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ORIGINAL ARTICLE

Ultrasonographic evaluation of gastric contents in term pregnant women fasted for six hours

S. Hakak,^{a,b} C.L. McCaul,^a L. Crowley^b^aDepartment of Anesthesia, The Rotunda Hospital, Dublin, Ireland^bDepartment of Anesthesia, National Maternity Hospital, Holles St, Dublin 2, Ireland**ABSTRACT**

Background: Current fasting guidelines suggest six hours are adequate to minimise the aspiration risk after a light meal consumed by pregnant women undergoing elective caesarean section. We assessed gastric contents in non-labouring pregnant women, using ultrasonographic analysis.

Methods: In a prospective study, pregnant women ≥ 36 weeks' gestation, without conditions likely to influence gastric emptying, underwent ultrasonographic analysis of their gastric antrum, after six hours of fasting following a standardised light meal. The primary outcome was solid food content in antrum. Other outcomes included fluid in the supine and right lateral positions, antral cross-sectional area and estimated residual gastric fluid volume. Antral grades were classified: grade 0 = absence of fluid in both supine and right lateral positions; grade 1 = fluid present in right lateral position only; grade 2 = fluid in both positions.

Results: Complete data were available in 46/51 (90%) women. No woman had solid food visible. Antral grades 0, 1 and 2 were seen in 6 (13%), 36 (78%) and 4 (9%) women respectively. Eighteen of 48 women (37.5%) had a residual volume greater than 1.5 mL/kg. Of those with a grade 1 antrum, 13/36 (36%) had residual volumes in excess of 1.5 mL/kg. For grade 2, this was 4/4 (100%).

Conclusions: Our cohort of pregnant women fasted for six hours had no solid food visible in the antrum, but many had both qualitative and quantitative ultrasonographic evidence of gastric volumes potentially associated with aspiration risk. This suggests that pregnancy-specific fasting guidelines may be required.

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Introduction

Fasting is a mandatory requirement prior to elective anaesthesia and is intended to reduce gastric fluid volume and the risk of aspiration of gastric contents and subsequent organ injury.¹ Pregnant women have been considered to be at particular risk of aspiration syndromes as a consequence of physiological changes during pregnancy which lead to relaxation of lower oesophageal sphincter and mechanical upward displacement of the stomach by the enlarged uterus.^{1–3}

Fasting guidelines have been liberalised recently and six-hours fasting after a light meal is considered an adequate duration by the European Society of Anaesthesiology in those without conditions that affect gastric emptying (including pregnant women).^{4–6} In contrast, the American Society of Anesthesiology guidelines

specifically exclude pregnant women and the Society for Obstetric Anesthesia and Perinatology taskforce recommend a fasting period of 6–8 hours, depending on the nature of food ingested.⁷ The pathophysiological processes which influence gastric emptying in pregnancy and labour are complex. While there is general acceptance that gastric emptying is inhibited by pain during active labour, and after opioid administration, there is less agreement about the risk in fasted, non-labouring pregnant women.⁸

In this study, we analysed the stomach contents of non-labouring term pregnant women after six hours of fasting, using previously described qualitative and quantitative ultrasonographic assessments.^{10,11}

Methods

This prospective observational trial was performed between September 2016 and January 2017 at the National Maternity Hospital, Dublin, Ireland, which is a university affiliated tertiary-referral centre. Following

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Correspondence to: Dr S. Hakak, Department of Anaesthesia, The Rotunda Hospital, Parnell Square, Dublin 2, Ireland.

E-mail address: sheeba_hakak@hotmail.com

research and ethics committee approval and clinical trial registration (ISRCTN14847686), an initial assessment of woman records was done and pregnant women meeting the inclusion criteria were identified. Selected women were recruited at antenatal clinics and written informed consent obtained. Inclusion criteria were age greater than 18 years and singleton pregnancy of greater than 36 weeks' gestation. Exclusion criteria were woman refusal, deviation from fasting times, body mass index (BMI) greater than 35 kg/m^2 , diabetes mellitus, preeclampsia, hiatus hernia, intestinal disease and previous upper abdominal surgery. Women were requested to fast from both liquids and solids for six hours after a light meal (which was standardised as tea and toast) prior to their next antenatal clinic visit.

