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Gastric ultrasonography in evaluating NPO status of pediatric patients in the emergency department

Pulmonary aspiration of gastric contents is uncommon but still considered a potential risk in patients who may require emergent intubation or procedural sedation [1, 2]. This normally occurs during induction, which tends to be technically variable for pediatric patients. The incidence of pulmonary aspiration is about four to ten times higher in pediatric populations than adults [3, 4]. Typically, preprocedural fasting time is recommended and used to determine the risk of aspiration. The American Society of Anesthesiology (ASA) 2011 Practice Guidelines recommends at least a 2-hour wait for clear fluids and 6 h for solid foods prior to general anesthesia [5]. However, NPO status is not an independent predictor of aspiration and a definitive assessment of gastric contents and NPO status in pediatric patients is either unavailable in emergency department (ED) [3, 6].

Given the variations in reliability of parent/self-reported NPO status and gastric emptying times, NPO status may not truly reflect whether or not contents are present in the stomach. In an effort to assess the application of point-of-care-ultrasound (POCUS) in detecting gastric contents, we conducted a prospective observational study at an academic pediatric emergency department (ED). We postulated that gastric US may offer an objective, alternative approach to assessing gastric contents in pediatric patients. Gastric US has been reported as highly sensitive and specific to detect or rule out gastric contents [7, 8].

In this study, we included patients aged 2 to 18 years with no prior history of esophageal or gastric surgery, hernia, or diabetes. After obtaining informed consents from the parent or legal guardian, EM US fellows performed gastric US on each patient. The sonographers were blinded to the patient's time of the last ingestion and only gathered that data after performing and storing the US images. Either a Sonosite M-Turbo or a Mindray® M-9 with curvilinear probe was used to perform gastric ultrasonography. Patients were placed in a right-lateral decubitus position, which is the position that can detect minimal fluid volume, and the antrum of the stomach was viewed in a sagittal orientation (Fig. 1). The gastric antrum was scanned and measured and the presence and type of contents (fluid versus solid) determined. The US images were then reviewed by two EM attending sonographers independent of each other and blinded to the other study data to assess reproducibility.

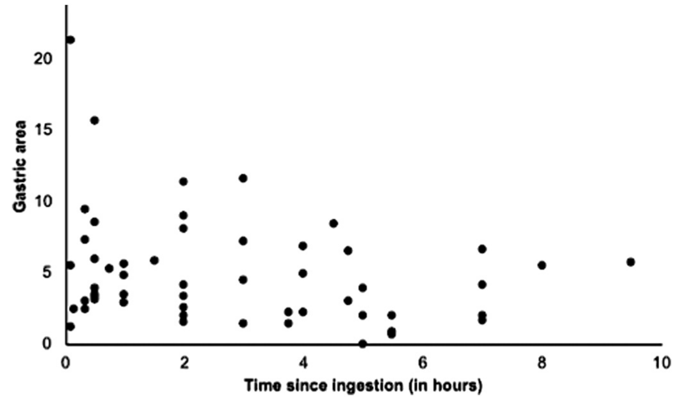

Fig. 2. Correlation of gastric area and time since oral food or drink ingestion.

1. Ultrasound findings

In this group of pediatric patients, we were able to demonstrate the use of US images of the gastric antrum to distinguish the presence or absence of gastric contents. Overall, we detected gastric contents in 83% of patients (43/52). In 69% of patients ($n = 36$), gastric US was able to detect expected gastric contents based on positive meal history. In 13% ($n = 7$) ultrasound showed gastric contents in patients who were NPO by history. In another 13% ($n = 7$) patients were not NPO by history but US showed no gastric contents. In only 22% (2/9) of patients who reported an NPO status were no gastric contents seen. In patients where US showed gastric contents, the average time since last ingestion was 2.3 h for any type and 4.7 h for solid foods. Fig. 2 shows a significant yet modest negative correlation between the gastric area observed on US and time since ingestion of solids and liquids (Pearson $r = -0.24$, $P_{one\text{-}tailed} = 0.04$). Both reviewers agreed on US findings in 49 out of 52 patients with a weighted kappa of 0.90.

2. How reliable is the self-reported NPO?

In 52 patients who were included in this study, only 9 patients (17%) reported no food/liquid intake in past 2–6 h. The estimated sensitivity of gastric US was 84% (95% CI 69–93%) and specificity was 22% (95% CI 4–60%) when compared to patient anamnesis as a gold standard. The positive likelihood ration (LR+) was 1.08 (95% CI 0.74–1.56) and the negative likelihood ration (LR−) was 0.73 (95% CI 0.17–3.09).

