

COMPARATIVE DIAGNOSTIC PERFORMANCE OF CHEST RADIOGRAPHY, COMPUTED TOMOGRAPHY AND ARTIFICIAL INTELLIGENCE IN COPD: THE GREATEST BENEFIT AT AN EARLY STAGE

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Relevance. Chest radiography, visual CT reading and AI-based image analysis are all used in COPD imaging, yet the literature lacks studies that compare them directly in one patient cohort against a single reference standard. Such a comparison is needed to define the place of each method in the diagnostic pathway, particularly for early disease.

Aim. To compare the diagnostic performance of chest radiography, visual and quantitative CT, a baseline AI model and a locally retrained AI model in patients with COPD.

Materials and methods. We examined 117 subjects: 78 patients with COPD confirmed by post-bronchodilator FEV1/FVC < 0.70, 24 individuals with risk factors and 15 healthy controls. All underwent digital radiography in two projections and 128-slice CT. Images were assessed by two radiologists, by a baseline AI model (C1) and by the same model retrained on local data (C2). Post-bronchodilator spirometry served as the reference standard. Diagnostic accuracy was evaluated by ROC analysis with pairwise DeLong comparison; sensitivity, specificity and predictive values were calculated on an independent test subset (n = 29).

Results. Diagnostic accuracy rose consistently from radiography (AUC 0.782) to the baseline model (0.887), expert CT (0.914) and the retrained model (0.962). CT outperformed radiography (p = 0.021), and the overall gain from radiography to the retrained model reached $\Delta\text{AUC} = +0.180$ (p = 0.002). Without local adaptation the AI model fell behind expert CT; after retraining it surpassed it. On the test subset, sensitivity increased from 73.7% for radiography to 94.7% for the retrained model, and overall accuracy from 75.9% to 93.1%. The largest difference concerned the negative

predictive value: 61.5% for radiography versus 90.0% for the retrained model. The methods differed most at GOLD 1, where sensitivity was 40.0% for radiography, 60.0% for the baseline model, 70.0% for expert CT and 80.0% for the retrained model; at GOLD 4 all CT-based approaches reached 100%. Fully automated analysis took 52.4 ± 11.3 seconds per study compared with 8.7 ± 2.1 minutes for manual quantitative analysis, added no radiation dose beyond the standard CT protocol and raised the examination cost by about 11%.

Conclusion. In COPD, diagnostic accuracy increases stepwise from radiography to CT and further to a locally adapted AI model, and the benefit is greatest at the early stage, where conventional imaging is least reliable. A negative result of the retrained model reliably excludes the disease in nine out of ten cases, which supports including automated quantitative CT analysis in the examination of at-risk patients.

Keywords: chronic obstructive pulmonary disease, chest radiography, computed tomography, artificial intelligence, diagnostic accuracy, early diagnosis.