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Title: Pulmonary emphysema: Qualitative assessment at CT of presence and subtypes

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Body: Pulmonary emphysema is defined by morphology and is a heterogeneous disease with variably defined subtypes. We hypothesized that reliable detection of the presence of emphysema and its subtypes by visual CT assessment could be achieved by application and training on standard definitions of subtypes and severity. CT scans from 40 participants were selected randomly from a population-based cohort of participants ages 60-80 years with ≥ 10 pack-year smoking history. Non-contrast CT scans (120 kVp, 100 mAs, 0.75 mm) were performed at full inspiration and sharp filter reconstruction. Standard definitions of centrilobular (CLE), paraseptal (PSE) and panlobular (PLE) emphysema subtypes and severity were developed and three readers (2 chest radiologists, 1 pulmonologist) trained. The three readers independently assessed the 40 scans plus 10 replicates. Intra- and inter-reader agreement were assessed using unweighted Cohen's κ and intraclass correlation coefficient (ICC), respectively. Results: The 40 participants had a mean age 68 ± 5 years, 40% were current smokers, and 55% had chronic obstructive pulmonary disease. The κ statistic was 0.91 for intra-reader agreement on presence of any emphysema and 0.74 for inter-reader agreement. ICC for intra- and inter-reader emphysema severity was 0.96. Intra-reader agreement for presence of emphysema was moderate to almost perfect depending on subtype (κ : 0.57-0.84); inter-reader agreement was good for CLE (κ : 0.67), moderate for PSE (κ : 0.32) and absent for PLE (κ : 0.06). Conclusions: This protocol for the visual assessment of chest CT can reliably detect the presence and extent of emphysema, in addition to selected emphysema subtypes.