This suggests gastric contents as seen on US correlated only modestly with patient history of ingestion. In 26% of patients there was discordance between the gastric US findings and the self-reported NPO status. There were only two instances where the patient's history aligned with the negative finding of gastric contents on US.

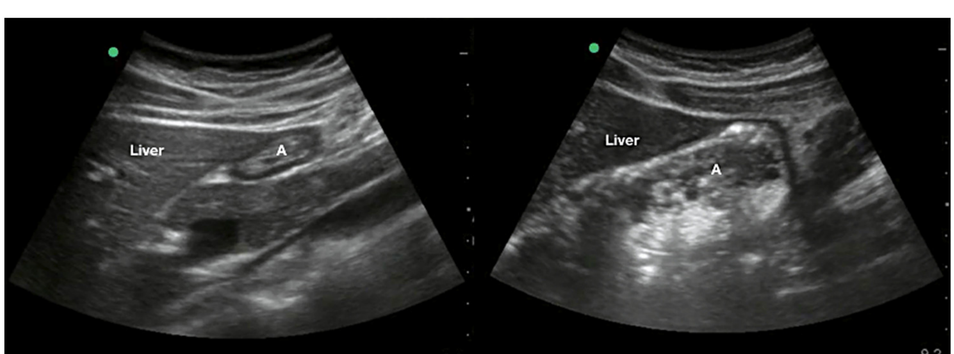

Fig. 1. Ultrasound scans of an empty and content-filled gastric antrum.

We may conclude that by utilizing POCUS we were able to visualize gastric contents in pediatric patients. In 73% (38/52) of cases the findings were compatible with the history of the last ingestion. On the other hand, relying on parents/self-reported history may not reliably reflect the presence or absence of gastric contents. Prolonged gastric emptying times may cause ingested contents to remain in the stomach longer than traditionally anticipated. Patient recall may also be unreliable and affect the findings. Alternatively, patients with rapid gastric emptying times may have no gastric contents despite recent ingestion. Gastric ultrasonography offers a means to assess the presence of gastric contents in pediatric patients, and this may correlate with aspiration risk. Furthermore, this method may assist anesthesiologists on predicting perceived level of aspiration risk leading to an optimal anesthetic management in elective patients who may or may not necessarily followed fasting instructions.

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Conflicts of interest

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Step right up! Healthcare provider weight estimation vs. a professional weight guesser

1. Weight estimation study

Bedside estimation of patient weight is commonly utilized in the emergency department where the patient is either too ill, obtunded, or comatose to communicate. However, there is a lack of evidence on the accuracy of visual weight estimation of the adult patient in the ED. Medications dosed based on the patient's weight introduce error. When inaccurate medication errors occur, dosing could be sub therapeutic [1].

Medications that utilize weight-based dosing include thrombolytics, steroids, and sedatives. Many have narrow therapeutic windows. An underestimation of weight may result in a lower dosage causing subtherapeutic concentrations. Overestimation can be life threatening, especially thrombolytics and anticoagulants [1].

One prospective clinical study using medical and nursing staff to perform visual estimates of patient's weight compared to actual weight. The study showed that staff estimation of weight was poor, with 47% of estimates at least 10% different from the measured weights [2].

The goal of the current study was to examine the accuracy of adult weight estimation by emergency medical professionals.

This study was conducted at a 310 bed community teaching hospital and approved by the IRB on 05/18/2017. We enrolled 15 healthcare professionals (5 attending physicians, 5 resident physicians, and 5 nurses) for estimating the weight of a sample 8 assessed subjects (120 estimates). A professional weight guesser (Carney) was included for comparison, to medical professionals' estimations.

The assessed population included adults of varied weights, both genders. Weight was recorded by single digit scale calibrated prior to the start of the study.

Weights were estimated while subjects were seated or laying on tables the same size and height of gurneys.

Subjects were in normal clothes instead of hospital gowns to emulate ill patients in an emergency department

Each estimator was blinded to other estimations.

Weights were compared with Student's *t*-test.

We used a weight of over 175 lbs for males and over 145 lbs for females as the threshold for being considered overweight. These two cutoffs were derived using the average United States male height of 5′10″ and a female height of 5′4″ and extrapolated for a BMI >25 being considered obese.

Fourteen health professionals guessed the weight of a 8 non-medical volunteers and the other 14 professionals.

The mean age was 42 years, and 61% were female. The medical measured weight was 175.1 lb. (sd:34.2).

The carney was an average 2.2 lbs under the subject's actual weight (mean 173.0 vs 175.1lbs; $p = 0.482$).

Healthcare professionals were off by 15 lbs overall (160 vs 175; $p < 0.01$) and significantly worse compared to the carney ($p < 0.001$).