Tumor volume comparison between semi-automatic tumor segmentations on CBCT and MDCT, and pathologic volumes in the VX2 rabbit hepatic tumor model.

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Abstract
Purpose.
The purpose of this study is to compare the tumor volume in a VX2 rabbit model as calculated by semi-automatic tumor segmentation from C-arm cone-beam CT (CBCT) and multi-detector CT (MDCT) images to the actual tumor volume.

Material & Methods.
20 VX2 tumors in 20 adult male New Zealand rabbits (1 tumor per rabbit) were imaged with CBCT (using an intra-arterial contrast medium injection) and MDCT (using intra-venous contrast injection). All tumor volumes were measured by using a semi-automatic 3D volumetric segmentation software. The software uses a region-growing method employing non-Euclidean radial basis functions. After imaging, the tumors were excised for pathologic volume measurement. The imaging based tumor volume measurements were compared to the pathologic volumes using linear regression, with Pearson test, and correlated with Bland–Altman analysis.

Results.
Average tumor volumes were 3.53cm$^3$±1.57 [1.36–7.20] on pathology examination; 3.80cm$^3$±1.58 [1.32–7.26] on CBCT; and 3.90cm$^3$±1.59 [1.76–7.53] on MDCT (p<0.001). A strong correlation between pathology and CBCT and also with MDCT volumes was observed (Pearson correlation=0.993; and 0.996, p < 0.001, for CBCT and MDCT, respectively). The Bland–Altman analysis showed that MDCT scans tended to overestimate tumor volume, and there was a stronger agreement between CBCT and pathology tumor volume than with MDCT, possibly due to the intra-arterial contrast injection.

Conclusion.
The tumor volume as measured by the semi-automatic tumor segmentation software showed a strong correlation with the “real volume” measured on pathology. Use of the segmentation software on CBCT and MDCT can be a useful tool for volumetric hepatic tumor assessment.

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