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Title: Within-breath specific gas volume variations (ΔSVg) assessed by four-dimensional computed tomography (4D-CT) in lung tumor patients

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Body: ΔSVg between different lung volumes reliably estimate regional lung function (Salito et al, Radiology 2009). Here we assessed with voxel-resolution within-breath ΔSVg from 4D-CT images in 5 tumor patients. Each breathing phase (1 to 9) of the 4D-CT dataset was registered onto the reference (phase 0, i.e. end inspiration) using the Demons algorithm and subtracted from it in terms of SVg. Mean value of ΔSVg in lower (LL) and upper (UL) lobes were computed in both healthy (H) and tumor (T) lung. In H mean ΔSVg was significantly different between UL and LL ($p<0.001$) with higher values in UL. Mean ΔSVg increased by 0.8±0.3 ml/g in UL and 0.4±0.2 ml/g in LL. No significant inter-lobes differences were found in T ($p=0.8$): mean ΔSVg increased by 0.8±0.4 ml/g in UL and 0.6±0.3 ml/g in LL. Fig.1 shows within-breath ΔSVg maps of an exemplificative tumor lung and the mean ΔSVg is reported for each breathing phase separately for UL and LL.

In conclusion: 1) ΔSVg maps applied to 4D-CT provide information about within-breath gas distribution in the lung; 2) in H there is higher ΔSVg in UL; 3) the presence of the tumor modifies ΔSVg distribution; 4) heterogeneous ΔSVg distribution suggests that areas with normal function could be identified as organs at risk during radiotherapy treatment planning. Acknowledgments: Cancer Center Leon Berard, France Funded by Fondazione U. Veronesi, Italy.