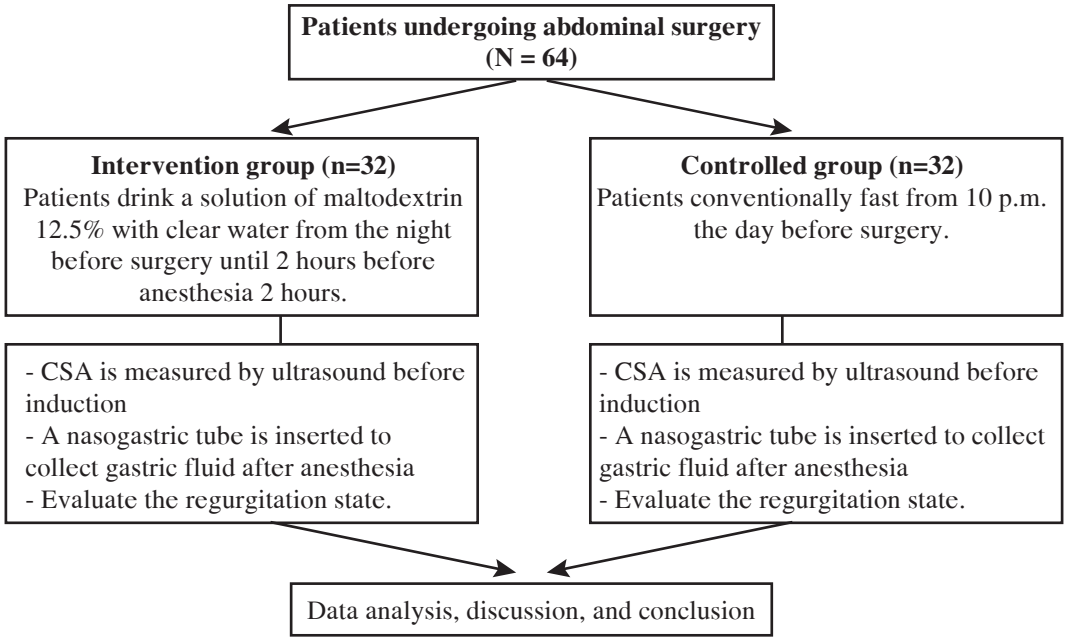

Fig.4: Flowchart of the study

Data analysis: By SPSS20. It is calculated: Mean ($\bar{X}$ ± SD), percentage. Test χ^2 to compare two rates, and the T-student test to compare two mean values. P< 0.05 is considered a significant difference.

Study ethicality: The study was conducted after being endorsed by the Ethical Committee boards of Ha Noi Medical University as well as Viet Duc University Hospital. All information of participants is secured, and data collected are used for scientific research purposes only.

Results

Patients characteristics

Table 1: Age, BMI

Variable	Group		p
	Intervention (n = 32)	Controlled (n = 32)	
Age (year)	58.16 ± 11.83	57.53 ± 13.09	0.842
BMI (kg/m2)	22.46 ± 3.49	21.72 ± 3.67	0.417

The average age of patients in the intervention and controlled groups are 58.16 ± 11.83 and 57.53 ± 13.09 years old, respectively. There is no significant difference in BMI between two groups.

Effects on gastric emptying

Table 2: Perlas classification

Level	Group		p
	Intervention (%)	Controlled (%)	
0	17/32 (53.1%)	22/32 (68.8%)	
1	14/32 (43.8%)	9/32 (28.1%)	0.447
2	1/32 (3.1%)	1/32 (3.1%)	

According to Perla's classification, there are 17 patients (53.1%) in the intervention group, and 22 patients (68.8) in the controlled group have no gastric fluid observed (level 0). In both groups, only one patient (3.1%) had residual gastric fluid at level 2.

Table 3: Gastric fluid volume measured through ultrasound and nasogastric tube, regurgitation rate

Variable	Group		p
	Intervention (%)	Controlled (%)	
Volume estimated by ultrasound (ml)	25.70 ± 21.13 (n = 15)	31.01 ± 26.74 (n = 10)	0.585
Volume collected by nasogastric tube (ml)	15.00 ± 23.34 (n = 32)	12.72 ± 22.43 (n = 32)	0.691
Gastric volume/kg (ml/kg)	0.33 ± 0.4	0.39 ± 0.4	0.51
Regurgitation rate (%)	0	0	

The volume estimated by ultrasound was 25.70 ± 21.13 ml in the intervention group and 31.01 ± 26.74 in the controlled group (p>0.05). The volume collected by the nasogastric tube is not significantly different between two groups (intervention group: 15.00 ± 23.34 ml; controlled group: 12.72 ± 22.43 ml). The regurgitation rate is 0 % in both groups.

Discussion

According to Table 1, the mean age and BMI of both groups (intervention and controlled) have no difference (p>0.05). Thus, the common features of both groups were similar and convenient to compare the gastric emptying process between the two groups.

In our study, the rates of patients in different residual gastric fluid volume levels by Perlas are comparable (p>0.05) respectively. Level 0 is when no gastric fluid is observed in both positions (50% in both groups, 17 patients in the intervention group, and 22 patients in the controlled group). Table 2 shows that 90% of patients in both groups are classified as level 0 and 1, and only 3.1% at level 2. Similarly, the study of Nguyen Thi Ngoc Mai et al. in patients undergoing spine surgery showed that 82% of them with Perlas classification levels 0 and 1 in both groups [7].

