

3D Steady State Free Precession (3D-FIESTA) Imaging of The Pancreaticobiliary Ductal System

Hani MARCOS¹, Vincent B. HO², Peter CHOYKE³, Maureen N. HOOD⁴, Thomas FOO⁵

¹National Institutes of Health, Building 10, Room 1C660, Bethesda, MD USA; ²Uniformed Services University of the Health Sciences, School of Medicine, Department of Radiology and Nuclear Medicine, Bethesda, Maryland United States; ³National Institutes of Health, Building 10, Room 1C660, Bethesda, MD; ⁴Uniformed Services University of the Health Sciences, Uniformed Services University, Bethesda, Maryland United States; ⁵G. E. Medical Systems, P. O. Box 414 (W-875), Milwaukee, WI;

Introduction

The aims of this study: 1) To assess the usefulness of three-dimensional Steady State Free Precession [3D-SSFP (FIESTA)] Magnetic Resonance Cholangiopancreatography (MRCP) for evaluation of pancreaticobiliary system, and 2) To determine the appropriate acquisition parameters.

Methods

Eight patients (5 men, 3women; age range 31-54years mean age 42.6 years) with clinical suspicion of dilated pancreaticobiliary ductal system underwent MR study. The standard MRCP technique included two-dimensional single shot fast spin echo (2D-SSFSE) sequence in thin and thick slabs. MRCP was also acquired with a three-dimensional Steady State Free Precession sequence (3D-SSFP; a.k.a. FIESTA, GE Medical Systems) using the following parameters: TR=4.7msec /TE=1.8msec/Flip angle=40° /matrix =265x256/0.5 NEX/ 2-3mm slice thickness/ 40-50 sections acquired in a coronal view in a 20-25 second breath-hold period. Qualitative evaluation included ratings by three observers for depiction of the pancreaticobiliary anatomy, biliary ductal signal / biliary to background contrast, artifacts, and analysis of cause of obstruction if possible. Source images and multiplanar reconstruction images from the 3D-SSFP and 2D-SSFSE MRCP were compared.

Results

Four of 8 patients demonstrated a markedly dilated pancreaticobiliary ductal system. In those patients the cause of obstruction was determined by 3D-SSFP and 2D-SSFSE MRCP. Image quality of 3D-SSFP technique as rated by the three observers was superior to the 2D-SSFSE technique based on the depiction of the intrahepatic bile ducts, common bile duct, and pancreatic ducts. High-resolution 3 D-SSFP MRCP acquired during a 20-25 second breath-hold produced the best depiction of the biliary tree often illustrating 1-mm ducts. Compared to 2D-SSFSE, 3D-SSFP also afforded the highest biliary signal intensity with diminished signal from non-biliary structures, especially hepatic arteries and portal veins. Volumetric data sets from 3D-SSFP (Figure 1,2) afforded improvements in post-processing (multiplanar reconstruction and maximum intensity projection) compared to 2D-SSFSE.

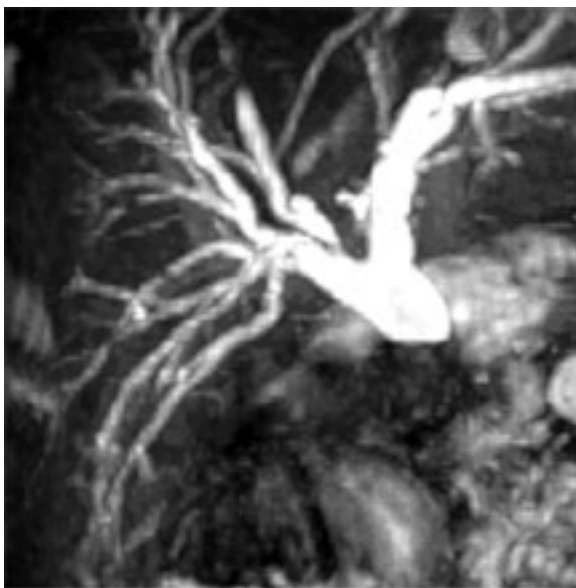


Figure 1

Figure 1: Coronal MIP of 3D-SSFP in a 56 year old male with pancreatic cancer demonstrates a narrowed distal common bile duct

with markedly dilated intrahepatic ducts. Pancreatic duct is moderately dilated (not shown).



Figure 2

Figure 2: Coronal MIP of 3D-SSFP in a 45 year old male with adrenal cortical carcinoma and metastatic disease to the pancreatic head shows a narrow distal common bile duct and pancreatic duct with proximal dilatation (note the corresponding intrahepatic bile dilatation). A 3 cm metastatic mass identified at the pancreatic head.

Discussion

3D-SSFP is a promising high-resolution breath hold imaging technique for the evaluation of biliary anatomy and of an obstructed biliary ductal system. The reconstructed projections using MIP may help to determine the cause of obstruction. 3D-SSFP is superior to standard 2D-SSFSE because it has higher biliary signal, improved biliary to background contrast, higher resolution as well as ability to perform zero filling for improved three-dimensional image processing to include performance of virtual endoscopy.

References

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