

Real-Time High-Resolution TrueFISP Imaging for Gastric Motility: Pre- and Post Pharmacological Stimuli

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ABSTRACT

Aim of this study was to evaluate the practicability of real-time MRI regarding the assessment of gastric motility. Besides, the effect of motility-modifying agents were determined. Six healthy volunteers were examined using a real-time TrueFISP sequence before and after the intravenous application of scopolamine as well as metoclopramide. A motility index was calculated depending on antral peristalsis. Antral motility was quantified: administration of scopolamine led to a decrease, metoclopramide to an increase of gastric motility compared to the data lacking intravenous drug application.

INTRODUCTION:

Disturbances of gastric motor function are believed to play a key role for the development of symptoms in patients with functional gastrointestinal disorders. While functional pathologies are highly prevalent [1], all available tests to assess motor function are either invasive, expose the patient to radiation or are inaccurate. Gastric barostat studies with an intragastric balloon assessing proximal motor function provide accurate results [2], but remain hampered by their intrinsic invasiveness which translates into only moderate patient acceptance. Recently MR imaging has been proposed for evaluation of gastric emptying [3]. The technique is non-invasive, operator-independent, and not associated with ionizing radiation. However, current MRI techniques have been focused on the evaluation of changes of gastric volume and/or morphology, while gastric motion could not be assessed. With new real-time-sequences these limitations may be overcome. Mainly been used for cardiac imaging, these sequences might be applicable for the evaluation of gastric motion. Aim of this study was to determine the practicability of a real-time TrueFISP sequence for the assessment of gastric motion. In addition, the effects of motility-modifying substances were quantified.

METHODS:

Six healthy volunteers with no history of gastrointestinal disorder ingested 400 ml of a high caloric, liquid nutrient after an eight hour fast. The MR examination was performed on a 1.5 T scanner (Magnetom Sonata[®], Siemens Medical Systems/Germany). 15 and 20 minutes following the ingestion of the nutrient a 2D real-time TrueFISP sequence (TR/TE/FLIP = 2.4/1.2/60°) was acquired. The acquisition plane was chosen parallel to the axis of the gastric antrum. The acquisition time for the real-time scan amounted to 20 sec. The examination was performed on three separate days with and without i.v. administration of 10mg metoclopramide or 20mg scopolamine 18 minutes after the oral ingestion of the liquid. For each real-time data set a motility index was calculated. Therefore, the minimal diameter of the antrum lumen parallel to the scan axis was multiplied with the distance that one peristaltic wave had passed within 20 sec.

RESULTS:

The high caloric nutrient was homogeneously bright on the real-time 2D TrueFISP data sets. Thus delineation of the gastric lumen proved easy and robust. The intra-individual comparison between the motility index of the three examinations 15 minutes after the contrast ingestion failed to demonstrate a statistically significant difference ($p > 0.05$). Average values of the motility index amounted to 2.42 cm²/sec (SD = +/- 0.29). The intravenous application of motility-modifying agents, however, resulted in significant changes of the index 20 minutes after contrast ingestion: applying metoclopramide, the index was averagely increased by a factor of 1.8 whereas the application of scopolamine led to a decrease of the index by a factor of 3.0.

DISCUSSION:

Gastric motility can be assessed by means of MRI. The acquired 2D real-time TrueFISP data turn out to be robust. Furthermore, the effect of motility-modifying agents can be evaluated and quantified. While the intravenous application of metoclopramide leads to a significant acceleration of antral peristaltic waves, scopolamine decreases gastric motility. Due to the non-invasive character of MRI, this imaging modality can be an attractive alternative to conventional invasive diagnostic tools for gastric motility disorders and therapeutical monitoring.

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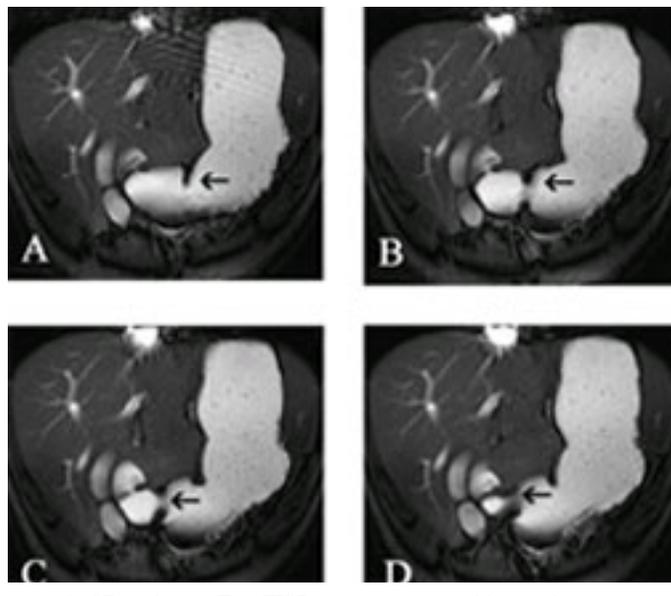


Fig 1: 2D real-time TrueFISP sequence in an oblique plane displaying the antral axis. Images A to D show the motion of the peristaltic wave toward the pylorus (arrow). Based on the distance that one wave passes within 20 seconds and its maximal diameter, a motility index could be determined.