GASTRIC-1 (Gastric Antral Screening To determine Residual Internal Contents)

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Background

Fasting guidelines exist in attempt to minimise the risk of regurgitation of gastric contents and pulmonary aspiration. However, the incidence of aspiration is low and there is no clear evidence to suggest that the risk is increased by shortened fluid fast [1]. Patients with prolonged fluid fast pre-operatively experience dry mouth, increased thirst, discomfort and anxiety [2]. Recently, gastric ultrasound has emerged as a readily available, cost-effective and non-invasive point-of-care tool to examine stomach contents and volume [3].

Aims

We aimed to determine gastric volumes in healthy, starved volunteers after water ingestion using gastric ultrasound. Secondary aim was to assess the feasibility of applying the same methodology in pre-operative patients, including the groups of patients with increased risks of delayed gastric emptying.

Methods

Ethics approval was obtained. Healthy volunteers fulfilling the eligibility criteria were recruited.

Inclusion criteria:

- Ability to understand the study protocol and provide informed consent
- Age 18 years or older
- American Society of Anaesthesiologists (ASA) physical status classification 1 or 2

Exclusion criteria:

- Current pregnancy
- Pre-existing abnormal anatomy of the upper gastrointestinal tract
- Administration of prescribed medications known to affect gastric motility

The enrolled volunteers were required to adhere to the current ANZCA fasting guideline (solid food up to 6 hours and clear fluids up to 2 hours prior to the procedure). The demographics data of the participants were obtained. The gastric scans were performed in North Shore Hospital using a standardised scanning protocol* [4]. Following a baseline scan, the participants were given 250mL of chilled water to drink. Serial gastric scans were performed after the ingestion of water at 1min, 5min, 10min, 15min and 20min, and every 10mins thereafter until the gastric antrum returned to baseline. Both the qualitative and quantitative assessments of the antrum were performed. The gastric volume (GV) was calculated using a previously described mathematical model [5].

GV = 27.0 + 14.6 x Right lateral CSA – 1.28 x age

Results

Twenty one volunteers were enrolled, one was excluded due to inadequate ultrasound image acquisition at baseline.

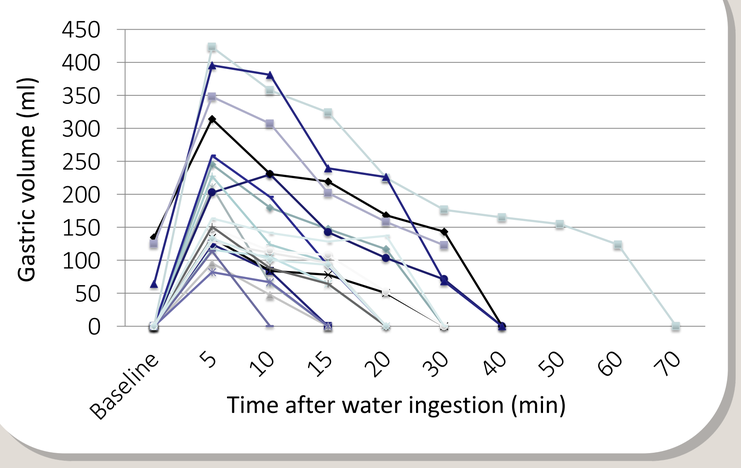
Table 1. Demographics

Characteristics	Mean ± SD*
Age (yr)	35 ± 9
BMI (kg/m^2)	23 ± 2
Sex (male:female)	9:11
Fasting interval for solids (h)	11.2 ± 2.4
Fasting interval for clear fluids (h)	8.4 ± 3.9

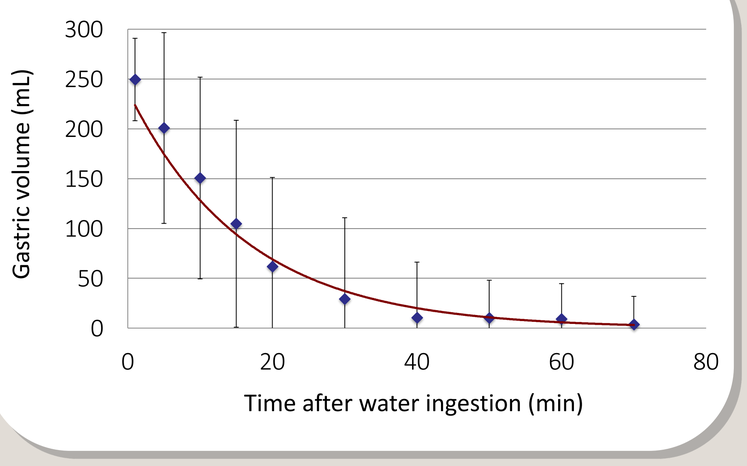
*SD = Standard Deviation

- Seventeen out of 20 volunteers (85%) had an empty stomach at baseline.
- Three (15%) had gastric fluid at baseline; 64mL, 125ml and 135ml.
- Sixteen (80%) had gastric antrum return to baseline within 30 minutes after water ingestion
- Nineteen (95%) had gastric antrum return to baseline within 40 minutes
- The end-points were an empty stomach for 19, including two of the participants who had measurable gastric fluid at baseline

