DOSIGE OPTIMIZATION OF HYDRO SOLUTION FOR SMALL BOWEL IMAGING

W. Ajaj[1], S. C. Goehde[1], R. Jeyrani[1], H. Schneemann[1], S. G. Ruehm[1], J. F. Debatin[1], T. Lauenstein[1]

[1]Department of Diagnostic and Interventional Radiology, University Hospital Essen, Essen, Germany

ABSTRACT:

We aimed to optimize the application protocol of a hydro solution for small bowel imaging in terms of bowel distension and patient acceptance. Four different quantities between 1500ml and 800ml of a solution containing 2.5% mannitol and 0.2% locust bean gum were tested in 10 volunteers. Coronal TrueFISP data were acquired between 0 and 30 minutes after the contrast ingestion. The use of 1000ml turned out to provide the optimal balance between high bowel loop distension and low-side effects.

INTRODUCTION:

Sufficient distension of the intestine is crucial for small bowel MR-Imaging. By applying contrast agents via a nasoduodenal tube, sufficient bowel distension is achievable. However, this method often is perceived as traumatizing by patients due to its invasive character. The mere oral administration of water without intubation is non-invasive and well accepted. Unfortunately this procedure is often associated with a rapid resorption of water in the small bowel which diminishes bowel distension. Certain additives such as mannitol or locust bean gum (LBG) can inhibit water resorption [1,2] and thus have been proposed for small bowel MR imaging. However, the dosage of mannitol is limited due to possible side-effects, e.g. nausea or diarrhea. The purpose of this study was to determine the optimal quantity of mannitol and LBG balancing between patient acceptance and bowel distension.

METHODS:

10 healthy volunteers (six female and four male; age range 27 to 46 years) without any history of previous abdominal surgery or gastrointestinal disease were examined. They ingested in a randomised order on four separate days 1500ml, 1200ml, 1000ml or 800ml of a solution containing 2.5% mannitol and 0.2% LBG. There was a minimal time lag of 48 hours between two examinations. MR examinations were performed on a 1.5 T system (Magnetom Sonata, Siemens Medical Systems, Erlangen, Germany). Coronal 2D images were collected in patients prone position using a fast T2-weighted steady state precession sequence (TrueFISP, TR/TE/flip 3.9/1.9/70°) at 0, 5, 10, 15, 20, 25 and 30 minutes. Other imaging parameters were the following: field of view = 35cm; slice thickness = 7mm with an intersection gap of 1mm (25 slices); matrix size = 144x256; acquisition time = 22 seconds. Small bowel distension was quantified on coronal 2D TrueFISP images measuring the diameters of 5 loops in the jejunum and 5 loops in the ileum and calculating a mean value. 24 hours after each MR exam, volunteers were questioned regarding the occurrence of side effects such as diarrhea, nausea, vomiting, abdominal spasms or flatulence. To this end, a standardized questionnaire was used, which was based on a four-point scale (1 = no side-effects, 2 = mild side-effects, 3 = moderate side-effects, 4= severe side-effects). The effect of the different quantities concerning small bowel distension and patient acceptance were compared by a paired t-test. For the adaptation to multiple samples, a Bonferoni-correction was used. For all statistical analyses, a P value < 0.05 was considered to indicate a statistically significant difference.

RESULTS:

The quantitative comparison of the four solutions revealed the highest small bowel distension after the ingestion of 1500ml of contrast. The mean small bowel diameter for the 1500, 1200 and 1000ml solutions amounted to 21.0mm, 20.7mm and 20.3mm respectively. However, these results failed to prove a statistically significant difference. The administration of 800ml resulted in a mean small bowel diameter of only 14.9mm, which was significantly lower compared to the other examinations.

Regarding the assessment of the single examinations along the time axis, best distension was seen after 0-15 minutes (e.g. mean distension between 22.4mm and 22.7mm for the examination with 1500ml contrast). Bowel loop distension decreased significantly after 20 and 30 minutes (19.2mm and 19.0mm for the examination with 1500ml contrast).

The highest degree of diarrhea was observed following the ingestion of 1500 and 1200ml solution (average of 3.3 and 3.1) The ingestion of the 1000 and 800ml solution led to no or only mild diarrhea (mean index 1.6 and 1.3). Also, the assessment of the other side-effects shown statistically significant differences between the examinations.

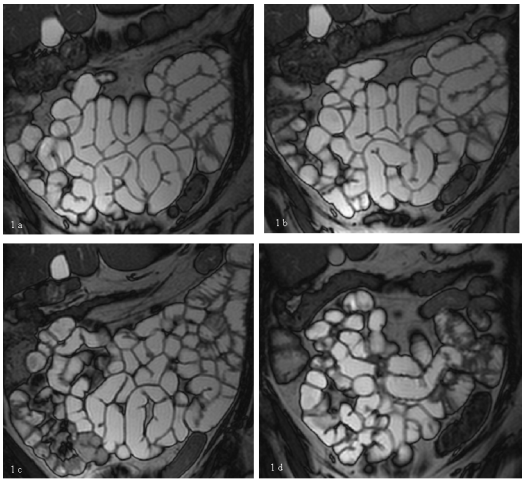

Fig 1a-d: coronal TrueFISP images of the examinations with 1500 (fig 1a), 1200 (fig 1b), 1000 (fig 1c) and 800ml (fig 1d) contrast solution five minutes after finishing the ingestion. No statistically significant differences were determined between the first three examinations regarding bowel distension. The ingestion of 800ml, however led to a significantly lower distension.

DISCUSSION:

The ingestion of 1500, 1200 and 1000ml of a 0.2% LBG / 2.5% mannitol solution turned out to provide a similar high small bowel distension. Since the side-effect rate was determined to be higher for the ingestion of 1500 and 1200ml, we recommend a 1000ml solution for the optimal balance between image quality and occurrence of side effects. Besides, MR imaging should be performed within the first 15 minutes after the ingestion.

REFERENCES:

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