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Title: Phantom-based evaluation of computed tomography parameters: Understanding the differences in automated emphysema scoring

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Body: **PURPOSE:** Automated lung emphysema (E) measurements vary strongly between examinations. We examined the effect of CT scanners, acquisition parameters, kernels and windowing on the software-based E scoring (S) in a phantom. **MATERIAL AND METHODS:** A human preserved torso in epoxy was used as phantom and was scanned on 5 different scanners using various settings of the following parameters: KV, mAs, care dose, slice/increment, window and kernel. For each of these data sets, the E was evaluated. The ES was performed using both 2D and 3D software. A multiple linear regression analysis (LRA) was used to evaluate the importance of each examined parameter. **RESULTS:** Measured E values ranged between 17.0% and 70.5% for 3D software evaluation. A similar range could be seen at 2D evaluation, ranging between 13.7% and 66.8%. The used kernel had the strongest impact on the measured ES, and a strong effect could also be seen for slice/increment, mAs, window and KV. However, the scanner-dependent parameters and the usage of the caredosis option proved to have only a minor impact on the measurement of E. The LRA found a very strong correlation between the measured values, and the estimated values based on the optimal regression formulas, with R² values of 0.828 and 0.772 for the right and left lungs on 3D evaluation, and 0.872 and 0.851, resp., on 2D evaluation. **CONCLUSION:** A fixed phantom allows assessing the influence of different scanners, acquisition parameters and evaluation techniques on the software-based ES. The current dataset indicates that scan parameters and the used kernels have the strongest effect, and that the induced differences can be estimated using multiple LRA.