

Comparison of Non-contrast Computed Tomography Pulmonary Perfusion Imaging and Contrast-Enhanced Iodine Density Maps

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PURPOSE / OBJECTIVES

- The clinical gold standard, SPECT/Q, is limited by spatial resolution and specialized nuclear medicine infrastructure requirements.
- CT-based functional imaging (NCCT-Q [1], CT-ID [2]) offers a more accessible alternative; however, **direct quantitative comparison between these two metrics remains limited.**
- Purpose:** To quantitatively compare NCCT-Q and CT-ID as CT-based pulmonary perfusion surrogates in a thoracic cancer cohort, and to evaluate their spatial agreement at the lobar and regional levels.

MATERIAL & METHODS

Patient Cohort & Image Acquisition

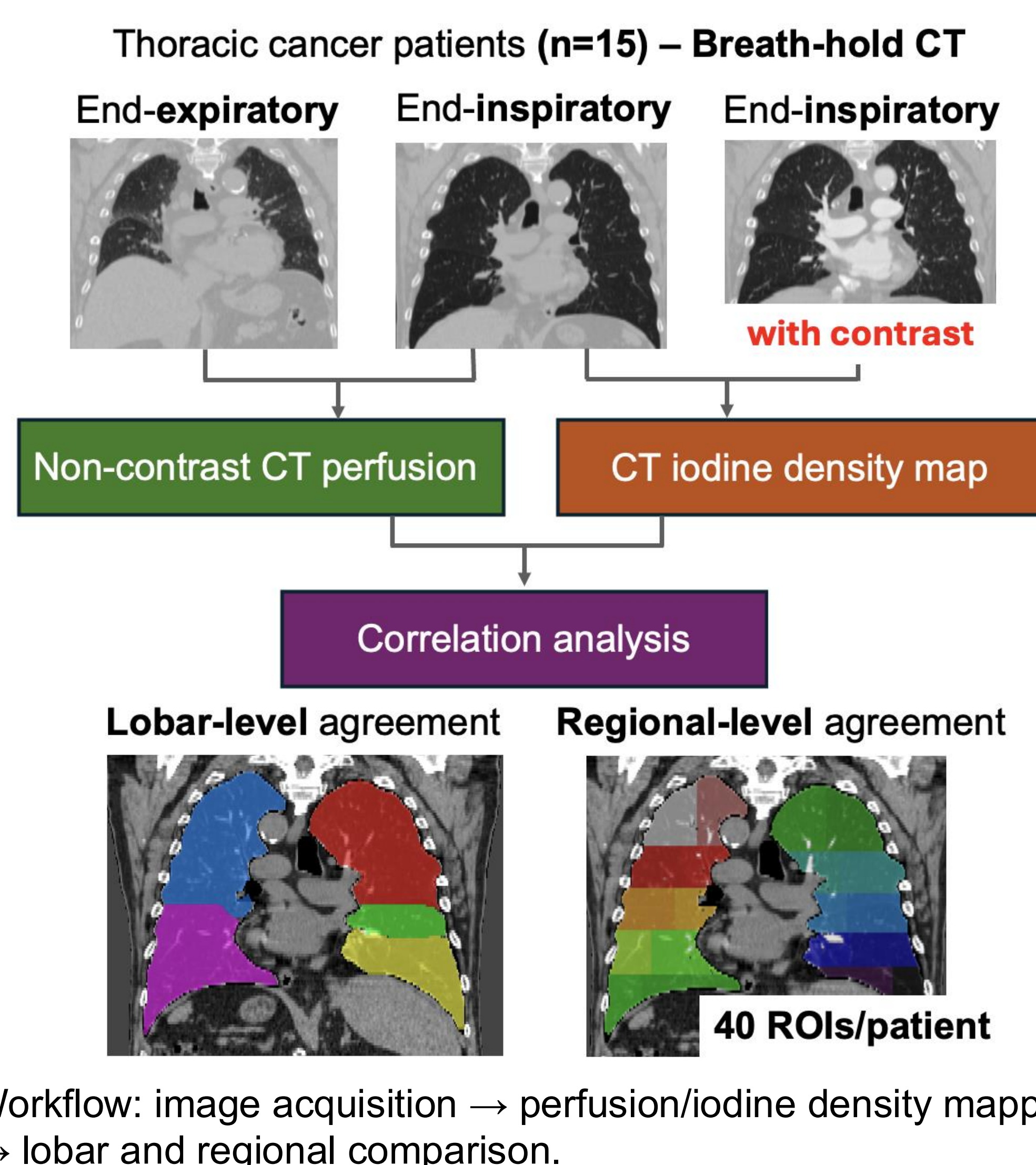
- 15 thoracic cancer patients;** breath-hold CT at end-exp/end-insp (pre-contrast) and end-insp (post-contrast)

