

High-Resolution MRCP Imaging Using 3D Fast Imaging Employing Steady-state Acquisition (FIESTA)

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Introduction

MRI's superior soft tissue contrast to CT and the reduction in MR acquisition times has created a niche for the utilization of MR in assessing hepatobiliary and pancreatic disease. Commonly, MRCP is performed using a breath-held single shot fast spin echo technique (ssFSE), which provides high biliary luminal contrast and black blood vascular imaging. A relatively new technique, short TR 3D coherent steady state free precession (FIESTA) provides advantages in assessing hepatobiliary pathology compared to ssFSE. The FIESTA 3D sequence is a fully-balanced steady-state coherent imaging pulse sequence designed to produce high SNR images at very short sequence times[1,2]. The FIESTA 3D sequence is a breath-held volume acquisition, which provides high luminal contrast for the pancreatic and biliary system. In addition, the high soft tissue contrast allows visualization of extraluminal and intramural biliary pathology. The white blood vascular component also allows assessment of portal venous patency using single acquisition technique.

Methods

All studies were performed on a GE Medical Systems 1.5T CV/i Scanner (Waukesha, WI) equipped with high performance gradients (40 mT/m with SR of 150 mT/m/ms). Patients with pathology were evaluated using the FIESTA 3D and ssFSE acquisitions. The FIESTA 3D pulse sequence uses fully-balanced gradients to re-phase the transverse magnetization at the end of each TR interval and maintain phase coherence. Typical scan protocol were: TR = 4.8ms, TE = 2.3 ms, +/- 62.5 kHz receiver bandwidth, flip angle = 40°, number of slice = 60, slice thickness = 2.0 mm with ZIP x2. Pixel size varied from 1.2 -1.6 mm depending on FOV and size of patient. A torso phased array coil was used.

Results

Twelve patients presenting with hepatobiliary and/or pancreatic pathology were evaluated using the FIESTA 3D acquisitions under IRB approval. Utilizing the high spatial and contrast resolution inherent to this sequence, the images were evaluated for the degrees of differentiation of intraluminal abnormalities, as well as the ability to assess the intramural and extraluminal extension of pathology. In addition, the degree of visualization of portal venous patency, portal variceal detection and identification of the proper hepatic artery was performed. Typical images from the FIESTA 3D technique are shown in Figures 1-3. The Common Hepatic Duct and Common Bile Duct are clearly seen in Figure 1. Figure 2 displays the Portal Vein and Superior Mesenteric Artery with clear delineation of the intestinal arteries. Figure 3 shows the Portal Vein and Superior Mesenteric Artery. Because of the shorter echo times of the FIESTA 3D technique compared to the ssFSE, it provides much brighter contrast for more rapidly flowing fluids in the arteries, veins and portal venous system. Thus, allowing for better delineation of this vasculature.

Conclusions

FIESTA 3D offers a competitive alternative for performing MRCP. Similar to ssFSE, FIESTA provides marked contrast between biliary and pancreatic ducts and adjacent soft tissues. Unlike the ssFSE, which is a 2D acquisition, the FIESTA 3D is a high-resolution volume acquisition that also provides the ability to perform arbitrary plane reformation for clear definition of smaller biliary ducts and vasculature including the arteries, veins and portal venous system.

References

1. A. Oppelt, R. Graumann et al, *Electromedica* 3:15, 1986.
2. Y. Zur, S. Stokar et al, *MRM* 6:175, 1988.

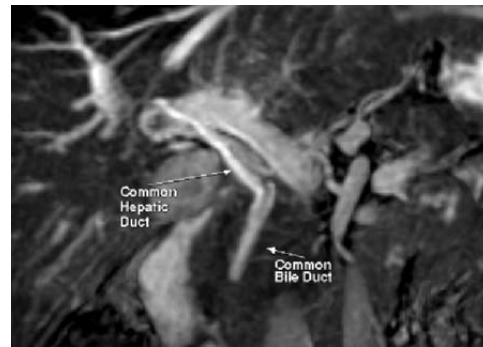


Figure 1. Common Hepatic Duct and Common Bile Duct image obtained using FIESTA 3D imaging pulse sequence.



Figure 2. Portal Vein and Superior Mesenteric Artery image obtained using FIESTA 3D imaging pulse sequence.

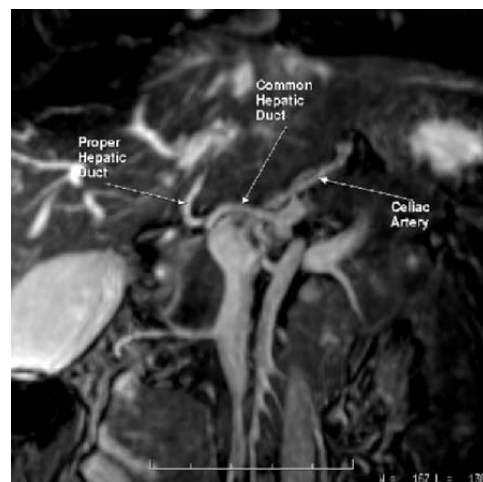


Figure 3. Proper Hepatic Duct, Common Hepatic Duct and Celiac Artery image obtained using FIESTA 3D imaging pulse sequence.