Ultrasound was applied in this study to estimate the residual gastric volume. Table 3 shows an insignificant difference in gastric fluid volume between both groups (p>0.05). This finding is comparable to the Ly Huyen Hoa study results which showed the gastric fluid volume was 30.27 ± 16.0 ml

in the intervention group and 33.88 ± 15.43 ml in the controlled group (p > 0,05). On the other hand, our study's gastric fluid volume is higher than Gomes PC's results on healthy patients, which were 13.56 ± 13.25 ml in the conventional fasting group and 16.32 ± 11.78 ml in the carbohydrate group9. Variation in results among studies is due to the difference in study participants. However, all studies showed similar residual gastric fluid volume in two groups (controlled and conventional fasting groups).

Besides, we also measured the residual gastric fluid volume by nasogastric tube suction, which showed that residual volume in the intervention group was 15.00 ± 23.34 ml, in the controlled group was 12.72 ± 22.43 ml, and there was no significant difference (p > 0,05). This result indicates that drinking carbohydrates before surgery does not slow gastric emptying, and conventional fasting does not lead to an empty stomach. Our results are higher than Kaska's when comparing gastric fluid volume through nasogastric tube suction. M., which showed that gastric fluid volume was 5 ml in all three groups (conventional fasting, glucose infusion, oral maltodextrin night before surgery up to 2 hours before surgery). On the other hand, our results are lower than those in a study by Yilmaz N for patients undergoing laparoscopic cholecystectomy11 (21.85 ml in the intervention group and 19.15 ml in the control group). Although the results are similar to other studies, there is no significant difference in the residual gastric fluid volume between the conventional group and the oral administration of the maltodextrin group.

According to Perlas, residual gastric fluid volume >1.5ml/kg is considered a high risk of regurgitation during induction. In our study, gastric fluid volume measured in both groups was <1.5ml/kg and there was no patient with regurgitation during anesthesia induction. This is similar to the results from a study by Rizvanovic N12. Although preoperative oral clear fluids raise concerns about the risk of aspiration during induction, many studies show that it is safe and there is no delay in gastric emptying when patients are given preoperative oral carbohydrate-containing clear fluid6 (maltodextrin 12,5%). The ASA and other societies have preoperative fasting guidelines that let patients drink clear fluids in 2 hours prior surgery [5].

Conclusion

Oral clear fluids containing carbohydrate in 2 hours before general anesthesia induction does not delay gastric emptying or increase the risk of regurgitation during anesthesia (estimated gastric volume through ultrasound and nasogastric tube suction before anesthesia were not significantly different in both groups 25.7 ± 21.13 ml and 15 ± 23.34 ml compared to the values in overnight fasting group which were 31,01 ± 26,74 ml and 12,72 ± 22,43 ml respectively, p > 0,05).

Recommendation

In routine clinical practice, it should be better to encourage patients to drink clear fluids containing carbohydrates 2 hours before elective surgery. Additionally, this indication should be applied to patients who undergoing other surgeries.

References

1. Goyal RK, Guo Y, Mashimo H. Advances in the physiology of gastric emptying. *Neurogastroenterol Motil.* 2019;31(4)
2. 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 Task Force on Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration*. *Anesthesiology*. 2017;126(3):376-393.
3. Charan J, Biswas T. How to Calculate Sample Size for Different Study Designs in Medical Research? *Indian J Psychol Med.* 2013;35(2):121-126.
4. Tran S, Wolever TMS, Errett LE, Ahn H, Mazer CD, Keith M. Preoperative Carbohydrate Loading in Patients Undergoing Coronary Artery Bypass or Spinal Surgery. *Anesth Analg*. 2013;117(2):305-313.
5. T.S. Chaitra, Dạneev Palta et al. Assessment of residual

gastric volume using point-of-care ultrasonography in adult patients who underwent elective surgery. *The Ultrasound Journal*. 2022; 15(7): 19- 179

6. Noba L, Wakefield A. Are carbohydrate drinks more effective than preoperative fasting: A systematic review of randomized controlled trials. *J Clin Nurs.* 2019;28(17-18):3096-3116.
7. Mai NTN, Kien NV, Manh LD, et al. Evaluate the effects of oral maltodextrin 12.5% solution 2 hours before surgery. *J 108 - Clin Med Phamarcy.* Published online August 12, 2022.
8. Ly Huyen Hoa (2019). Evaluate residual gastric volume of oral maltodextrin 12.5% solution 2 hours before surgery. *Resident doctor thesis defense*. Ho Chi Minh University of Medicine and Pharmacology.
9. Gomes PC, Caporossi C, Aguilar-Nascimento JE, Silva AMC da, Araujo VMT de. Residual gastric volume evaluation with ultrasonography after ingestion of carbohydrate- or carbohydrate plus glutamine-enriched beverages: a randomized, crossover clinical trial with healthy volunteers. *Arq Gastroenterol.* 2017;54:33-36.
10. Käka M, Grosmanová T, Havel E, et al. The impact and safety of preoperative oral or intravenous carbohydrate administration versus fasting in colorectal surgery – a randomized controlled trial. *Wien Klin Wochenschr*. 2010;122(1):23-30.
11. Yilmaz N, Çekmen N, Bilgin F, Erten E, Ozhan MO, Cosar A. Preoperative carbohydrate nutrition reduces postoperative nausea and vomiting compared to preoperative fasting. *J Res Med Sci Off J Isfahan Univ Med Sci*. 2013;18(10):827-832.
12. Rizvanovic N, Nesek Adam V, Caüevic S, Dervievic S, Delibegovic S. A randomized controlled study of preoperative oral carbohydrate loading versus fasting in patients undergoing colorectal surgery. *Int J Colorectal Dis*. 2019;34(9):1551-1561.