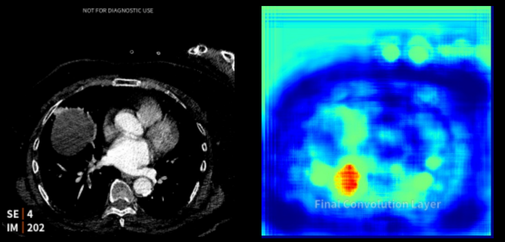
The Impact of Artificial Intelligence on the Detection of Incidental and Symptomatic Pulmonary Emboli at the Mater Hospital: A Review of 11,000 CT studies.

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Background

Pulmonary embolism is the third leading cause of cardiovascular mortality worldwide [1]. Patients can present with typical cardiorespiratory symptoms, or can be asymptomatic and present with "incidental" pulmonary emboli (iPE) on imaging performed for other reasons.

Artificial intelligence has shown promising performance in the detection of pulmonary emboli on dedicated CTPA and non-dedicated imaging, with a recent meta-analysis showing pooled sensitivity and specificity of 88% and 86% respectively on dedicated CTPA analysis [2].

A recently published prospective study has shown that radiologists' performance in PE detection improved when working with AI, and outperformed AI or radiologists alone [3].

What is not clear yet is the impact of introducing AI on PE reporting rates – in particular iPE, which has been shown to be missed frequently in routine clinical practice, with "miss rates" of 32-79% quoted [4].

Objective

To evaluate a large cohort of patients presenting to a large tertiary referral centre before and after the introduction of AI tools for PE detection. To assess the impact of these tools on PE detection rate and reporting practice.

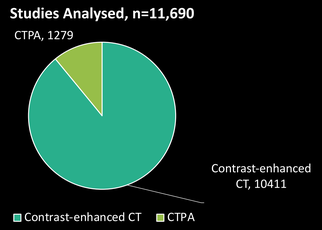
Secondary objective was to perform a retrospective assessment of AI tool performance against the standard of a consultant report.

Methods

We analysed consecutive adult patients presenting to our institution (a large tertiary referral centre) between Sept 1st and Dec 31st 2022 (before AI) and Sept 1st and Dec 31st 2023 (following introduction of AI). Patients were included if they underwent CTPA or any contrast-enhanced CT that included at least partial imaging of the chest.

Radiology reports were extracted and automatically searched for terms related to pulmonary embolism. Reports were manually categorized as positive or negative for PE.

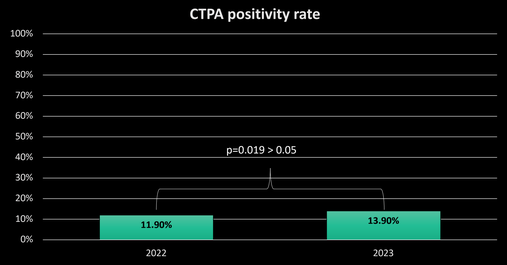
AI tool for PE detection was provided by AIDOC. A widget was embedded in the PACS, studies assessed automatically for PE and a heatmap was provided in positive cases with the area of interest for PE.

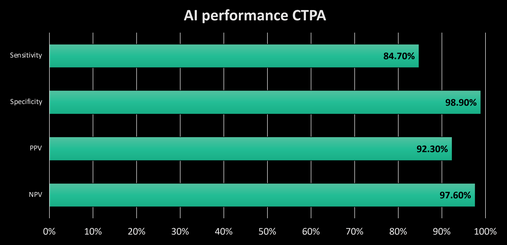


Results

We analysed 11,690 studies in total, including 1,279 CTPA studies and 10.411 other contrast-enhanced CT studies with at least partial chest imaging.

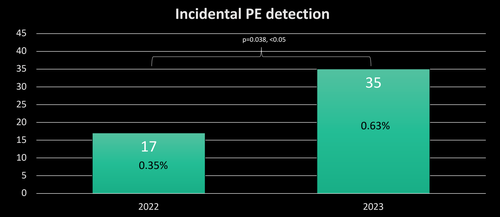
CTPA positivity rate increased slightly from 11.90% to 13.90%, which did not reach statistical significance. The AI tool performed well on dedicated CTPA analysis, with a sensitivity of 85% and specificity of 99%.

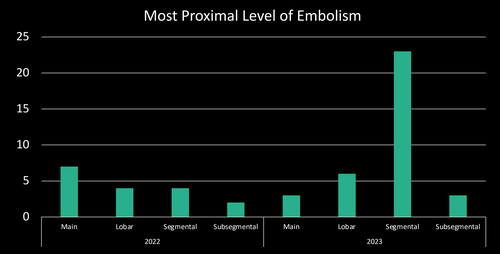


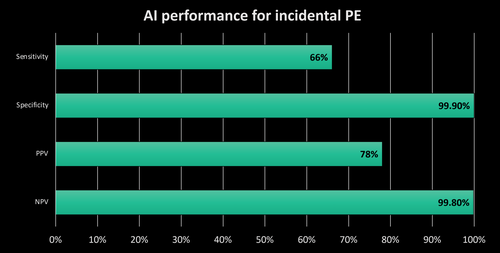


Results, continued

The detection rate of incidental pulmonary emboli significantly increased following the introduction of a dedicated AI detection tool, with a relative increase of 82% (p=0.038). There was a particular increase in iPE detected with most proximal thrombus at a segmental level. AI performance for iPE detection was not as sensitive as dedicated CTPA performance, with a sensitivity of 66%.







Discussion

The clinical significance of incidental pulmonary emboli has been debated at length amongst haematologists. To date, no randomised controlled trial has been performed to compare outcomes with anticoagulation versus placebo. Instead, data is extrapolated and guidelines generated based on the observations that the risk of repeat VTE events (and overall prognosis) is similar for incidental and symptomatic PE [5]. Guidelines suggest treatment as per symptomatic PE, and studies have previously found that most incidentally-discovered pulmonary emboli will alter management [3].

We demonstrated a significant increase in the detection and reporting rates of incidental PE following the introduction of a dedicated AI detection tool. While the tool's performance in isolation was imperfect (sensitivity of just 66% compared to consultant report) it still proved clinically useful.

We observed a trend towards an increase in CTPA positivity rate. Although this did not reach statistical significance, this suggests an area for future research, given the frequency with which this study is performed worldwide.

Conclusion

Dedicated artificial intelligence tools for PE detection perform well in CTPA analysis, and can be particularly clinically useful in aiding detection of incidental pulmonary emboli. We found that detection rates of iPE increase post introduction of AI.

References

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