The Evaluation of Emphysema by Artificial Intelligence on Computed Tomography

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Introduction
Emphysema is the irreversible destruction of alveolar walls that results in enlargement of the distal airspaces. Emphysema is defined on the basis of post-bronchodilator spirometry testing and can be a finding seen by the radiologist on Computed Tomography (CT). Currently, CT is one of the most precise imaging methods for the characterization of emphysema. Artificial intelligence (AI) can be used to facilitate the radiologist in evaluating the presence of emphysema and its severity.

Hypothesis
Artificial intelligence can be used to determine the presence of emphysema and the severity of emphysema on a CT scan of the chest.

Methods
In this retrospective study, 52 chest CT scans over a span of one month were evaluated by Zebra Medical Vision, an artificial intelligence program. Zebra determined the presence and severity of emphysema in terms of normal, mild, moderate, and severe. CT scans were then visually assessed by the radiologist based on morphological appearance and graded normal, mild, moderate, and severe.

Results
52 chest CT scans over a span of one month were assessed by both Zebra and the radiologist. Of the 52 CT scans interpreted by Zebra, 42 CT scans were interpreted as normal or without any emphysematous change, 6 CT scans were interpreted as mild, 3 CT scans were interpreted as moderate, and 1 CT scan was interpreted as severe. Of the 52 CT scans visually assessed by the radiologist, 31 CT scans were visually determined to be normal, 12 CT scans were determined to be mild, 8 CT scans were visually determined to be moderate, and 1 CT scan was determined to be severe. When CT scans were evaluated for the presence of emphysema, regardless of the degree of severity, the results obtained were as follows: The sensitivity was 42.86%, the specificity was 96.77%, the positive predictive value was 90.00%, and negative predictive value was 78.45%. The sensitivity and specificity were low when individual degrees of severity were taken into consideration. The numbers were more favorable when Zebra could distinguish the presence of emphysema versus the absence emphysema.

Conclusion
Artificial intelligence is reliable adjunt in identifying normal patients without emphysema. Effects are underway to improve sensitivity.

Statement of impact
Artificial intelligence is a reliable adjunct in identifying the absence of emphysema in normal chest CT scans.

Keywords
emphysema, artificial intelligence, computed tomography