

MRCP with the Use of Navigator-echo Triggering Turbo Spin-echo: A Comparison with Single Shot Techniques

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Introduction: Navigator triggering uses a navigator (i.e. MR signals) to monitor the respiratory motion unlike prior methods that relied on respiratory gating using a respiratory belt. This method allows a predefined number of slices during the quiet phase near end expiration. The sequence allows enhanced fluid signal to evaluate the biliary system and reduction of motion artifacts. It has advantages in that patients can free breath during the examination. The purpose of this study was to determine the efficacy of this sequence in the evaluation of the bile ducts and a comparison to single shot techniques.

Material and methods: Nineteen patients with suspected liver or biliary pathology were evaluated with MRCP using the navigator triggering method using a 1.5T MR system (Siemens Magnetom Sonata, Islen, NJ) and 2 or 6 channel body phased array coil. The following parameters were used for the 3D TSE sequence: TR/TE 1700/670, slice thickness 1-1.5 mm, matrix 384x281, 260kHz bandwidth, NEX 1, ETL 127, and voxel size of 1x1x1.5 mm. The coronal navigator slice was placed central on the diaphragm. Average acquisition time was 5.5 minutes (range 4-9). Respiratory motion was sampled with 150 ms repetition time. The reasons for examination included liver donors (6), biliary leak (1), suspected biliary obstruction (8), suspected cholangiocarcinoma (1), pancreatic lesions (2), and sclerosing cholangitis (1). This sequence was compared with HASTE and RARE MRCP. The conspicuity of the extrahepatic and intrahepatic ducts, pancreatic duct, gallbladder and duodenum and overall comparison score were evaluated on a 5 point scale.

Results: Respiratory triggered 3D MRCP showed significantly superior conspicuity of all structures except the duodenum and gallbladder ($p < .01$). In patients with difficult to visualize ducts including patients with cirrhosis, the intrahepatic and common bile ducts were well-visualized. This technique also has important applications in the evaluation of patients with liver transplants or donors for liver transplants where detection of anatomic variants is critical. The use of source images and maximum intensity projection (MIP) images allows optimal visualization of the ducts without the disadvantages of volume averaging seen in thick slab (RARE) MRCP or the low signal artifact seen on thin section HASTE which can be confused with stones and believed due to flow.

Discussion: Respiratory triggered 3D-MRCP showed significant better image quality than breath-hold 2D HASTE or RARE images. In addition, it provided thin slice source data with nearly isotropic spatial resolution and projection images that can be viewed in any angle using multi-planar reconstruction.

| | RT 3DMRCP Average | RARE Average | HASTE Average |
|---------|----------------------|-----------------|------------------|
| GB | 3.9 | 2.6 | 3.9 |
| RHD | 4.1 | 2.2 | 2.7 |
| LHD | 4.5 | 2.5 | 2.8 |
| CBD | 4.4 | 2.8 | 3.4 |
| PD | 4.4 | 2.1 | 2.9 |
| Overall | 4.6 | 2.7 | 3.2 |

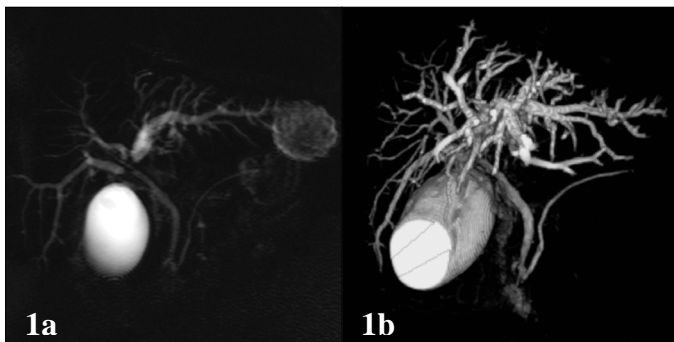


Fig. 1a. RARE image showing stricture due to cholangiocarcinoma 1b, RT-3D MRCP MIP better demonstrates extent of intrahepatic biliary dilatation as well as other ducts. Stricture was well seen on the source images.

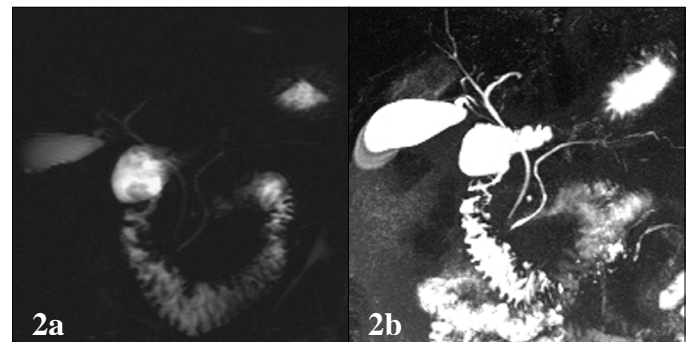


Fig. 2a. RARE image does not demonstrate the intrahepatic or extrahepatic ducts as well as the RT 3D MRCP (b).