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Dual-energy CT of liver metastases in patients with uveal melanoma

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ABSTRACT

Objective: To investigate the value of different kVp images of dual-energy CT (DECT) for the detection of liver metastases.

Methods: 20 Patients with uveal melanoma were investigated with DECT of the liver. In each patient contrast-enhanced DECT imaging with arterial delay was performed. Number and size of metastases were documented on arterial phase 80-kVp images, virtual 120-kVp images and following angiographic images (DSA) as part of hepatic chemoperfusion. Attenuation of metastases and several anatomic regions, subjective (image noise, image quality) and objective (SNR, CNR) parameters were documented.

Results: The mean number of liver metastases detected was significant higher on 80-kVp images than on virtual 120-kVp/DSA images (5.6 ± 2.1 vs. $4.1 \pm 1.8/4.3 \pm 1.6$); ($p < 0.001$). All lesions sizes were significant better detected with 80 kVp images than with virtual 120 kVp and DSA-Images (80 kVp vs. 120 kVp: <10 mm: 34 vs. 19, $p < 0.05$; 10–20 mm:, 33 vs. 25, $p < 0.05$; >20 mm: 56 vs. 42, $p < 0.05$/80 kVp vs. DSA: <10 mm: 34 vs. 18 $p < 0.05$; 10–20 mm: 33 vs. 24, $p < 0.05$; >20 mm: 56 vs. 41, $p < 0.05$). Number of detected small lesions <10 mm with 120 kVp compared to DSA-images were significant higher (19 vs. 13; $p < 0.05$), lesions 10–20 mm and >20 mm were measured statistically equally. Noise, SNR and CNR of 80 kVp images were higher compared to 120 kVp images. Image quality of 120 kVp images was higher compared to 80 kVp images.

Conclusion: Low-kVp images of DECT datasets are more sensitive in detecting liver metastases of patients with uveal melanoma than virtual 120 kVp- and DSA images.

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1. Introduction

Uveal melanoma (UM) is a rare disease arising from the pigmented uveal tract of the eye. The incidence in Europe is 4.4 cases per million, varying between 2 in the south to 8 in the north of Europe [1]. Around 5% of patients with UM have distant metastases at diagnosis. Metastases appear usually within a median of 3 years after the treatment of the primary tumor with a range between 1 and 10 years. There is an unexplained hepato-tropism with the liver being the first site of metastases in up to 90% of patients and is the only site in 46% of them [2,3]

A recent development in CT has been the introduction of dual-source technology [4].

One important advantage of dual-source CT compared with a single-source system is the option to use the two tubes at different tube currents offering differentiation of materials of non-equal

density. Previous study demonstrated the feasibility of contrast-enhanced dual-energy CT for the detection of hypervascular liver lesions in patients with hepatocellular carcinoma [5]. Higher detection rates were explained by higher attenuation of iodine in the low-kVp images in comparison to 140-kVp and virtual 120-kVp images.

FDG-PET-CT and MRI were described as reliable and accurate diagnostic methods in previous studies [6–9]. So far however, there is no study that investigated the sensitivity of the detection of hepatic metastases of uveal melanoma in DECT.

The aim of our study was to investigate to what extent the low kVp images of DECT are suitable compared to the virtual 120 kVp and DSA images for detection of liver metastases in patients with uveal melanoma. DECT was performed in each patient as part of the regular staging and planning examination before and 3 anf 6 monh after transarterial hepatic chemoperfusion. Angiographic image data sets were consulted as the reference imaging technique for comparison [10,11].

