

Comprehensive Evaluation of Potential Liver Transplant Donors: Comparison of MRI with 3D MRCP and CT with CT cholangiography

B. Taouli¹, G. M. Israel¹, M. Macari¹, G. R. Morgan², L. W. Teperman², D. A. Moses¹, E. M. Hecht¹, V. S. Lee¹

¹Radiology, NYU Medical Center, New York, NY, United States, ²Transplant Surgery, NYU Medical Center, New York, NY, United States

Introduction

Due to the shortage of cadaveric livers for transplantation, living related right lobe liver donation is an increasingly performed procedure. Potential liver donors routinely undergo anatomic evaluation of the liver and vasculature with either CT or MR imaging. Preoperative evaluation of biliary anatomy is of great importance since variant anatomy, typically affecting the right lobe drainage, is seen in nearly half of the population. The aim of the study was to compare the accuracy of MR, including high-resolution 3D MRCP [1], versus CT, including CT cholangiography (CTC) [2], for the evaluation of right lobe biliary and vascular anatomy.

Methods

Twelve subjects (6 men and 6 women; mean age, 37 y) were evaluated for potential liver donation with MRI and CT within the same day. MRI was performed using 1.5 T multichannel Avanto system (Siemens), and included: respiratory-triggered 3D T2 MRCP (1 mm interpolated slice thickness using prospective motion correction and parallel imaging), GRE T1 in- and out-of-phase, axial and coronal T2 HASTE, pre- and post-contrast 3D gradient echo (VIBE and FLASH) imaging with 20 ml of gadolinium DTPA. CT was performed using 16-detector CT (Siemens Sensation), and included: CTC (0.75 mm collimation after injection of 20 ml of Cholografyn), and CT angiography (0.75 and 1.5 mm collimation at the arterial and portal venous phases, respectively, after injection of 150 ml of contrast). Two CT and two MR observers evaluated each dataset independently and then in consensus. The final reading of both CT and MR datasets by 4 observers together was considered the gold standard. The following findings were evaluated on MRCP and CT cholangiographic images: overall image quality (0-3), bile duct visualization [including cystic duct, common bile duct (CBD), right and left intrahepatic ducts (IHD), right anterior, right lateral, left medial and left lateral branches], using a 4-point scale (0-3, maximum 24 per patient). In addition, relevant arterial, venous, and biliary variants were recorded by each observer on MRI and CT, and reevaluated in consensus.

Results

There were no adverse reactions with either approach. None of the donors had evidence of fatty infiltration by either technique. Overall image quality was excellent and not significantly different with MRCP and CTC (mean overall score 2.6 vs. 2.9, respectively, $p=0.31$). Nine donor candidates had biliary variants: biliary trifurcation ($n=1$), right lateral duct draining into left IHD ($n=6$), and right lateral duct draining into CBD ($n=2$). All biliary findings were identified on both CTC and MRCP (Fig. 1,2). Bile duct visualization was equivalent with both techniques (mean overall score 21.6 vs. 22.2, respectively, $p=0.19$). Arterial variants were observed in 4 subjects (Fig. 3). All subjects had a conventional portal venous anatomy, and accessory veins were identified in 7 patients (4 accessory veins > 5 mm). All vascular variants were identified by both techniques.

Discussion

Our study had a surprisingly high number of biliary variants, in part reflecting the relatively small sample size. However, we found nearly perfect agreement between CT and MR assessment of donor anatomy, including biliary and vascular variants. When performed using high resolution 3D T2-weighted MRCP, MR provides comparable image quality to CTC but without the associated risks of radiation exposure and adverse contrast-related reactions.

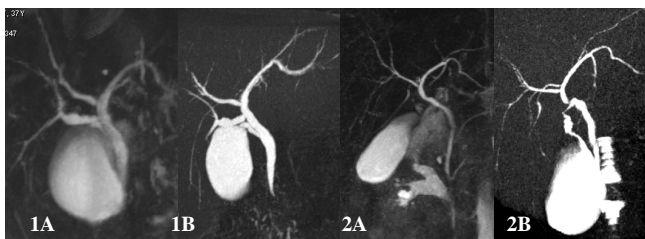


Fig.1: MIP image from 3D MRCP (A) and MIP image from CTC (B) show right lateral duct draining into CBD with same image quality

Fig.2: MIP image from 3D MRCP (A) and MIP image from CTC (B) show right lateral duct draining into right IHD with same image quality and conspicuity.

Fig.3: MIP images from CTA (A) and MRA (B) show hepatic artery coming off the SMA with same conspicuity and image quality.



References

1. Zhang J, et al. MRCP with 3D TSE and parallel acquisition technique. Proc ISMRM 2004;431
2. Yeh BM, et al. Biliary tract depiction in living potential liver donors: comparison of conventional MR, mangafodipir trisodium-enhanced excretory MR, and multi-detector row CT cholangiography-initial experience. Radiology 2004;230: 645-651