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EXTENDED ABSTRACT

P4

Importance of gastric ultrasound in the study of gastric content

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Introduction

Pulmonary aspiration is one of the most important complications in anesthesiology [1]. Although upper gastrointestinal endoscopy (UGI) has been the gold standard to obtain a qualitative assessment of gastric content, ultrasound as also been considered a good method to evaluate the gastric volume and thus determine the risk of perioperative pulmonary aspiration [2,3].

The main objective of this study was to confirm the usefulness of gastric ultrasonography (US) in the analysis of gastric content. A second objective was to compare gastric areas obtained by the free-tracing method (FTM) and the two-diameter method formula (TDM).

Material and Methods

A prospective study was conducted between March and June 2019 at CEMERT Clinic and Hospital San Francisco de Assis. A certified sonographer and a clinical anesthesiologist performed gastric ultrasounds to 40 patients older than 18 years, scheduled for elective UGI, with ASA physical status from I to III. Individuals with preexisting abnormal anatomy of the upper gastrointestinal tract and pregnancy were excluded.

Patients were scanned in the supine position (SP) and in the right lateral decubitus position (RLDP) with a low-frequency (2 to 6 MHz) curvilinear array transducer using a Samsung RS60 or Sonoscanner U-lite ultrasound machines. The transducer was placed in a sagittal plane in the epigastric region in order to see gastric antrum between the left lobe of the liver and the pancreas, at the level of the aorta. The craniocaudal (CC) and anteroposterior (AP) diameters were measured. The cross-sectional area of the gastric antrum (CSA) in both positions was determined using FTM and TDM [4]:

$$CSA_{TDM} = \frac{AP \times CC \times \pi}{4}$$

Gastric content was qualitatively evaluated by the sonographer as: empty, if it appeared flat with anterior and posterior walls juxtaposed; containing fluid content, when a hypoechoic content was observed; containing solid content, if lumen was distended with an internal "frosted-glass appearance" [5]. Model V1 suggested by Perlas et al. [3] was used to estimate the total gastric fluid.

$$V1 = 27 + 14.6 \times CSA_{right\ lateral} - 1.28 \times age$$

age in years, CSA $_{\text{right lateral}}$ in cm^2, height in cm and weight in kg

Using UGI two gastroenterologists evaluated the same qualitative characteristics of the gastric content. The gastric content was aspirated and the volume was measured to nearest *cl*.

Normality of the quantitative variables was assessed using Shapiro- Wilk test. Statistically linear dependence was tested using Pearson's and Spearman's correlation tests. T tests for paired samples were used to compare the area determined by TDM and FTM in the SP. McNemar test was performed to analyze differences between the two assessment technics. Wilcoxon rank-sum test was used to evaluate if the difference of volumes was statistically equal to zero. A significance level of 0.05 was considered.

Keywords:
Point of Care Gastric ultrasound, gastric volume, pulmonary aspiration.

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Results

From the initial 40 patients included in the study, two patients were excluded because antral CSA could not be measured due to obesity. Two more individuals were excluded due to the presence of a significant amount of gas in the stomach in one patient and due to an error in the registration of measures in another one, resulting in a total of 36 individuals analyzed.

Statistically linear dependence was found between areas calculated by TDM and FTM in SP ($P < 0.0001$, $r = 0.89$) and in RLDP ($P < 0.0001$, $r = 0.93$). The t-tests for differences between the values of TDM and FTM in the two positions allow us not to reject the hypothesis that the differences are equal to zero ($P = 0.9143$ and $P = 0.1740$ respectively).

US assessment identified 22 individuals with no solid nor liquid content whereas the UGI assessment identified 18 individuals in the same condition. No statistically significant differences between the two assessment technics were found using McNemar's test ($P = 0.2888$).

The difference between the estimated volume using the area obtained by FTM and the Measured Volume was statistically different from zero ($P = 0.0002$) (Figure 1).

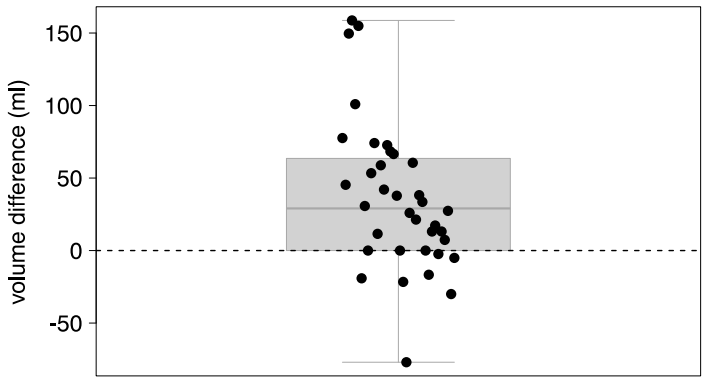

Figure 1 - Boxplot of the differences between estimated volume (FTM) and measured volume

Discussion

In this study we determined gastric contents and verified that the totality of individuals underwent the necessary fasting period and thus had a gastric volume of less than 1.5 ml/kg, which corresponds to a perioperative low risk of aspiration according to Perlas et al [6].

The analysis of the CSA obtained by the FTM and TDM showed no significant differences between methods in accordance with the results obtained by Kruisselbrink et al [7].

Although the model proposed by Perlas et al. [3] to estimate gastric volume is the most widely used we found no statistically significant correlation with the measured volume. Study limitations or the lack of sensibility of this model to estimate very low gastric volumes (<80 ml) could provide explanation regarding this finding.

The study had limitations: the qualitative analysis of gastric content was not based on a 3-point grading system [3]; individuals had small gastric volumes that were difficult to aspirate and clinically irrelevant.

We concluded that there is no difference between US and UGI assessments which supports the use of point-of-care gastric ultrasound (POCGUS) in the evaluation of perioperative aspiration risk.

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