Quantitative Evaluation of Signal Elimination in Gastrointestinal Tract by Oral Negative Contrast Agent in MRCP using 3T apparatus in comparison with 1.5T

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Introduction

Magnetic resonance cholangiopancreatography (MRCP) has developed as a noninvasive examination demonstrating the pancreaticobiliary tree. Although the cholangiopancreatic tract has been shown with high-signal intensity caused by extremely T2-enhanced images, sometimes these structures masked by the signal hyperintensity of fluid in gastrointestinal tract. To remove gastrointestinal signals, T2-shortening contrast agent was used as negative contrast agent with oral administration. Though there are some reports of this effect at 1.5T, no report was found at 3T. The purpose of this study was 1) to evaluate the relationship between the elimination of signal intensity and the concentration of agent and 2) to quantitative evaluate the effectiveness of this agent in MRCP using 3T in comparison with 1.5T.

Materials and Methods

Young adult volunteers (22-25y) without any digestive system findings were evaluated in this study. Local ethics committee approval was granted and full normal volunteer consent obtained. All studies were performed with a 3T clinical scanner (Signa Excite HD 3.0T) with a 8 channel cardiac coil and 1.5T clinical scanner (Signa Excite HD 1.5T) with a 8 channel body array coil. Commercially-available oral negative gastrointestinal contrast agent (FerriSeltz; Otsuka Pharmaceutical, Japan) with 6mg/150cc administration was performed. Phantom study was conducted to evaluate both signal elimination in T2-WI and quantify T2* values by FeriSeltz aqueous solution. 2D Single-shot Fast SE (SSFSE) sequence and 3D Fast SE-XL (FSE-XL) sequence were used for pre and post (until 80min.) acquisition. Detectability of bile duct and pancreatic duct and effectiveness of negative contrast were evaluated by visual evaluation using scoring method by 4 ranked scores. Scoring observation for blind visual estimation was carried out by three observers with enough experience with MR image diagnosis.

Results and Discussions

The MRCP images (2D) obtained by 1.5T and 3T were shown in fig.1 and 2. The intra-gastrointestinal tract signals were eliminated caused by contrast agent in both 1.5T and 3T at post administration. The relationship between the ratio of T2 signal intensity elimination using 2D-MRCP sequence and concentration of ferric ammonium citrate were shown in fig.3. The relationship between quantitative T2* value and concentration of ferric ammonium citrate were shown in fig.4. There was no significant difference of signal elimination between 1.5T and 3T, but T2* value in 3T at low concentration was much shorter than that in 1.5T. These results were suggested that susceptibility effect by higher magnetic field was less effective for elimination of T2 signal intensity in MRCP. The signal elimination effects of stomach between 1.5T and 3T were shown in fig.5. From the results of visual evaluation of detectability and effectiveness of signal elimination, there was not large difference between 1.5T and 3T in 2D images. But in 3D images, higher scores of 3T than 1.5T were shown until 80min.. It was suggested that the duration of elimination effect at 3T prolonged more than that at 1.5T.
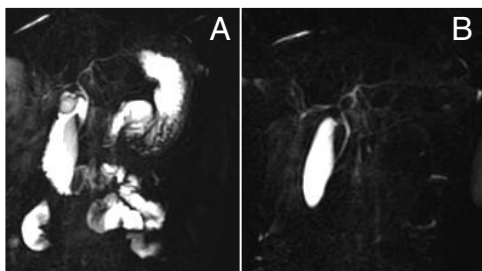

Fig.1. The MRCP images (2D) of pre (A) and post 20min. (B) obtained by 1.5T.
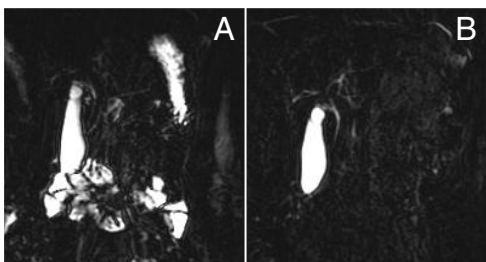
Fig.2. The MRCP images (2D) of pre (A) and post 20min. (B) obtained by 3.0T.

Conclusions

Our result suggested that 3T needs the same dose of oral negative contrast medium as 1.5 T for MRCP, but the duration of elimination effect at 3T might prolong more than that at 1.5T.

References

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4. Coppens E. Eur Radiol. 2005; 15: 2122-2129

Fig.3. The relationship between the ratio of T2 signal intensity elimination and concentration of ferric ammonium citrate using 2D-MRCP sequence.
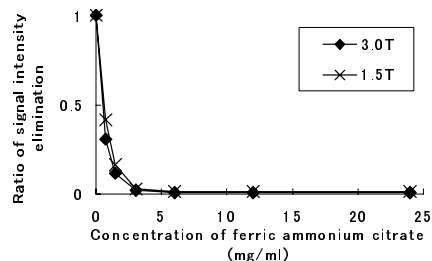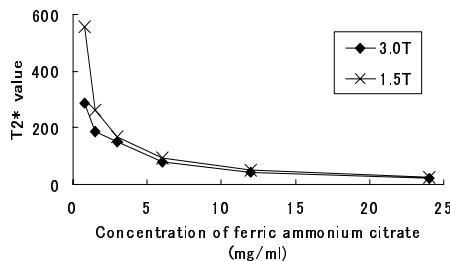

Fig.4. The relationship between T2* value and concentration of ferric ammonium citrate.
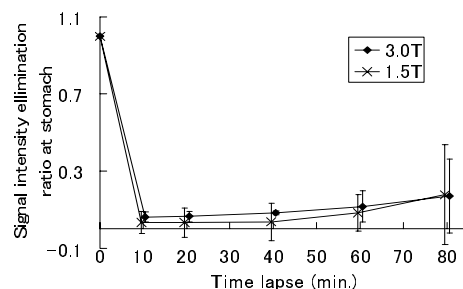

Fig.5. The signal intensity elimination ratio at stomach shows same tendency in 1.5T and 3.0T.