Accuracy of automated central pulmonary embolism detection using RapidAI.

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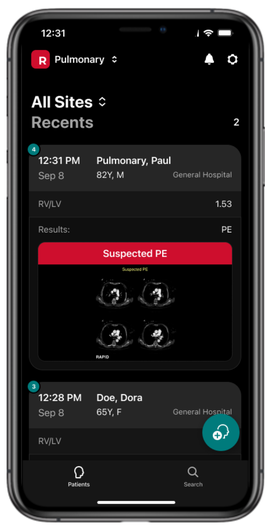
Introduction

Pulmonary Embolism (PE) is a common and potentially deadly form of venous thromboembolic disease. It is the third most common cause of cardiovascular death and is associated with multiple inherited and acquired risk factors[1]. Novel solutions to improve the efficiency and efficacy of PE detection are in development.

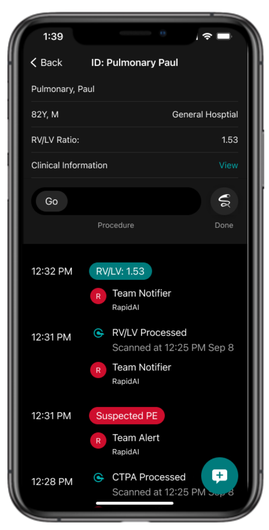
RapidAI has released the Pulmonary Embolism Triage and Notification (PETN) module which identifies central PE's and notifies Pulmonary Embolism Response Teams (PERT) to evaluate identified patients for triage.

AI-Powered Identification and Notification of Suspected PE

Anywhere, Anytime CTPA Image Viewer



HIPAA-Compliant Messaging and Communication Tools



Patient Clinical Information On The Go

Figure 1: Screenshots from RapidAI's PETN module including AI-imaging diagnostics, integrated mobile DICOM viewer, team communication abilities, Electronic Medical Record integration and statistical metrics.

Methodology

Retrospective review of consecutive Computed Tomography Pulmonary Angiogram scans performed at 5 sites which use the RAPID PE triage and notification module. Results of PE prediction by the RAPID PE module were compared to gold standard PE interpretation performed by human expert radiologists. Standard of care reporting by local radiologists were utilized when available (n=161). Human radiologist evaluation as gold standard was performed as part of the review when standard of care reporting was not available (n=918).

Central PE detection accuracy, sensitivity, specificity, positive predictive value, and negative predictive value by RAPID PE were determined.

Results

We included 1079 studies (mean age, 51 years +/- 17.8 years); 429 men, 648 women, 2 unknowns.

RAPID PE correctly identified 329/350 positive central PE cases and 675/729 central PE-negative cases, which resulted in high sensitivity (94.0%, CI: 0.91,–0.96), specificity (92.6%, CI: 0.90–0.94), positive predictive value (85.9%, CI: 0.82-0.89), and negative predictive value (97.0%, CI: 0.95–0.98) for central PE detection. Table 1 states these metrics.

		Patients with positive central PE (as confirmed by radiologist)		
		Condition positive	**Condition negative**	
RapidAI detection of central PE	Module outcome positive	True Positive TP = 329	False Positive FP = 54	**Positive Predictive Value** = TP/(TP+FP) = 329/(329+54) **= 86%**
	Module outcome negative	False Negative FN = 21	True Negative TN = 675	**Negative Predictive Value** =TN/(FN+TN) = 675/(21+675) **= 97%**
		Sensitivity =TP/(TP+FN) = 329/(329+21) **= 94 %**	**Specificity** =TN/(FP+TN) = 675/(54+675) **= 93%**	

Figure 2: Performance of the software module compared with expert radiologists.

Group	Number of Positive Scans	Sensitivity (%)	Specificity (%)
All Patients	350	94	93
GE	104	91	93
PHILIPS	117	97	87
TOSHIBA	71	94	97
SIEMENS	56	95	92
Female	190	93	95
Male	160	95	89
Age ≤ 50	81	90	95
50 < Age < 70	107	94	93
Age ≥ 70	92	95	90

Table: Sensitivity and specificity in subgroups based on scanner manufacturer, sex and age.

Conclusion

The results of this study demonstrate that RapidAI's Pulmonary Embolism Triage and Notification module performs with a high sensitivity, specificity, PPV and NPV for identification of central PE. This is true regardless of CT scanner manufacturer and across gender and age spectra. This AI tool can assist hospital networks and trained clinicians in improving workflow and triage by identifying positive findings of central pulmonary embolism pathology and rapidly notifying clinicians and Pulmonary Embolism Response Teams.

Reference

1. Turetz M, Sideris AT, Friedman OA, Triphathi N, Horowitz JM. Epidemiology, pathophysiology, and natural history of pulmonary embolism. *Semin Intervent Radiol*. 2018; 35(2):92-98.

Disclosures

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