

Real-time MR imaging for the assessment of gastric motility disorders

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ABSTRACT

Aim of this study was to evaluate whether patients with increased or decreased gastric motility can be differentiated from healthy volunteers by means of real-time MRI. Each 10 healthy volunteers, ten patients with gastroparesis and ten patients with functional pylorospasm / peptic pyloric stenosis underwent real-time MRI. Antral motility was quantified by calculating a gastric motility index. Patients with gastroparesis showed a lower motility index compared to the reference volunteer group, while the mean motility index of the patient group with pylorospasm was more than three times as high as the reference value of the volunteer group. Hence, real-time MRI is a reliable tool for the assessment of gastric motion.

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, all available tests to assess motor function are either invasive, expose the patient to radiation or are inaccurate. MR imaging has been proposed for evaluation of gastric emptying [1]. This modality combines the advantages of non-invasiveness and operator-independence. Furthermore MRI is not associated with ionizing radiation exposure. Most 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 techniques might be applicable for the evaluation of gastric motion and have been evaluated in volunteer trials [2]. Aim of this study was to determine the practicability of a real-time TrueFISP sequence for the assessment of gastric motion in patients with gastric motility disorders and compare the results with reference values obtained in a healthy volunteer group.

METHODS:

Ten healthy volunteers (group A) without any history of gastrointestinal disease and twenty patients were examined. Ten patients suffered from gastroparesis (group B) and ten patients from functional pylorospasm or peptic pyloric stenosis (group C). All subjects ingested 400 ml of a high caloric, liquid nutrient after a six hour fast. The MR examination was performed on a 1.5 T scanner (Magnetom Sonata[®], Siemens Medical Systems/Germany) in supine position. Between 5 and 30 minutes following the ingestion a 2D real-time TrueFISP sequence (TR/TE/FLIP = 2.4/1.2/60°) was acquired in five-minute intervals. The acquisition time for the real-time scan amounted to 20 sec. The acquisition plane was chosen parallel to the axis of the gastric antrum. 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. Mean gastric motility indices for the volunteer group as well as for both patient groups are shown in figure 1. Average values of the motility index within the volunteer group for the examination at 15 minutes amounted to 2.5 mm²/s (SD = +/- 0.29). For patients with gastroparesis, however, the mean index at the same acquisition time point was 1.5 mm²/s (range 1.2-1.9 mm²/s). In opposite, patients with functional pylorospasm and peptic pyloric stenosis were found to have a mean motility index of 9 mm²/s (range 7-16 mm²/s). Figure 2-4 displays an example of each study group.

DISCUSSION:

Gastric motility can be assessed by means of real-time MRI. The acquired 2D real-time TrueFISP data turn out to be robust. Patients with decreased gastric motion can be reliably distinguished from patients with increased gastric motility. Due to the non-invasive character of MRI, this imaging modality can be an attractive alternative to conventional invasive diagnostic tools for diagnosis of gastric motility disorders and consecutive therapeutical monitoring.

REFERENCES:

1. Kunz P et al.. Gastric emptying and motility: assessment with MR imaging-preliminary observations. Radiology 1998; 207: 33-40
2. Real-time high-resolution MR imaging for the assessment of gastric motility: pre- and post pharmacological stimuli. ISMRM 07/2003, Poster, Toronto, Canada.

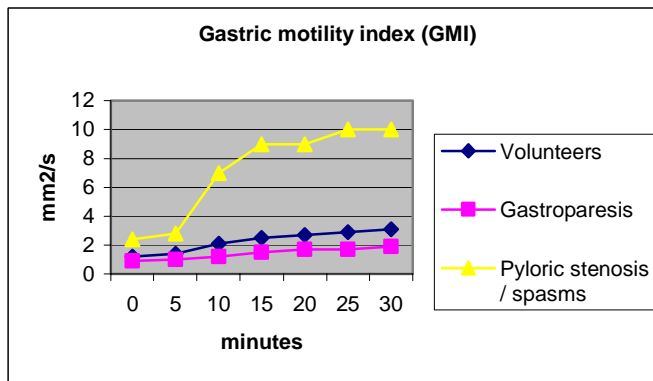


Fig. 1: Mean gastric motility indices for the volunteer group and both patient groups.

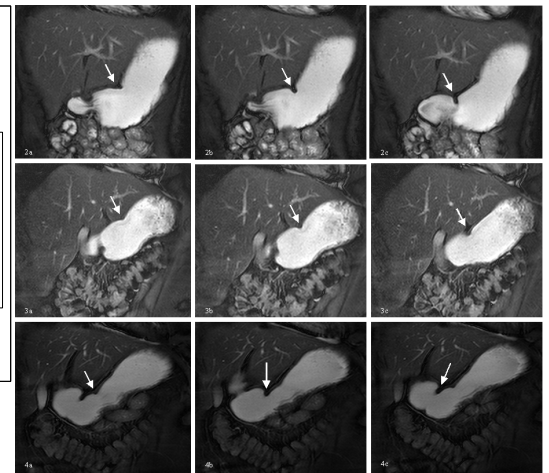


Fig 2-4: 2D real-time TrueFISP sequence in an oblique plane displaying the antral axis. Images A to C show the motion of the peristaltic wave toward the pylorus (arrow) in healthy volunteers (fig 2), in patients with decreased gastric motion (fig 3) and in patient with increased gastric motility (fig 4). Based on the distance that one wave passes within 20 seconds and its maximal diameter, a motility index could be determined and gastric motion can be quantified.