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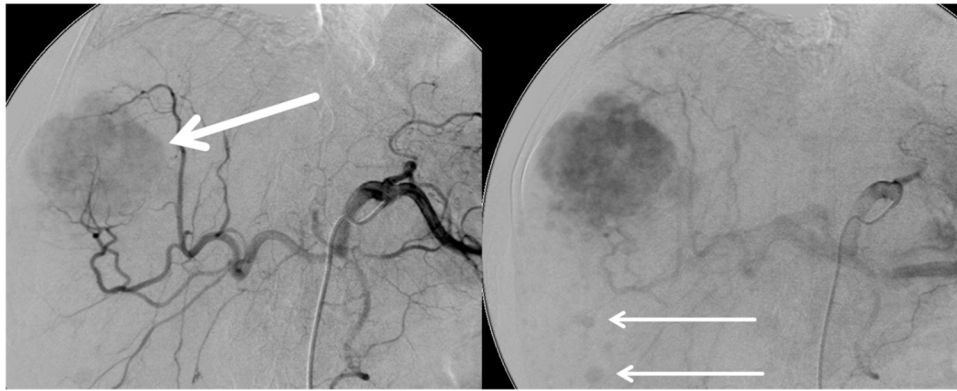E-mail address: jens.altenbernd@uni-due.de (J. Altenbernd).

Fig. 1. Multiple hypervasculare liver metastases of uveal melanoma detected with DSA.
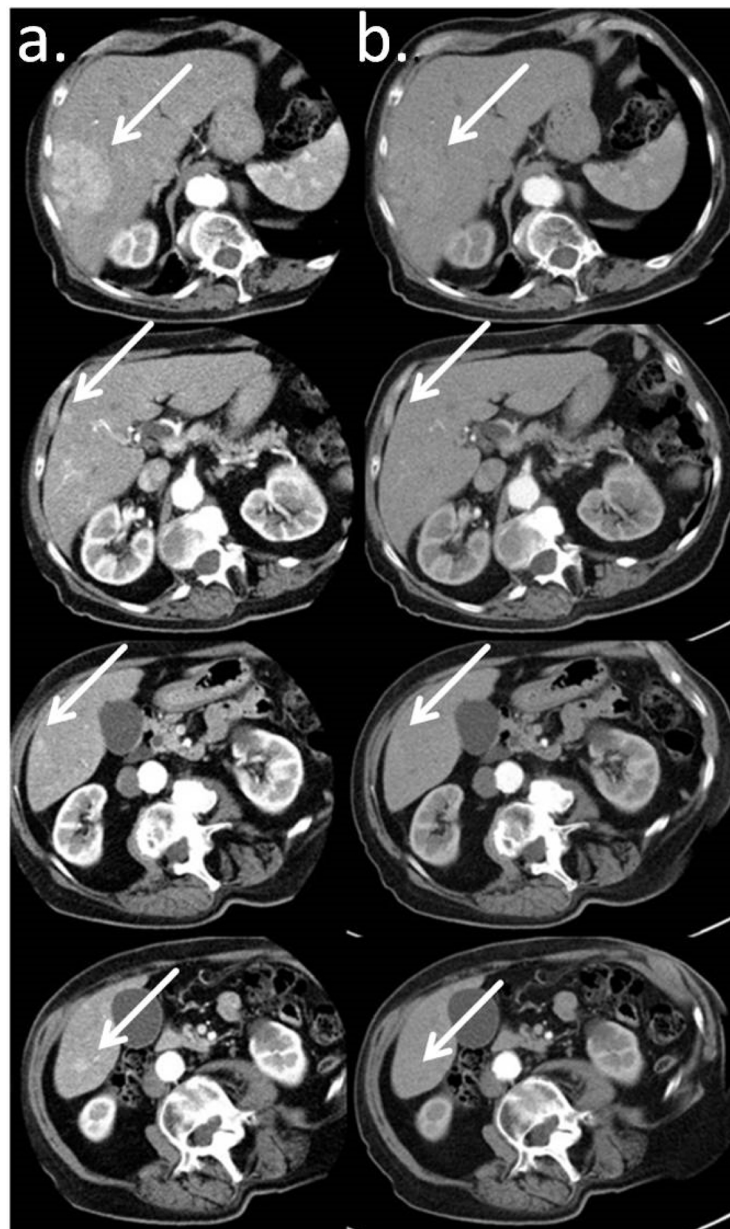

Fig. 2. Liver metastases of uveal melanoma detected significantly better on 80 kVp images (a) than on virtual 120 kVp (b) images based on DECT. (Slice thickness 3 mm; Window 350 HU, Center 50 HU, Kernel D50).