Non-contrast CT-based Perfusion (NCCT-Q) / CT Iodine Density (CT-ID)

- NCCT-Q: **CT:VQ™** (4DMedical), density-based perfusion from respiratory HU changes.
- CT-ID: HU enhancement between pre/post-contrast CT, deformable registration-based [2].

Comparative Analysis

- Lobar-level:** r_{rm} (repeated measures correlation coefficient; accounts for intra-patient non-independence) [3] + repeated measures Bland-Altman [4].
- Regional-level:** 40 ROIs/patient, patient-specific Spearman correlation



RESULTS

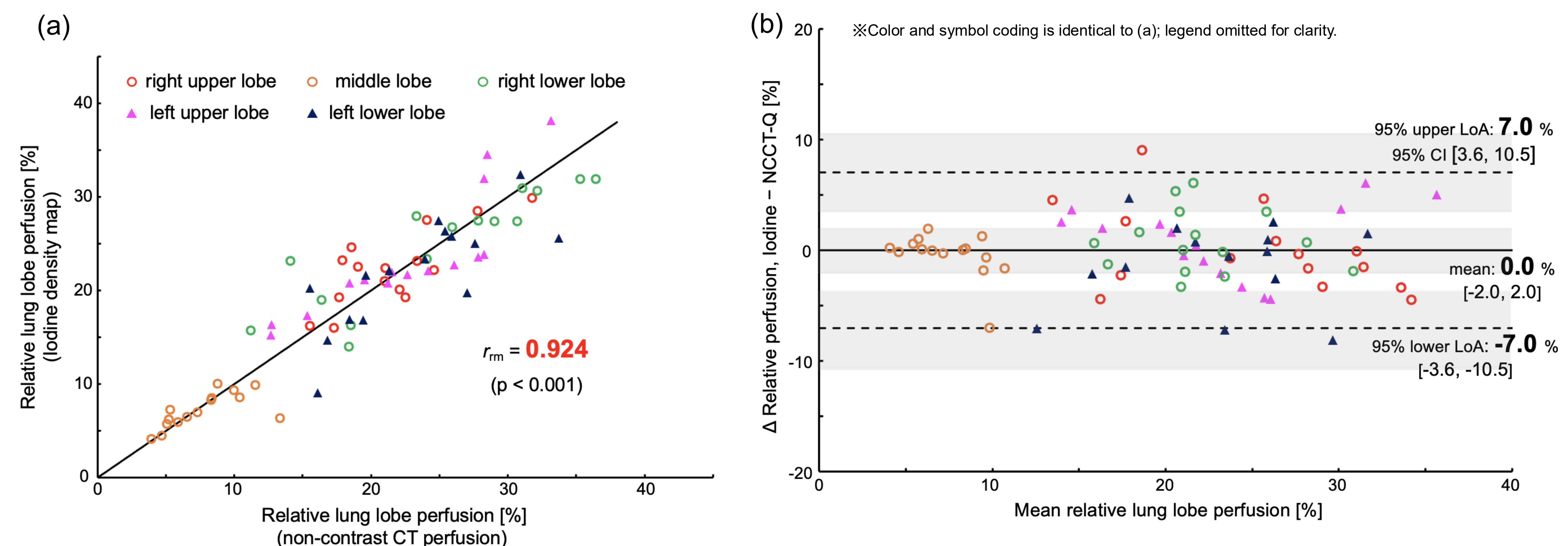


Fig.1. **Lobar-level** correlation and agreement analyses between NCCT-Q and CT-ID for regional lung perfusion (n = 15 patients, 5 lung regions per patient, N = 75 measurements).

