CT arterial enhancement fraction (AEF) for hepatocellular carcinoma (HCC) screening in patients with end-stage liver cirrhosis

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Background and aims: Computer tomography imaging with arterial enhancement fraction (AEF) uses a tri-phasic CT image acquisition (unenhanced, arterial, portal venous phase) to generate color coded CT-images. The purpose of this study was to investigate if the use of the AEF imaging would supersede the acquisition of a fourth contrast phase (equilibrium phase) and thus allow a 25 % reduction of radiation dose. **Materials and Methods:** 55 patients who underwent liver transplantation between 2010 and 2013 and who had a CT scan acquired in four contrast phases (unenhanced, arterial, portal venous and equilibrium phase) on a Siemens Somatom Sensation 64 were included: 35 patients with 108 histologically proven HCC-, as well as 20 patients without HCC-lesions. 47 lesions were already treated by prior TACE. AEF was calculated using the syngo.via workstation (Siemens, Erlangen, Germany): AEF = $[(HU_A - HU_U)/(HU_P - HU_U)] \times 100$, where HU is the attenuation, A the arterial phase, P the portal phase, and U the unenhanced scan. A total of 6 radiologists read the tri-phasic grayscale images in conjunction with the color AEF-maps. For the second read-out, three readers looked at the CT images with four contrast phases and three readers only at three contrast phases (without equilibrium phase). **Results:** The JAFROC analysis showed a significant difference of the figures of merit (θ) between the tri-phasic read-out without (θ = 0.718) and with the AEF-maps (θ = 0.750, p=0.0007). Diagnostic performance with four-phases (θ = 0.775) was significantly better than with tri-phases (θ = 0.718) without using the AEF-map (p = 0.0018), but not different from the tri-phasic CT with the AEF-maps (θ = 0.750, p = 0.3053). Sensitivity of tri-phasic CT was 36.4 % (95% CI: 32.5 % to 40.5 %) and PPV was 76.5 % (95% CI: 71.0 % to 81.4 %). With the AEF-maps sensitivity and PPV increased to 49.7 % (95% CI: 45.6 % to 53.9 %) and 83.4 % (95% CI: 79.0 % to 87.1 %), respectively. Lesions with and without prior TACE treatment were detected with a sensitivity of 31.9 % and 42.3 % without the use of the AEF map and with a sensitivity of 48.4 % and 51.6 % with the AEF map. A normalized AEF cut-off value of 70 % for small lesions (<1cm) and 60 % for larger lesions (≥1cm) lead to highest HCC-accuracy. **Conclusion:** In HCC CT-screening the fourth equilibrium phase could be replaced by the calculated AEF-maps. This allows a 25 % reduction of radiation dose, which is relevant for patient undergoing repetitive HCC-screening.

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