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MRI for evaluation of gastric physiology

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Citation

Zwart, I. M. de. (2010, November 2). *MRI for evaluation of gastric physiology*. Retrieved from <https://hdl.handle.net/1887/16093>

Version: Corrected Publisher's Version

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Note: To cite this publication please use the final published version (if applicable).

Chapter 1

General introduction and outline

General introduction

The function of the stomach comprises storage of ingested food, production of gastric secretion and mixing food with gastric secretion, grinding the ingested food (motility) and emptying of the stomach to the duodenum. This function can roughly be summed up by two main processes: gastric emptying and gastric motility.

Disorders of gastric function such as diabetic gastroparesis, functional dyspepsia and disorders after gastrointestinal surgery are characterized by a variety of changes of gastric motility and emptying: hyper- or hypomotility, disturbed gastric accommodation and delayed emptying, all in the absence of pathology found at endoscopy or abnormal laboratory results (1-3). Patients with disorders of gastric motility and gastric emptying experience a wide variety of complaints that are meal-related, such as nausea, bloating, gastric pain and/or gastric tension after meal consumption. Assessment of these disorders plays an important role in differential diagnosis and subsequent treatment of these patients.

Several techniques are currently applied to study normal and pathological gastric motility and gastric emptying but they measure or evaluate only few of the various aspects. For example, the barostat technique is considered the gold standard for evaluation of proximal gastric motor function, including gastric accommodation (4). Accommodation of the stomach wall is considered to be a vagally mediated reflex that causes the stomach wall to relax in response to a meal that has been consumed and acts as both a chemical and a mechanical stimulus. Gastric accommodation results in a reduction of gastric wall tone, which gives the stomach the opportunity to distend, providing a reservoir for the meal (5). Disadvantages of the barostat technique are the invasive nature requiring oral intubation with intragastric positioning of a polyethylene bag. Moreover, questions have been raised about possible interference of the barostat with gastric physiology (6-8), since it could act as a mechanical stimulus itself. Recognition of these characteristics may contribute to the diagnosis of motility disorders.

Since the early 1990's, magnetic resonance imaging (MRI) has been employed experimentally to investigate gastric motility and emptying non-invasively (5;9-11). Feinle et al validated MRI as a tool for the analysis of gastric emptying (12). And since that time, MRI has been used more often to study gastric pathophysiology (1;2;6;7;13-15).

Therefore, the aim of this thesis is to study and hereby validate MRI as a non-invasive tool for evaluation of gastric emptying and gastric motility in both healthy subjects and in patients with functional dyspepsia, both with and without pharmacological stimuli.

Outline of the thesis

This thesis describes and validates magnetic resonance imaging (MRI) as a tool for evaluation of gastric emptying and gastric motility in both healthy subjects and in patients with functional dyspepsia.

Chapter 2 reviews the main studies that employ MRI for evaluation of gastric function. In **Chapter 3**, real-time MR imaging of gastric motility is compared with simultaneous barostat recordings in healthy subjects. Changes in gastric motility and gastric volume were induced by intravenous administration of erythromycin and glucagon. In **Chapter 4**, the effect of the barostat bag on gastric function was evaluated with MRI. This was done in healthy subjects by simultaneous MRI + barostat recording vs. MRI alone in response to meal ingestion. In **Chapter 5** intragastric meal volumes (i.e. gastric emptying) and the accommodation response to a meal was studied in a group of 14 healthy subjects with simultaneously performed barostat and MRI and with MRI alone.

In **Chapter 6**, the effect of intravenously administered somatostatin on gastric emptying and motility is evaluated with MRI in healthy subjects and in patients with functional dyspepsia. In **Chapter 7**, twenty healthy subjects and 20 patients were studied with MRI. Aim of this part of the study was to evaluate whether MRI was able to differentiate between healthy subjects and patients with functional dyspepsia.

Reference list

- (1) Tack J, Piessevaux H, Coulie B, Caenepeel P, Janssens J. Role of impaired gastric accommodation to a meal in functional dyspepsia. *Gastroenterology* 1998; 115(6):1346-1352.
- (2) Vu MK, Straathof JWA, Van der Schaar PJ, Arndt JW, Ringers J, Lamers CBHW et al. Motor and sensory function of the proximal stomach in reflux disease and after laparoscopic Nissen fundoplication. *Am J Gastroenterol* 1999; 94:1481-1489.
- (3) Whitehead WE, Delvaux M. Standardization of barostat procedures for testing smooth muscle tone and sensory thresholds in the gastrointestinal tract. The Working Team of Glaxo-Wellcome Research, UK. *Dig Dis Sci* 1997; 42:223-241.
- (4) Schwizer W, Fraser R, Borovicka J, Asal K, Crelier G, Kunz P et al. Measurement of proximal and distal gastric motility with magnetic resonance imaging. *Am J Physiol* 1996; 271(1 Pt 1):G217-G222.
- (5) Wright J, Evans D, Gowland P, Mansfield P. Validation of antroduodenal motility measurements made by echo-planar magnetic resonance imaging. *Neurogastroenterol Motil* 1999; 11(1):19-25.
- (6) Fruehauf H, Goetze O, Steingoetter A, Kwiatek M, Boesiger P, Thumshirn M et al. Intersubject and intrasubject variability of gastric volumes in response to isocaloric liquid meals in functional dyspepsia and health. *Neurogastroenterol Motil* 2007; 19:553-561.
- (7) Richter J. Dyspepsia: organic causes and differential characteristics from functional dyspepsia. *Scand J Gastroenterol Suppl* 1991; 182:11-16.
- (8) Tack J, Broeckaert D, Coulie B, Janssens J. The influence of cisapride on gastric tone and the perception of gastric distension. *Aliment Pharmacol Ther* 1998; 12(8):761-766.
- (9) Boulby P, Moore R, Gowland P, Spiller RC. Fat delays emptying but increases forward and backward antral flow as assessed by flow-sensitive magnetic resonance imaging. *Neurogastroenterol Motil* 1999; 11(1):27-36.
- (10) Kunz P, Crelier GR, Schwizer W, Borovicka J, Kreiss C, Fried M et al. Gastric emptying and motility: assessment with MR imaging-- preliminary observations [see comments]. *Radiology* 1998; 207(1):33-40.

- (11) Kunz P, Feinle C, Schwizer W, Fried M, Boesiger P. Assessment of gastric motor function during the emptying of solid and liquid meals in humans by MRI. *J Magn Reson Imaging* 1999; 9(1):75-80.
- (12) Feinle C, Kunz P, Boesiger P, Fried M, Schwizer W. Scintigraphic validation of a magnetic resonance imaging method to study gastric emptying of a solid meal in humans. *Gut* 1999; 44(1):106-111.
- (13) Ajaj W, Goehde SC, Papanikolaou N, Holtmann G, Ruehm SG, Debatin JF et al. Real time high resolution magnetic resonance imaging for the assessment of gastric motility disorders. *Gut* 2004; 53:1256-1261.
- (14) Borovicka J, Lehmann R, Kunz P, Fraser R, Kreiss C, Crelier G et al. Evaluation of gastric emptying and motility in diabetic gastroparesis with magnetic resonance imaging: effects of cisapride. *Am J Gastroenterol* 1999; 94(10):2866-2873.
- (15) Tack J, Piessevaux H, Couli B, Janssens J. Influence of a fundus-relaxing drug on meal-related symptoms in dyspeptic patients with hypersensitivity to gastric distention. *Gastroenterology* . 1999.