Clinical feasibility of single breath-hold multiphase dynamic MR imaging of liver using THRIVE-CENTRA-keyhole sequence

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Purpose

To evaluate the clinical feasibility of, and optimize, single breath-hold multiphase dynamic MR imaging of liver using THRIVE-CENTRA-keyhole, a novel 3D T1-weighted fat suppressed spoiled gradient echo technique.

Materials and Methods

Sixty-two consecutive patients had hepatic MR examinations including multiphase 3D THRIVE-CENTRA-keyhole dynamic MR imaging. After bolus intravenous injection of gadolinium chelate, three to six phase dynamic images were obtained during a single 22-30 sec breath-hold, with timing determined using real-time MR fluoroscopic technique. Typically, three phases were obtained during a 24-sec breathhold with following parameters: TR 2.8, TE 1.4, flip angle 10°, matrix 192 x 192, 100 slices with thickness/spacing 4/2 mm, FOV 40 x 40 cm, parallel imaging (SENSE) acceleration of 2. The central 20 - 25% of k-space data were collected for each phase, but the remaining peripheral k-space data were collected only once, immediately following the first or last phase, and were used to reconstruct the images of all phases. In 6 patients, six phase images were obtained at two separate breathholds with four second interscan interval, either by 4 phases plus two phase scans or two of 3-phase scans. In 25 patients the first phase was used as a mask to generate subtraction images for other phases.

Results

In all patients in whom 3-phases were imaged, image quality was acceptable. Among the patients in whom 6 phases were obtained during one or two breathholds, motion artifacts and contrast enhancement spill-over were frequent.

Among 62 patients, hepatocellular carcinomas (HCCs) were diagnosed in twenty-one, hemangiomas in ten, metastases in ten, focal nodular hyperplasia (FNH) in four, pseudotumors in seven, and miscellaneous lesions in ten. Small HCCs showed progressive complete flushing enhancement and larger lesions showed heterogeneous progressive enhancement. Gradual spreading enhancement of hemangiomas was clearly depicted. Metastases showed irregular peripheral rim enhancement with progressive thickening of the rim. FNH showed early homogeneous enhancement with slow progressive central scar enhancement in two.

Conclusion

A novel THRIVE-CENTRA-keyhole imaging technique is clinically feasible to acquire single-breathhold multi-arterial phase images for improved hemodynamic evaluation of focal hepatic lesions.

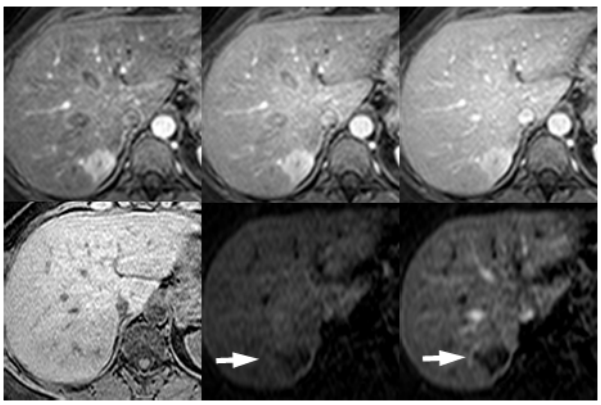

Figure. A forty-year-old woman with a focal nodular hyperplasia. Three-phase images were obtained during a 24-sec breath-hold. (Top left, first phase; top middle, second phase; top right, third phase; bottom left, precontrast; bottom middle, subtraction of the second phase by first phase; bottom right, subtraction of third phase by first phase). Serial enhancement is visible and the peritumoral hepatic venous drainage (arrows) is seen at the subtraction images.

References

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