Annalise.ai and RapidAI for Detection of Subarachnoid Haemorrhage on Head CT Scans

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Background

Annalise.ai and RapidAI are commercially available artificial intelligence programmes that allow assessment of head CT scans for acute intracranial abnormalities. At our institution, Annalise.ai is employed by frontline physicians in the Accident & Emergency Department (AED), while RapidAI is utilised by a multidisciplinary neuroscience team for acute stroke management. Both programmes include modules for detection of intracranial haemorrhage (ICH).

Subarachnoid haemorrhage (SAH) is a subtype of ICH that can be particularly challenging to diagnose clinically, and can be overlooked on head CT scans especially when the SAH volume is small. While CT is highly sensitive for SAH when interpreted by expert reviewers, radiologists are often not part of the triage team in the initial review of head CT scans at our institution. This study aims to assess the performance of Annalise.ai and RapidAI in the detection of SAH in head CT scans, and to identify any limitations in their application.

Methods

- Plain head CT scans performed in our hospital from 1st June 2021 to 30th June 2022 and reported by radiologists to have SAH were retrieved.
- Routine 0.6mm section thickness CT scans were processed with Annalise.ai and RapidAI.
- CT interpretation by AED physicians were obtained through retrospective retrieval of clinical records.
- Segmentation of ICH on false negative CT scans were performed to calculate the volumes of missed SAH.

Results

256 eligible head CT scans with SAH were retrieved and successfully processed. 25 cases were not detected by AED physicians.

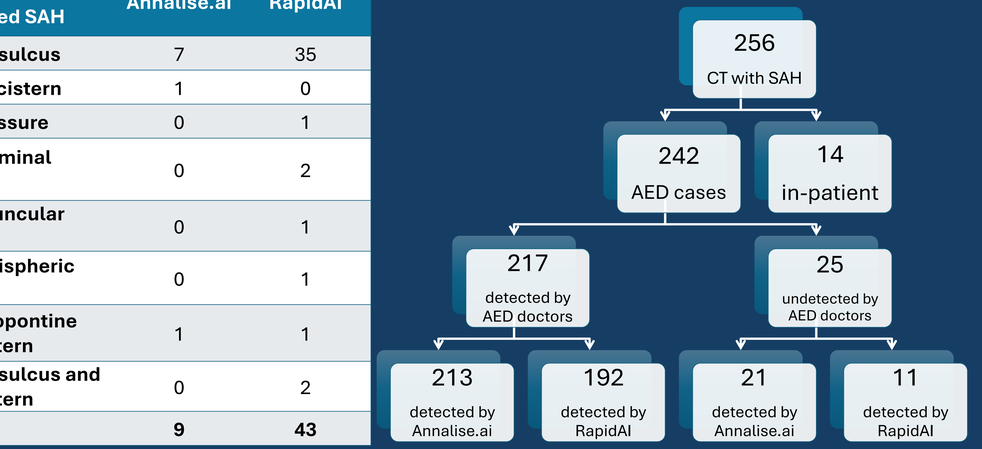
Detection rates of Annalise.ai and RapidAI and volume of SAH in false negative results

AI Module	Overall detection rate of SAH	Detection rate for cases missed in AED	Average volume of undetected SAH (Range)
Annalise.ai	96% (247/256)	84% (21/25)	0.35ml (0.05 – 1.77ml)
RapidAI	83% (213/256)	44% (11/25)	0.56ml (0.05 – 2.24ml)

False negative AI results based on location

Location of undetected SAH	Annalise.ai	RapidAI
Cerebral sulcus	7	35
Ambient cistern	1	0
Sylvian fissure	0	1
Quadrigeminal cistern	0	2
Interpeduncular cistern	0	1
Interhemispheric fissure	0	1
Cerebellopontine angle cistern	1	1
Cerebral sulcus and basal cistern	0	2
Total	**9**	**43**

Detection of SAH in the AED by AED physicians, Annalise.ai and RapidAI





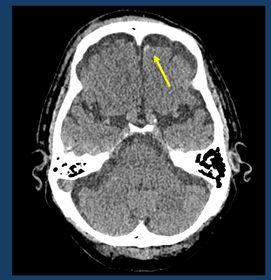
False negative on RapidAI only: SAH in right ambient cistern



False negative on RapidAI only: SAH in left frontal sulci



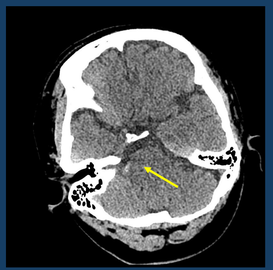
False negative on Annalise.ai only: SAH in right calcarine sulcus (streak artefacts from bilateral cochlear implants)



False negative on Annalise.ai only: SAH in left frontal region



False negative on Annalise.ai and RapidAI: SAH in left temporal sulcus



False negative on Annalise.ai and RapidAI: SAH in right cerebellopontine cistern

Conclusion

Annalise.ai and RapidAI are effective AI-assistive tools in SAH detection. Both modules detected a significant proportion of SAH cases which were undetected by AED physicians, which can serve as useful adjuncts in the initial assessment of SAH. Both modules had limitations in the detection of subtle SAH in the sulcal spaces or cisterns, which serve as important areas for cross-checking by frontline physicians.