

Abdominal Viscera (Solid Organs)

Liver

C-011

MRI of hepatic lesions in patients with hereditary hemorrhagic telangiectasia (HHT) and arterio-venous malformations (AVM) of the liver

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Purpose: To evaluate imaging characteristics of the liver in patients with HHT and AVM of the hepatic circulation.

Methods and Materials: 215 HHT patients or first degree relatives were screened for the presence of hepatic, pulmonary or cerebral AVM by means of MR imaging. In patients with signs of involvement of the liver further workup by CE-MRA after bolus injection of Gd-BOPTA at a dose of 0.1 mmol/kg was performed. In 18 patients AVM were demonstrated and the liver parenchyma was further evaluated by dynamic and steady state imaging post injection of Gd-BOPTA (0.05 mmol/kg BW).

Results: Two different findings were observed in patients with hepatic AVM. In 11 patients the liver was of a normal size and no liver lesions were demonstrated whereas in the remaining 7 patients first an enlargement of the liver and second multiple hyperplastic nodules were found. The nodules showed a contrast medium behaviour comparable to that of FNH and NRH especially in the hepatobiliary phase of contrast medium uptake.

Conclusion: Because of the specific vascular blood supply of the liver it appears that two different forms of AVM may be found in HHT patients. A hypertrophy of the liver together with presence of hyperplastic lesions most likely results from arterio-portal shunts with local overgrowth of hepatic tissue due to an increased arterial blood supply. In contrast arterio-venous shunts do not seem to influence the hepatic parenchyma since the arterial blood-flow from AVM bypasses the liver and thus does not result in development of hyperplastic changes.

C-012

Automatic analysis of liver perfusion quantification with dynamic contrast enhanced MR imaging (DCE-MRI) by a dual-input model and non-linear sampling

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Purpose: The hepatic artery and portal venous system derive the liver blood supply jointly. The influence of breathing, the large number of pharmacokinetic parameters and the fast variations in contrast concentration in the first moments after the contrast injection reduce the efficiency of traditional liver perfusion quantification approaches. In this work we will present a tool for easy and automatic analysis of liver DCE-MRI data.

Methods and Materials: Contrast agent concentration and bolus injection rate were selected randomly between 0.2-0.3 ml/Kg and 4-5 ml/s respectively. Thirteen T1W-spoiled-GE MR dynamic-acquisitions (each one with 24 slices in 4 s covering the whole liver) were acquired during 210 seconds using variable delays between acquisitions, according to perfusion theoretical curves. Images were 4D (XYZ+time) co-registered with the ITK-package in a GRID environment. A one-compartment-two-input model was used for the pharmacokinetic characterization of the hepatic perfusion. A MATLAB-based tool for automatic analysis of DCE-MRI data was developed.

Results: Liver DCE-MRI data were measured, co-registered and analyzed for 25 patients. Concentration/time curves obtained by non-linear sampling allowed the capture of contrast concentration peaks, improving the accuracy of parametric images and the correlation of the data to the pharmacokinetic models. The software allowed the analysis of these curves and correlation. Parametric images of TTP, rBV and several pharmacokinetic constants were also created.

Conclusion: The developed software allowed the automatic semi-empirical pharmacokinetic analysis of the liver and upper abdominal organs with DCE-MRI data with great consistency. This software may help in the diagnosis of diffuse liver and kidneys diseases.

C-013

The natural course of small intrahepatic low density areas without early enhancement (LDA) in chronic liver disease: Evaluation with dynamic CT using multidetector CT (MDCT) scanners

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Purpose: To clarify the natural course of LDA, on dynamic CT in chronic liver disease visualized frequently using MDCT.

Methods and Materials: We randomly selected 100 patients with chronic liver disease who had undergone a dynamic study with 4-detector-row MDCT from 2000- 2002, and included LDA larger than 7 mm in diameter. The diameter was determined as the maximum diameter at equilibrium phase. Two radiologists reviewed the findings in consensus. We excluded liver cysts and LDA which remained unchanged on follow-up within 1 year. According to the follow-up results, we classified the LDAs into 4 categories: 1) hypervascularized, 2) enlarged more than 3 mm in size, 3) no change, and 4) reduced more than 3 mm in size or disappeared.

Results: Forty-one LDA were included. Twenty-three LDA were 7-10 mm in initial diameter; among them, 3 (13%), 3 (13%), 5 (25%) and 12 (53%) LDAs were classified into 1), 2), 3), and 4), respectively. Fifteen LDA were 11-15 mm initially; 2 (13%), 3 (20%), 0, and 10 (67%) were classified into 1), 2), 3), and 4), respectively. Three LDA were 16-18 mm initially; 2 (67%), 0, 1 (33%), and 0 were classified into 1), 2), 3), and 4), respectively. The percentage of clinically problematic LDA categories 1) + 2) was 26% for 7-10 mm lesions, 33% for 11-15 mm lesions, and 67% for 16-18 mm lesions.

Conclusion: Larger LDA tend to be hypervascularized or enlarged more frequently. More than half of the lesions which were less than 15 mm reduced or disappeared.

C-014

Single breath-hold diffusion-weighted MRI of the liver with parallel imaging: Initial experience

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Purpose: To evaluate the improvement in the signal to noise ratio (SNR), with the use of parallel technique in single breath-hold diffusion weighted imaging (DWI) of the liver and its affect on apparent diffusion coefficient (ADC) measurements.

Methods and Materials: Fifteen patients underwent single breath-hold DWI of the liver with and without parallel imaging technique. SNR and ADC values were measured over a lesion-free right hepatic lobe by two radiologists in both series. When a focal hepatic lesion was present contrast to noise ratio (CNR) and ADC were also measured. Student's t-test was used for statistical analysis.

Results: Mean SNR values of the liver were respectively 20.82 ± 7.54 and 15.83 ± 5.95 for DWI with and without parallel imaging. SNR values measured in DWI using parallel imaging were found to be significantly higher ($p < 0.01$). Mean ADC of the liver were respectively $1.61 \pm 0.45 \times 10^{-3} \text{ sec/mm}^2$ and $1.56 \pm 0.28 \times 10^{-3} \text{ sec/mm}^2$ for DWI with and without parallel imaging. No significant difference was found among the two sequences for hepatic ADC measurement ($p > 0.05$). Overall lesion CNR was found to be higher in DWI with parallel imaging.

Conclusion: Parallel imaging is useful in improving SNR of single breath-hold DWI of the liver without compromising ADC measurements.

C-015

Three dimensional ultrasonography: Determination of the right lobe liver volume in living donor liver transplantation (thesis)

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Purpose: To evaluate the right lobe liver volume in living donors by three dimensional ultrasonography (US3D) using VOCAL (Virtual Organ Computer-Aided Analysis) software.

Methods and Materials: Between January 2003 and September 2004, 16 donors were prospectively studied. The mean age of patients was 33 years (range 23 to 50 years). We applied a new method to estimate right liver lobe grafts, through US3D, in preoperative evaluation of living donors. Comparison was made with actual weights of right lobe grafts that were determined after lobectomy and back table flushing.

Results: Mean estimated right lobe liver volume determined by US3D was $758.4 \text{ cm}^3 \pm 130.7 \text{ cm}^3$. Actual right hepatic lobe weight was $792.8 \text{ g} \pm 131.2 \text{ g}$. The relationship between estimated graft volume and graft weight was linear ($r = 0.762$; $p = 0.001$). A good agreement was observed between the two measurements based on graphical techniques by Bland-Altman. The discrepancies