Validation of a Deep Learning Tool in the Detection of Intracerebral Hemorrhage and Large Vessel Occlusion

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Purpose:

Recently developed machine-learning algorithms have demonstrated strong performance in the detection of intracerebral hemorrhage (ICH) and large vessel occlusion (LVO). However, their generalizability is limited given geographic bias of studies. The aim of this study was to validate a commercially available deep learning-based tool in the detection of both ICH and LVO across multiple hospital sites and vendors throughout the U.S.

Materials and Methods:

This was a retrospective study using anonymized data from two institutions. 814 non-contrast CT cases and 378 CT angiography cases were analyzed in regards to ICH and LVO, respectively. The tool's ability to detect and quantify ICH, LVO and their various subtypes was assessed amongst multiple CT vendors and hospitals across the United States. Ground truth was based off imaging interpretations from two board-certified

neuroradiologists.

Results:

There were 255 positive and 559 negative ICH cases. Accuracy was 95.6%, sensitivity was 91.4 % and specificity was 97.5%. AUC ($p<0.001$) was 0.94. ICH was further stratified into the following subtypes: intraparenchymal, intraventricular, epidural/subdural and subarachnoid with true positive rates of 92.9%, 100%, 94.3% and 89.9 %, respectively. ICH subtypes were further divided into small (<5 mL), medium (5-25 mL) and large (>25 mL) volumes, with true positive rates of 71.8%, 100% and 100%, respectively.

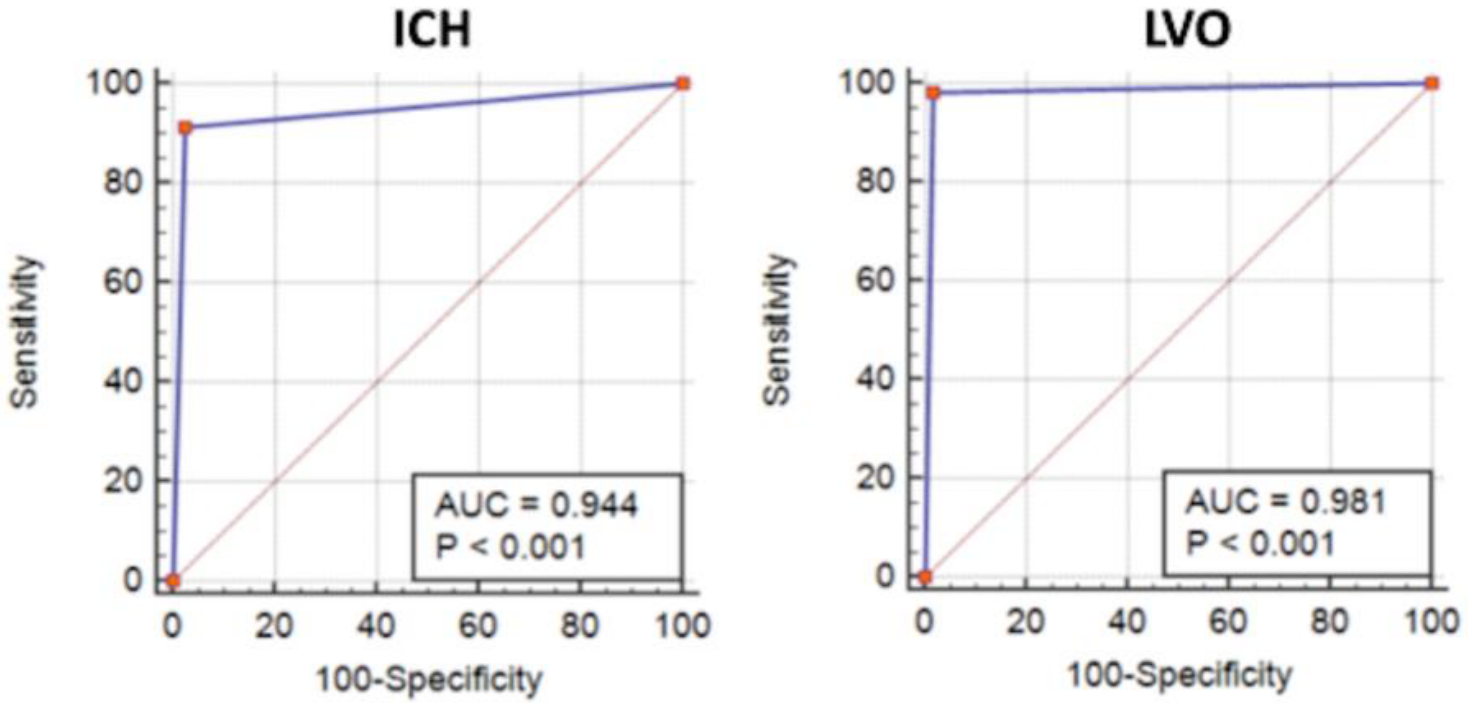
There were 156 positive and 222 negative LVO cases. Accuracy was 98.1%, sensitivity was 98.1% and specificity was 98.2%. AUC ($p<0.001$) was 0.98. A subset of 55 randomly selected cases were also assessed for LVO detection at various sites, including the distal internal carotid artery, middle cerebral artery M1 segment, proximal middle cerebral artery M2 segment and distal middle cerebral artery M2 segment with an accuracy of 97.0%, sensitivity of 94.3% and specificity of 97.4%.

Conclusions:

Deep learning tools can be effective in the detection of both ICH and LVO across a wide-variety of hospital systems. While some limitations were identified, specifically in the detection of small ICH and distal M2 occlusion, this study highlights a deep learning tool that can assist radiologists in the detection of emergent findings in a variety of practice settings.

Categories:

AI/INFORMATICS, AI/Machine Learning



(https://files.aievolution.com/prd/asn2101/abstracts/abs_1409/Abstractfigure1.jpg)

Reference One:

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