Use of a Machine Learning Algorithm to Detect Incidental Pulmonary Embolus

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Introduction
Tools utilizing artificial intelligence have been proposed to improve the accuracy and efficiency of radiologists. In this study, we investigate the performance of a novel AI algorithm to detect incidental pulmonary embolus (PE) on contrast-enhanced chest computed tomography (CT) not performed using a pulmonary angiographic technique.

Hypothesis
Our artificial intelligence (AI) algorithm can detect incidental pulmonary embolus with satisfactory performance, focused on specificity and negative predictive value.

Methods
An artificial intelligence (AI) tool trained to detect PE was applied to a retrospective cohort of 2632 consecutive contrast enhanced chest CT exams performed at our large healthcare system over a two-month period, between January 1 and February 28, 2018. CT angiography exams using a PE protocol were excluded from the cohort. Natural language processing (NLP) was applied to the reports from the cohort to identify cases where incidental PE was described by the radiologist. All discrepant cases between the algorithm and the NLP results were reviewed by a board-certified cardiothoracic radiologist with more than 5 years of experience (Figure).
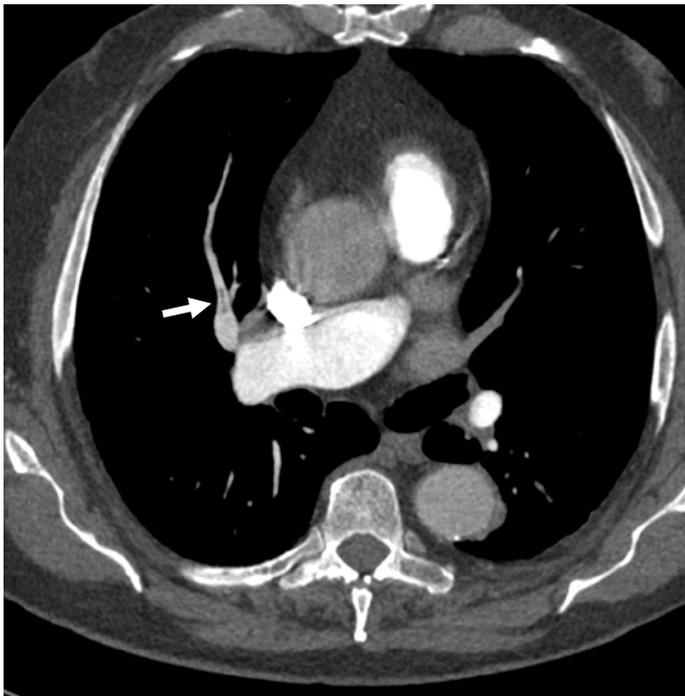

Figure: CT of the chest, abdomen, and pelvis in an 85-year-old man for evaluation of a thoracoabdominal aneurysm. The AI algorithm detected an incidental segmental PE in the right middle lobe (arrow).

Results

The prevalence of incidental PE was 1.2% (31 cases), lower than the reported 2.6%. The algorithm was 94% sensitive and 99.6% specific in detecting incidental PE. The positive predictive value was 74% and the negative predictive value was 99.9%. Of the 25 discrepant cases that were positive according to the algorithm,14 (56%) demonstrated incidental PE on secondary review.

Conclusion

The AI algorithm proved to be very sensitive and specific in the detection of incidental PE on contrast-enhanced CT. Importantly, the very high negative predictive value could point to this algorithm as a good method to screen routine contrast-enhanced CT examinations, ensuring that a diagnosis of PE is not delayed or overlooked. Finally, the use of this AI algorithm could improve the accuracy of the interpreting radiologist.

Statement of Impact

The integration of an AI algorithm such as the one tested in this study could potentially improve the detection of incidental PE, expedite interpretation, and identify patients that may need immediate medical attention, particularly in the outpatient setting.