MRCP with a Combination of Respiratory-triggered 3D Fast Recovery Fast Spin-echo (FRFSE) Sequence and a Parallel Imaging Technique: A comparison with 2D Single-shot Fast Spin-echo (SSFSE) Sequence

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SYNOPSIS:
The purpose of this study was to determine efficacy of 3D MRCP imaging with a combination of respiratory-triggered 3D FRFSE sequence and a parallel imaging technique by comparison with 2D SSFSE MRCP imaging. Twelve patients were included in this study. Images were subjectively graded based on the conspicuity of pancreatobiliary structures. Respiratory-triggered 3D FRFSE sequence showed statistically significant superior mean grading score to breath-hold 2D SSFSE sequence. Thus, it was concluded that respiratory-triggered 3D FRFSE MRCP imaging is efficient technique for evaluation of pancreatobiliary diseases.

INTRODUCTION:
Fast recovery fast spin-echo (FRFSE) sequence is a sequence with which sequential 180 degrees and 90 degrees radiofrequency pulses are applied at the end of FSE sequence to accelerate recovery of longitudinal magnetization after the echo train is acquired. The sequence can provide enhanced fluid signal in the setting of short TR (around 2000 msec). It can be used for breath-hold T2-weighted MR imaging of the liver (1) or the female pelvis (2). 3D acquisition in MR cholangiopancreatography (MRCP) imaging may be challenging due to long acquisition time. But, a combination of 3D fast spin-echo (FSE) sequence and fast recovery pulses can be used for detailed 3D imaging of biliary system or pancreatic ducts with rather short acquisition time. The purpose of this study was to determine efficacy of 3D MRCP imaging with a combination of respiratory-triggered 3D FRFSE sequence and a parallel imaging technique by comparison with 2D single shot fast SE (SSFSE) MRCP imaging.

METHODS:
Twelve patients (6 men, 6 women) who ranged in age from 36 to 76 years (mean 61 years) with suspected pancreatobiliary disease by ultrasound or CT had MRCP examinations using 1.5T MR system (Signa Horizon LX, GEMS, Milwaukee, WI) and a torso phased array receiver coil. Kinds of diseases were as follows: gallstones in the gallbladder and/or the CBD (N=3), gallbladder poly (N=1), chronic pancreatitis (N=1), cystic lesion in the pancreas (N=3), pancreas cancer (N=2), and normal (N=2). MRCP images were obtained using respiratory-triggered 3D FRFSE sequence and breath-hold 2D SSFSE sequence in all patients. Respiratory-triggered 3D FRFSE MRCP imaging was performed with a parallel imaging technique (ASSET, GEMS). The following parameters were used for 3D FRFSE sequence: TR/TE 2400-3330 (mean 2540)/800 ms, 0.5 NEX, 2 or 3-mm thickness, 20 to 26-cm FOV, 512 x 192 matrix (512 ZIP), 62.5 kHz bandwidth, coronal plane, and 102-s mean acquisition time. Maximum intensity projection (MIP) images were reconstructed from the original images by using a 3D workstation. Breath-hold 2D SSFSE MRCP imaging was performed with thick slice technique with the following parameters: TR/TE ~900 ms, 0.5 NEX, 50-mm thickness, 35-cm FOV, 512 x 256 matrix, 62.5 kHz bandwidth, coronal oblique plane, and 3-s acquisition time for each imaging. 2D SSFSE MRCP images were obtained in more than three different scan planes. Spectrally selected fat saturation pulses were applied for both techniques. For image evaluation, MIP images from 3D MRCP technique and original images of 2D SSFSE MRCP technique were used. All images were subjectively graded based on the conspicuity of pancreatobiliary structures by an experienced abdominal radiologist. The grading score was considered as excellent (=5) if fourth branches of the intrahepatic bile duct were clearly seen on the images. If neither common bile duct nor main pancreatic duct was seen on the image, the grading score was considered as poor (=1). Wilcoxon signed-rank test was used for statistical analysis.

RESULTS:
Table shows the results of image grading score for both respiratory-triggered 3D FRFSE MRCP and breath-hold 2D SSFSE MRCP images. For one case of the twelve, fourth branches of intrahepatic bile duct were clearly seen with 3D FRFSE MRCP images (Fig. 1a). However these branches were seen with 2D SSFSE sequence for none of the cases (Fig. 1b). Respiratory-triggered 3D FRFSE sequence showed statistically significant superior mean grading score to breath-hold 2D SSFSE sequence (P<0.05).

DISCUSSION:
Respiratory-triggered 3D FRFSE MRCP images showed significantly better image quality than breath-hold 2D SSFSE MRCP images. Its acquisition time was less than two minutes and there were no clinical problems due to its rather long acquisition time. Moreover, it can enable us to observe pancreatobiliary system from any view angle by using 3D workstation. In conclusion, respiratory-triggered 3D FRFSE MRCP imaging is efficient technique for evaluation of pancreatobiliary diseases.

REFERENCES: