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Reproducibility of computer-aided volume measurements on same-day repeat CT scans reconstructed with different imaging parameters

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PURPOSE: Volume change shows a stronger correlation with EGFR mutations in lung adenocarcinoma than unidimensional change. As the first step to qualify volumetric CT as a better imaging biomarker, determination of optimal imaging acquisition parameters for measuring volume and magnitude of measurement variability is critical. The purpose of this study was to explore the reproducibility of lung tumor volumes measured by a computer-aided method on CT scans reconstructed with different imaging parameters.

MATERIALS AND METHODS: This study used a retrospective dataset containing 32 non-small cell lung cancer patients, each having two repeat CT scans performed within 15 minutes and reconstructed into 6 image series, ie, a combination of 3 slice intervals (5, 2.5 and 1.25 mm) and 2 reconstruction algorithms [Lung (L) and Standard (S)]. A semi-automated algorithm was used to segment 32 lung tumors (> = 1 cm; one per patient) in all image series. Tumor contours were randomly displayed for an experienced radiologist's adjustment, series by series in separate sessions. Bland-Altman plots were used to assess the agreement between the volumes measured on the 2 repeat scans reconstructed with different imaging parameters; a narrower 95% limits of agreement (LoA) indicates a higher reproducibility of the measurements.

RESULTS: The LoAs for volume measurements on 2 repeat scans, both reconstructed using the same imaging parameters, were (−37.2%, 49.2%), (−14.4%, 25.4%) and (−30.1%, 22.3%) for 5S (i.e., 5 mm slice and S recon), 2.5S and 1.25S, respectively. The LoAs were (−19.6%, 39.4%), (−24.9%, 21.3%) and (−27.7%, 16.8%) for 5L, 2.5L and 1.25L, respectively. When combining the measurements of all slice intervals, the LoAs were (−29.9%, 34.9%) for S and (−27.2%, 29.0%) for L recon images. When combining the measurements of all reconstruction algorithms, the LoAs were (−29.2%, 45.0%), (−20.7%, 24.6%), and (−28.9%, 19.8%) for 5, 2.5 and 1.25 mm images, respectively.

CONCLUSION: Lung tumor volumes can be reproducibly measured on CT using the computer-aided method. Volumes measured on 1.25 mm and 2.5 mm images are similar and more reproducible compared to those made on 5 mm images. Sharper images are preferred to measure lung tumors.

CLINICAL RELEVANCE/APPLICATION: Thinner reconstruction thickness would improve the reproducibility of tumor volume measurement and thus improve sensitivity of detection of tumor volume change for therapy response assessment.