Graph 1. Gastric volume change of 20 participants

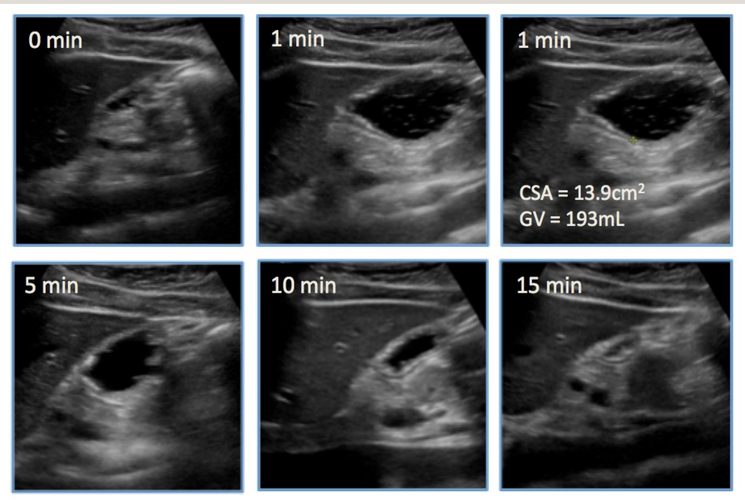


Graph 2. Mean gastric volume ± SD vs time

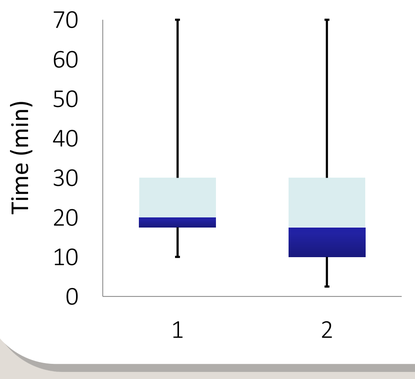


The best-fit line has been selected for the trend of the mean gastric volume change (in red), which fits an exponential pattern. It takes approximately 15 minutes in average to reach 100mL of gastric volume after 250mL of water ingestion. This value is of clinical interest as 1.5mL/kg is considered as a cut-off value for high aspiration risk [ ].

Picture 1. Ultrasound images



Graph 3. Gastric emptying time



1 Return to baseline
Range 10 - 70 min
Median 20 min
IQR* 17.5 - 30 min
*IQR = interquartile range

2 Return to 1.5mL/kg
Range 10 - 70 min
Median 20 min
IQR 17.5 - 30 min

Discussion

A strength of the study is that it represents local data of gastric volumes of healthy volunteers after water ingestion. Ultrasound is a practical way of assessing gastric volumes compared to other studied modalities such as scintigraphy, MRI or endoscopic suctioning. To ensure the quality of the raw data, all the stored images were double checked by a second anaesthetist experienced in gastric ultrasound.

Image acquisition was not always possible, however this has been described in other studies [ ]. Some participants had calculated gastric volumes over 250mL post water ingestion and this could be attributed to measurement error as well as possible air swallowing and production of baseline gastric fluid. The calculated gastric volumes are only as good as the mathematical model used, which has limitations of its own.

The demographics of the study population do not represent our usual patient groups and future studies on patients are planned to potentially improve the fasting guideline and the quality of peri-operative care and experience of the patients.

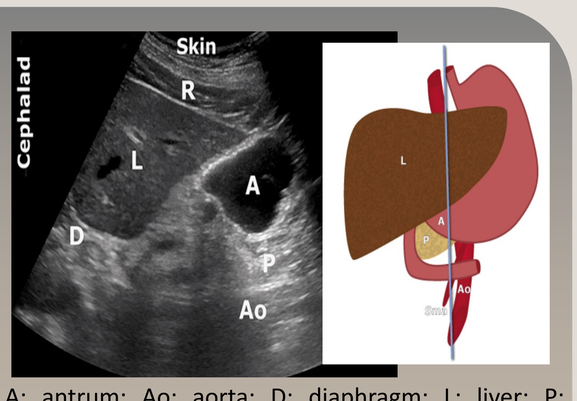
Conclusion

Ninety-five percent of the eligible volunteers were studied. Median gastric emptying time was 20 minutes. Gastric volumes returned to baseline by 70 minutes in all participants after the ingestion of 250mL of water.

We have demonstrated feasibility for future studies in patient population.

SCANNING PROTOCOL*

Particiapnts were scanned in both supine and right lateral decubitus (RLD) position, using low frequency curvilinear transducer in abdominal setting of the Exporte Sonosite ultrasound machine. Epigastrum was scanned in a sagittal or parasagittal plane to identify the gastric antrum. The antrum lies posterior to the left lobe of the liver and anterior to the pancreas at the level of the aorta. These landmarks were used when acquiring the image for qualitative and quantitative assessments. For gastric volume calculation, the antrum was traced including the full thickness of the gastric wall, from serosa to serosa, when it was at rest between peristaltic contractions.



A: antrum; Ao: aorta; D: diaphragm; L: liver; P: pancreas; R: rectus abdominis muscle, Sma: superior mesenteric artery

References

[1] Brady MC, Kinn S, Stuart P, Ness V. Preoperative fasting for adults to prevent perioperative complications. Cochrane Database of Systematic Reviews 2003, Issue 4. Art. No.: CD004423. DOI: 10.1002/14651858.CD004423.
[2] Read MS, Vaughan RS. Allowing pre-operative patients to drink: effects on patients' safety and comfort of unlimited oral water until 2 hours before anaesthesia. *Acta Anaesthesiol Scand* 1991; 35: 591-595.
[3] Van de PUtte P, Perlas A, Ultrasound assessment of gastric content and volume. *Br J Anaesth* 2014; 113: 12-22.
[4] Perlas A, Vand de Putte P, Van Houwe P, Chan VWS. I-AIM framework for point-of-care gastric ultrasound. *Br J Anaesth* 2016; 116: 7-11.
[5] Perlas A, Mitsakakis N, Liu L, et al. Validation of a mathematical model for ultrasound assessment of gastric volume by gastroscopic examination. *Anesth Analg* 2013; 116: 357-63.