

Prevalence and factors predictive of full stomach in elective and emergency surgical patients: a prospective cohort study

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Abstract

Background. This prospective observational study sought to assess the rate of full and empty stomach in elective and emergency patients and to determine the factors associated with full stomach.

Methods. Non-premedicated patients were consecutively included between May 2014 and October 2014. Ultrasound examination of the gastric antrum was performed by an operator blinded to the history of the patient. It included measurement of the antral cross-sectional area, performed in the supine position with the head of the bed elevated to 45°, and qualitative assessment of the gastric antrum, performed in both semirecumbent and right lateral decubitus positions. Full stomach was defined by the appearance of any gastric content in both positions (Grade 2). Empty stomach was defined either by empty antrum in both positions (Grade 0) or by empty antrum in the semirecumbent position only (Grade 1) with measured antral area <340 mm². The combination of Grade 1 and antral area >340 mm² defined intermediate stomach. Logistic regression analyses were performed for the identification of factors associated with full stomach.

Results. Four hundred and forty patients were analysed. The prevalence of full stomach was 5% (95% confidence interval: 2–9) in elective patients and 56% (95% confidence interval: 50–62) in emergency patients ($P<0.0001$). Obesity, diabetes mellitus, emergency surgery, and preoperative consumption of opiates were independent factors predictive of full stomach.

Conclusions. The results suggest that preoperative ultrasound assessment of gastric content should be performed in all emergency patients, and in elective patients with identified predictive factors for full stomach.

Key words: gastrointestinal contents; stomach; ultrasound

Editor's key points

- Pulmonary aspiration of gastric contents is the major cause of death related to general anaesthesia, but incidence and risk factors of full stomach are still not clear.
- Preoperative ultrasound examination of the gastric antrum was performed to assess the incidence and risk factors of full stomach.
- The incidence of full stomach was 5% in elective patients and 56% in emergency patients. Obesity, diabetes mellitus, emergency surgery, and preoperative consumption of opiates were risk factors for full stomach.

Increased gastric content volume may contribute to the occurrence of pulmonary aspiration of gastric contents, one of the most feared complications related to general anaesthesia.^{1–2} Preoperative fasting guidelines were therefore proposed in order to reduce gastric content volume in elective patients and, consequently, to minimize the risk of regurgitation and pulmonary aspiration.^{3–4}

In clinical practice, physicians are regularly faced with emergency patients who have fasted for various durations, ranging from a few minutes to several hours. There is a lack of data as to the status of gastric content and volume, leading to discrepancies between preoperative fasting guidelines regarding their applicability in the setting of emergency surgery.^{3–4} Furthermore, gastric content volume may be high after prolonged fasting, exposing some elective patients to increased risk for pulmonary aspiration,^{5–7} yet the prevalence and predictive factors for high gastric content in elective patients who have fasted remains uncertain.

Ultrasound examination of the gastric antrum has been described for the successful assessment of gastric content and volume, with high intra- and inter-rater reliability.^{8–17} Perlas and colleagues¹³ have described a qualitative grading score, based on the presence, or not, of gastric content in the antrum when ultrasound examination was performed in the supine position and in the right lateral decubitus position. The appearance of any gastric content in both positions may correspond to high gastric volume, as previously assessed in elective patients undergoing upper gastrointestinal endoscopy,¹⁴ whereas no appearance of gastric content in both positions may correspond to empty stomach.^{13–14} Furthermore, the measurement of the antral cross-sectional area in the semirecumbent position is reported to be highly predictive of empty stomach, when antral area is <340 mm².¹⁰

Using this non-invasive tool for the assessment of gastric content volume, the present prospective cohort study aimed to assess the prevalence of full and empty stomach in elective and emergency patients and to determine the factors associated with full stomach in a large cohort of elective and emergency surgical patients.

Methods

This prospective observational cohort study received approval (L14-160) from the local ethics committee (Comité pour la Protection des Personnes Sud-Est IV, Lyon). The methodology followed the recommendations of the STROBE (Strengthening the Reporting of Observational studies in Epidemiology) statement.¹⁸ The study was conducted between May 2014 and

October 2014 in a university hospital (Hôpital Édouard Herriot) in Lyon, France. Patients were recruited according to operator availability (three physicians, L.B., C.A., and E.B., with a practice of at least 50 gastric ultrasounds). Patients received information about the study during the preoperative visit and gave oral consent to the attending anaesthetist upon their arrival at the operating theatre. The local ethics committee stated that written consent was unnecessary because ultrasound assessment of gastric content is usually performed in our unit. The study was therefore considered as being observational and non-interventional, requiring only the patient's oral consent.

Adult patients undergoing elective or emergency surgery were consecutively screened for eligibility. Exclusion criteria were pregnancy, any oral premedication given within 6 h before arrival in the operating theatre, and patient refusal.

A preoperative ultrasound examination of the gastric antrum was performed for each patient by one of the operators blinded to the history of the patient, using ultrasonography (SonoSite, S-Nerve™, Inc., Bothell, WA, USA, fitted with a 2–5.5 MHz probe), to obtain a sagittal cross-section of the antrum in a plane including the left lobe of the liver and the aorta, as previously described.^{10–19–20} All examinations were performed with the patient placed in the semirecumbent position (i.e. supine position with the head of the bed elevated to 45°) and then, whenever feasible, in the right lateral decubitus position.

This examination allowed qualitative assessment of gastric contents, according to the three-point grading scale previously described by Perlas and colleagues.¹³ Grade 0 was defined by the absence of appearance of any content in a flat antrum in both the semi-upright and the right lateral decubitus positions. Grade 1 was defined by the appearance of any gastric content in the right lateral decubitus position only, and Grade 2 was defined by the appearance of any content in both the right lateral decubitus and the supine positions.

The antral cross-sectional area was also calculated in the semirecumbent position, by measuring the longitudinal diameter (D_1) and the anteroposterior diameter (D_2) of the antrum between antral contractions, from serosa to serosa, using the following formula:²¹

$$\text{Antral area} = (\pi \times D_1 \times D_2) / 4.$$

According to the ultrasound examination of the antrum, the stomach was considered as empty (low risk of pulmonary aspiration of gastric contents) in the presence of either Perlas Grade 0 irrespective of the antral area, or Perlas Grade 1 with antral cross-sectional area <340 mm². Conversely, a full stomach (increased risk of pulmonary aspiration of gastric contents in the event of general anaesthesia) was defined as Perlas Grade 2, irrespective of the antral area. Intermediate stomach contents were defined by Perlas Grade 1 and antral area >340 mm².

Patient characteristic data (age, sex, weight, height, BMI, and ASA physical status classification), fasting duration (defined as the time between last meal ingestion, inclusive of all types of dairy products, and ultrasound examination), type of elective and emergency surgery, preoperative morphine consumption (whether for acute or chronic pain), and complications, such as regurgitation and pulmonary aspiration occurring during induction and the recovery period, were recorded for analysis.

Statistical analysis

Statistical analysis was performed using MedCalc® version 12.1.4.0 for Windows (MedCalc Software, Ostend, Belgium). After

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