On the day of assessment, fasting and dietary compliance was confirmed individually with each woman and gastric ultrasonography was performed after six hours of fasting. All scanning was performed by a single operator (SH) with prior experience in the technique (75 scans on pregnant women). All women were scanned using a single GE Healthcare ultrasound machine (Venue 40 model) using a low frequency (2–5 MHz) curvilinear probe. Women were first scanned in a semi-recumbent (45 degrees head up) supine position, followed by a semi-recumbent (45 degrees head up) right lateral position (RLP). In both positions the gastric antrum was identified in the sagittal plane with its internal anatomical landmarks identified, i.e. the left lobe of the liver anteriorly and the abdominal aorta posteriorly.^{10,15,24} A qualitative assessment was performed to identify material in the stomach (solid or liquid) and a gastric antral grade, as described by Perlas et al. was designated based on the presence of fluid as follows: Grade 0 = absence of fluid in both supine and RLP; Grade 1 = fluid in RLP only; Grade 2 = fluid in both supine and RLPs.¹⁰ Quantitative assessment was performed by measuring antral cross-sectional area (CSA) and antral volume.^{10,11} The antral CSA was calculated by measuring two perpendicular diameters in a longitudinal (d1) and antero-posterior (d2) plane from serosa to serosa and using the formula $\text{CSA} = \pi[d1 \times d2]/4$ (Fig. 1).^{11,15} Four measurements of gastric antral CSA were obtained for each woman, one in the semi-recumbent supine and three in the semi-recumbent RLP. These were then averaged to obtain a mean value in the semi-recumbent RLP. The following mathematical model was used to calculate the volume of the gastric contents and to determine the volume in mL/kg: $\text{Volume} = 27.0 + (14.6 \times \text{right-lateral CSA}) - (1.28 \times \text{age})$.^{11,23} Currently recommended thresholds for increased risk of aspiration include a gastric volume in excess of 1.5 mL/kg and a right lateral CSA $>10.3 \text{ cm}$.^{2,5,12–14} Woman age, gestation, BMI and fasting time were also recorded.

The primary outcome was the presence of solid food contents in the gastric antrum after six-hours of fasting.

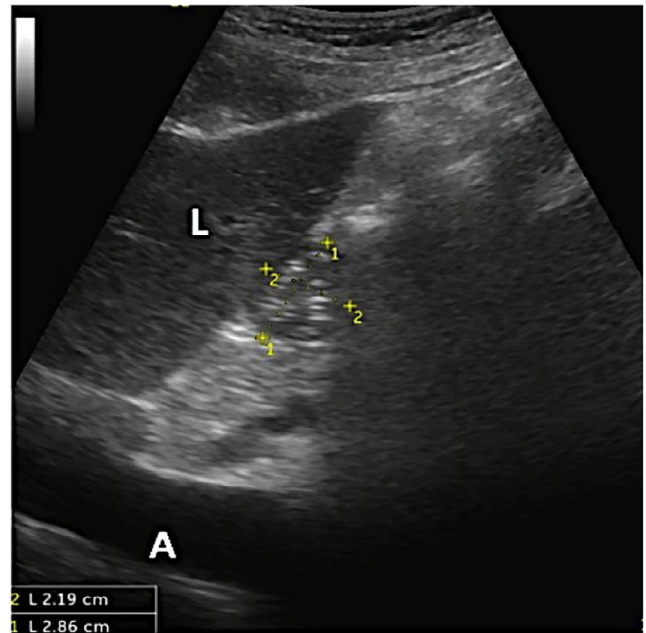


Fig. 1 Ultrasonographic image of gastric antrum. Two perpendicular diameters 1 and 2 for antral cross-sectional area (CSA) are demonstrated. L: liver; A: aorta

Secondary outcomes included antral grade, antral CSA area and estimated residual gastric fluid volume.

Data were analysed using Sigma Stat (Version 2.0; Jandel Corporation, San Rafael, CA). Categorical data are presented as numbers and percentage (with 95% confidence intervals [CI]) and were analysed by Chi-square or Fisher's exact test as appropriate. Continuous data were analysed by analysis of variance or analysis of variance for ranks, as appropriate. Correlation coefficients were calculated using Spearman's rank correlation coefficient. Continuous data are presented as mean (standard deviation [SD]) and median (interquartile range) where appropriate. The α level for analyses was set as $P \leq 0.05$. Correction for multiple comparisons was made using the Bonferroni method, where appropriate.

Results

Four hundred and fifty-six woman records were assessed to identify those meeting the inclusion criteria. One hundred and seventy-seven pregnant women met the inclusion criteria. One hundred refused to participate, 20 did not attend and six did not comply with fasting instructions. We studied and analysed 51 women for our study. Imaging was inadequate in five participants (Fig. 2). Complete data were obtained in 46 pregnant women for qualitative assessment and 48 pregnant women for quantitative assessment (Fig. 3). The characteristics of the 51 pregnant women who participated are shown in Table 1. Mean (SD) BMI was $27.3 (3.4) \text{ kg/m}^2$

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