ueg week

MONASH University

WESTERN SYDNEY UNIVERSITY

atmo BIOSCIENCES

Pattern of intragastric carbon dioxide concentrations in healthy subjects and patients with functional dyspepsia and gastroparesis: Evidence of greater duodeno-gastric reflux in association with delayed gastric emptying?

Phoebe A Thwaites[1], Jerry Zhou[2], CK Yao[1], Kyle J Berean[3,4], Emma P Halmos[1], Daniel So[1], Peter R Gibson[1], Rebecca E Burgell[1], Vincent Ho[2]

[1]Department of Gastroenterology, Monash University & Alfred Hospital, Melbourne, VIC, Australia. [2]Western Sydney University, Penrith South, Sydney, NSW, Australia.
[3]Atmo Biosciences, Box Hill, VIC Australia. [4] RMIT University, Melbourne, VIC

Background

The Atmo gas sensing capsule is a novel, single–use ingestible device that measures several parameters, including carbon dioxide (CO_2). Intra-gastric CO2 "bursts" were observed during a pilot study of regional gut transit in dysmotility.[1] The aetiology of this CO_2 was unclear prompting further evaluation.

Aims

To describe these intragastric bursts of CO_2 in patients with a clinical diagnosis of functional dyspepsia and/or gastroparesis compared with healthy subjects in relation to:

- Frequency and duration
- Clinical diagnosis
- Physiological events – speed of gastric emptying & ingestion of liquid/food
- Intragastric pH profile

Methods

Subjects: Clinical diagnosis of functional dyspepsia or gastroparesis and healthy subjects.

Capsule studies: Following an 8-hour overnight fast, subjects ingested a standardised cereal bar followed by the gas-sensing capsule and wireless motility capsule (WMC) in random order with an additional 6-hour fast prior to resuming their habitual diet (without carbonated beverages). Motility- and pH-altering medications were withheld 72h prior and for the study duration. Food/drink consumption was recorded on a patient-held data receiver.

Outcomes measured: CO_2 bursts were described by:

1) frequency and size (area-under-the-curve);
2) associations with food/drink consumption and intra-gastric pH changes;
3) correlation with clinical diagnosis;
4) correlation with gastric emptying time.

Results

Example traces shown in Fig 1.

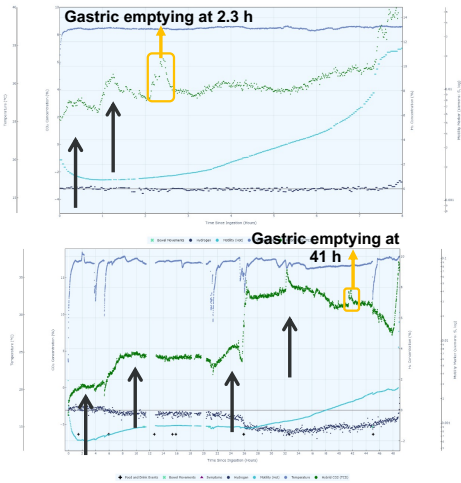

***Fig. 1**. Example traces of CO_2 (green) with black arrows showing bursts. Gastric emptying shown in mustard.*

***Table 1.** Characteristics of CO_2 bursts.*

	Healthy	Gastro-paresis	Functional Dyspepsia	p-value
No. (%) subjects with CO_2 bursts	2/4 (50%)	16/25 (64%)	5/5 (100%)	0.25[b]
No. of bursts per participant med. (IQR)	3 (2-3)	2 (1-4)	2 (1 -3)	0.57[a]
Proportion related to food/drink	0	13/41 (32%)	2/9 (22%)	0.35[b]
AUC (flat), %.h med. (IQR)	1.2 (0.17-2.2)	6.1 (0.7-30.3)	1.8 (0.5–4.4)	0.22[a]

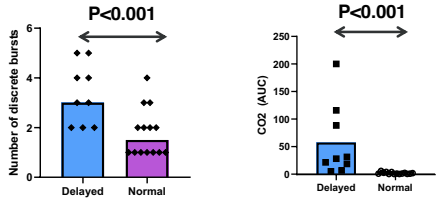

***Fig. 2.** Frequency and size of CO_2 bursts according to delayed (blue) or normal (pink) gastric emptying.*

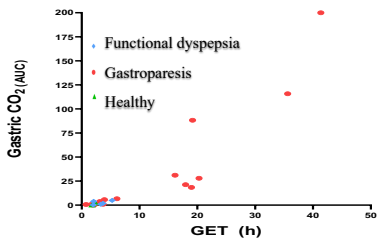

***Fig. 3.** Association of AUC for CO_2 bursts with gastric emptying time (GET) according to clinical diagnosis.*

The greater number and size of bursts in subjects with delayed gastric emptying time remained significant when adjusting for gastric residence time (all p-values <0.01).

Conclusions

Intra-gastric bursts of CO_2 are

- associated with delayed gastric emptying, not prior clinical diagnosis
- can be quantified by number and size.

So, what are they?

There are four potential sources of intragastric CO_2 production.[2-4]

1. Chemical reactions with acid/base $H^+ + HCO_3^- \rightarrow CO_2 + H_2O$ (e.g., duodeno-gastric reflux of bicarbonate-rich fluid)
2. Ingestion of CO_2 (e.g., swallowing air, food/drink)
3. Alteration in gastric diffusion of CO_2 (e.g., hyperventilation effect)
4. Microbial metabolic activity (not significant in non-rumen stomach).

The most likely physiological explanation for these bursts of CO_2 is *duodeno-gastric reflux*

Implications

Further validation is required in a larger cohort of healthy subjects and those with functional dyspepsia and gastroparesis.

Ability to quantify this phenomenon offers a unique opportunity to evaluate duodeno-gastric reflux

- in a variety of clinical conditions
- its modulation with therapeutic intervention.

1. Zhou et al., DDW, 2023; 2. Ou et al., Sci Rep, 2016; 3. Cuomo et al, Nutr Metab. Cardiovasc Dis. 2009; 4. Levitt and Bond, Gastroenterol, 1970.

COI: PAT: None to declare; JZ: None to declare; CKY: Received research support from Atmo Biosciences for investigator-initiated studies; EH: Received research grants from investigator -driven studies, from Mindset Health, and speaker honoraria from Sandoz PTY LTD and Mindset Health; KJB: Employee and shareholder of Atmo Biosciences; PRG: Consultant or advisory board member for Anatara, Atmo Biosciences, Immunic Therapeutics, Novozymes, Novoviah and Comvita. He has received research grants for investigator-driven studies from Atmo Biosciences. He holds shares in Atmo Biosciences. His Department financially benefits from the sales of a digital application, booklets and online courses on the FODMAP diet; REB: Consultant or advisory board member for Allergan, Atmo Biosciences, Antara. She has received speaking honoraria from Bayer; VH: None to declare.