PET/CT radiomics analysis contributes to detection of pulmonary lymphangitic carcinomatosis (PLC) in non-small cell lung cancer (NSCLC)

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Purpose: Pulmonary lymphangitic carcinomatosis (PLC) is defined as the spread of cancer through the lymphatic system into the lung interstitium. Radiologic diagnosis on CT is known to be challenging. We aimed to correlate PET/CT Radiomics analysis with the definitive diagnosis of PLC on histopathologic examination in NSCLC.

Methods and Materials: 24 patients addressed for initial staging of NSCLC were retrospectively included (PLC, n = 12 and non-PLC, n = 12). An initial set of 160 radiomic features were extracted from 18F-FDG PET/CT with the platform QuantImage, including intensity and 3D texture feature groups. A LASSO logistic regression model was built on three distinct feature sets: (i) a subset of 84 features from the PET only, (ii) 76 features from the CT only, and (iii) all 160 features from both modalities. Confidence interval [95 % CI] were assessed with bootstrap analysis.

Results: The following performances were observed: accuracy (i) 0.81 [0.57 – 1], (ii) 0.83 [0.57 – 1], (iii) 0.85 [0.60 – 1]; sensitivity (i) 0.75 [0.33 – 1], (ii) 0.83 [0.40 – 1], (iii) 0.81 [0.33 – 1]; specificity (i) 0.87 [0.5 – 1], (ii) 0.84 [0.40 – 1], (iii) 0.89 [0.50 – 1]; Area Under the ROC Curve (i) 0.86 [0.58 – 1], (ii) 0.92 [0.67 – 1], (iii) 0.91 [0.67 – 1]; number of features (i) 12.2 [2 – 71], (ii) 9.1 [3 – 45], (iii) 11.1 [3 – 49].

Conclusion: These results suggest that even though there is currently no definite CT-based diagnosis capturing all lymphangitis cases, the proposed radiomics model was able to leverage higher-order 3D textural information that is invisible to the naked eye to predict lymphangitis.