(a) Scatter plot of regional measurements. $r_{rm} = 0.924$ ($p < 0.001$) denotes strong agreement.

(b) Bland-Altman plot. Bias = **0.0%** [95% CI: -2.0, 2.0]; limits of agreement = **-7.0%** to **+7.0%** [95% CI: -10.5 to 10.5].

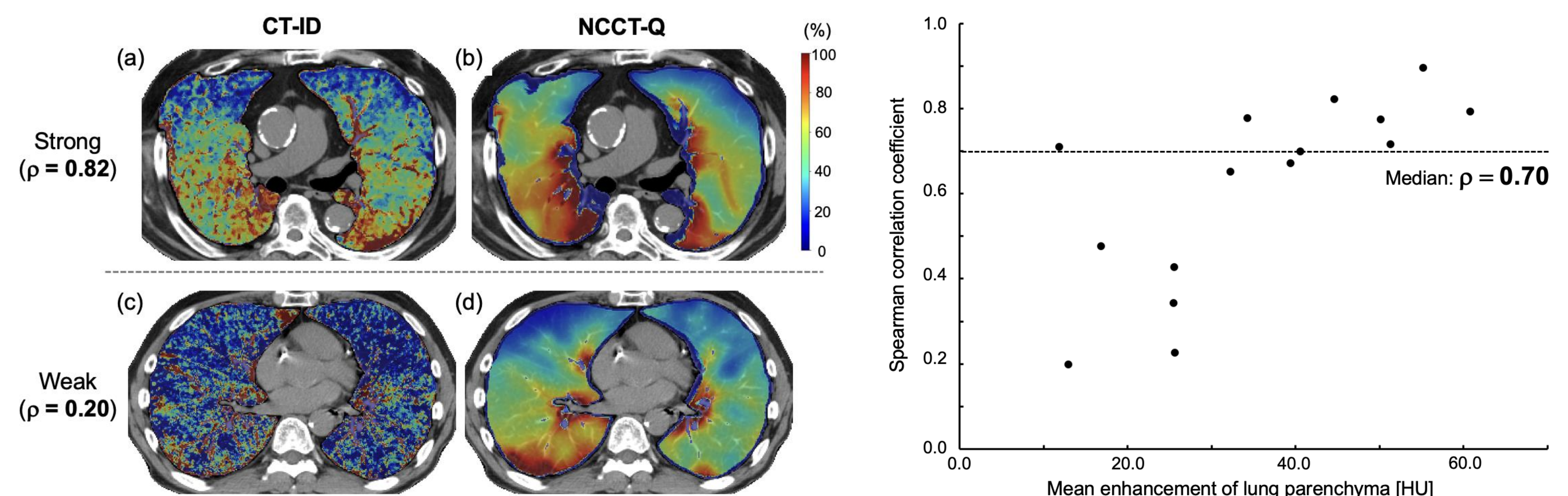


Fig.2. Representative perfusion maps in patients with strong and weak regional correlation.
 ρ = Spearman correlation coefficient (40 ROIs/patient).

Fig.3. **Regional-level** agreement: Spearman correlation coefficient vs. mean lung parenchymal enhancement (HU) per patient.

Lower enhancement may increase relative noise in CT-ID values, reducing agreement between the two modalities.

SUMMARY / CONCLUSION

- NCCT-Q and CT-ID showed **strong lobar-level agreement** in 15 thoracic cancer patients ($r_{rm} = 0.924$, $p < 0.001$; bias = **0.0%**, **95% limits of agreement (LoA): -7.0% to +7.0%**).
- Regional-level agreement was **moderate-to-substantial** (**median $\rho = 0.70$**), ranging from **strong** ($\rho = 0.82$) to **weak** ($\rho = 0.20$).
- Lower parenchymal enhancement was associated with reduced regional agreement**, likely reflecting relative noise in CT-ID.
- Findings provide reciprocal validation of the physiological relevance of NCCT-Q and CT-ID in assessing regional pulmonary perfusion
- Validation against the clinical gold standard (SPECT/Q)** is warranted to support clinical adoption.

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