

Dual Contrast MR Cholangiopancreatography (MRCP): A technique to manipulate the signal intensity arising from intestinal fluid.

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BACKGROUND

Previously, we reported the efficacy of high concentration ferric ammonium citrate solution as a negative oral contrast agent in MRCP [1-3]. It suppresses high intensity intestinal fluid superimposing on the biliary tract. On the other hand, the visualization of duodenal fluid WITH high intensity on the source images is also important as a landmark for the papilla of Vater. Pre contrast images can be helpful, but some patients do not have enough duodenal fluid to localize the papilla Vater.

PURPOSE

Recently, we observed that FerriSeltz solution at an intermediate concentration has unique characteristics. It can be used both as a positive contrast agent (i.e., T2 longer than surrounding visible tissue) in short TE MRCP and negative contrast agent (i.e., T2 shorter than surrounding visible tissue) in long TE MRCP [4]. We introduce here a new method, "dual contrast MRCP", based on this positive-negative contrast effect, with explanation of the mechanism and illustrative cases.

METHODS AND MECHANISM

SUBJECTS

Five patients with suspected biliary obstruction (three men and two women; mean age: 72 years) were examined with a 1.5T unit (GYROSCAN ACS-NT, PHILIPS, Best, Holland) using the body coil. The underlying diseases include a duodenal diverticulum (n = 2), papilla vater cancer (n = 2), and gall stone ileus (n = 1).

IMAGING TECHNIQUE

FerriSeltz solution (FerriSeltz (Otsuka Pharmaceutical, Tokushima, Japan) is a ferric ammonium citrate-based positive oral contrast agent, known as OMR in preclinical studies. We found that a three-fold higher than normal concentration solution has a T2 value of 86 ms. Therefore, after mixing with the duodenal fluid, the relative signal intensity will be reduced one hundred-fold with a TE of 600 ms or more. FerriSeltz then acts as a negative contrast agent. Conversely, for a TE of 90 ms or less, the signal is largely retained. The FerriSeltz then solution has significantly bright signal intensity.

MR IMAGING

We obtained MRCP images using a 1.5T scanner (GYROSCAN ACS-NT, PHILIPS, Best, The Netherlands) and a 17-cm circular surface coil. Two types of MRCP images were acquired. For the positive contrast effect, multi-slice 2D MRCP was performed with a gapless and interleaved Turbo SE sequence (TR/TE 7500/90 ms, 151x256 matrix, slice thickness 5 mm, Turbo factor 55) during a 10-sec breathhold period. For the negative contrast effect, single slice 2D MRCP was done with a one shot turbo SE sequence (TE 1200

ms, 151x256 matrix, slice thickness 65 mm, Turbo factor 151) during a 2-sec breath-holding period. Both sequences were used before and after oral administration of FerriSeltz solution at a three-fold higher concentration than normal.

RESULTS

Duodenal diverticula were diagnosed in one case on positive contrast images (Fig. 1) and in another on negative contrast images. Both papilla vater cancers were diagnosed on the positive contrast images. Gall stone ileus was diagnosed on positive contrast images.

DISCUSSION

The image quality of MRCP is being improved steadily and it seems to rival that of ERCP. However, ERCP still has a great advantage, because the endoscopic approach allows screening for duodenal lesions. In this situation, conventional MRCP has a poor diagnostic capability. The volume of the duodenal fluid varies greatly from patient to patient.

Dual contrast MRCP can be used to resolve this problem. Because the oral contrast material will fill the duodenum, duodenal lesions can be evaluated on short TE images. Furthermore, we can immediately also obtain a good projection image without disturbance of the high intensity signal from intestinal fluid. Both benefits are obtained by only one oral administration. In conclusion, dual contrast MRCP, which allows two different contrast effects in duodenal fluid with only one oral administration of carefully adjusted FerriSeltz solution, overcomes a potential problem in conventional MRCP and further improves its usefulness in comparison to ERCP.

REFERENCES

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Fig. 1. ---66-year-old man with Lemmel syndrome. A, MRCP without oral contrast material shows bright areas superimposing on the bile (arrowhead). This signal originates from fluid in the duodenal bulb. B, Long TE MRCP with oral contrast medium shows marked suppression of signal from the intestinal fluid. Note the clear image of the bile duct. C, Short TE MRCP without oral contrast medium reveals poor demonstration of the intestinal tract and proper evaluation can not be made on the duodenum. D, Short TE MRCP with oral contrast medium clearly demonstrates duodenum and a round high-intensity structure (arrowhead) suggesting a parapapillary diverticulum. E, Hypotonic duodenography confirms the duodenal diverticulum.