Submission Type: Scientific Presentations

Contact: Jennifer Soun MD
INSTITUTION:
E-Mail: jsoun10@gmail.com

Primary Category: Neuroradiology/Head and Neck
Secondary Category: Techniques and Methods: AI for Image Analysis

Validation of a deep learning tool for automatic intracranial hemorrhage detection and classification

J Soun, MD, Santa Ana, CA; S Quenet, BS; P Chang, MD; D S Chow, MD (jesoun@hs.uci.edu)

PURPOSE

Intracranial hemorrhage (ICH) causes significant morbidity and mortality. The timely, accurate diagnosis of ICH is necessary for initiating early interventions that could be life-saving. Artificial intelligence tools for expeditious and accurate diagnosis allows for fast decision-making that may ultimately improve clinical outcomes. However, the generalizability of these tools to different patient cohorts, scanning equipment, and scanning protocols is not well described. This study aims to assess the generalizability of a commercially available deep learning-based tool, CINA® v1.0 device (Avicenna.ai, La Ciotat, France), in detecting ICH across 41 unique hospital systems and 4 unique vendors.

METHOD AND MATERIALS

This was a retrospective study which evaluated 395 anonymized non-contrast CT cases from vRad (Minneapolis, Minnesota, USA), a teleradiology organization, and 419 cases from University of California Irvine Medical Center (UCI; Orange, California, USA). Data spanned 41 unique hospital systems using 4 CT vendors. The tool's ability to detect and quantify ICH was evaluated. In addition, the tool's performance classifying subtypes of ICH was analyzed. For ground truth, segmentation was performed by two neuroradiologists.

RESULTS

There were 255 positive ICH cases: 204 from vRAD and 51 from UCI. CINA® v1.0 correctly identified 91.4% (233/255) positive ICH cases. The sensitivity was 0.91, specificity 0.98, and area under the curve (AUC) 0.94 with $p < 0.001$. For size, ICH volumes were categorized into small (< 5 cm3), medium (5-25 cm3), and large (>25 cm3), and true positive detection was 73.1% (57/78), 100% (100/100), and 100% (77/77), respectively. For ICH subtypes (for which some cases had a combination of subtypes), true positive detection was 92.9% (92/99) intraparenchymal, 100% (23/23) intraventricular, 94.3% (115/122) epidural/subdural, and 89.9% (71/79) subarachnoid.

CONCLUSION

This study demonstrates that deep learning-based tools may be generalizable despite heterogenous hospital systems and vendors. Limitations of the tool include missing small volume ICH, particularly in the presence of noise, motion, or streak artifacts. Regardless, the validation of this robust tool has implications for widespread clinical use given the different settings from which the cases were obtained. This tool could help radiologists with triage in the acute setting.

CLINICAL RELEVANCE/APPLICATION

This study validates a deep-learning based tool which can detect ICH accurately and quickly across a variety of practice environments.

FIGURE (RECOMMENDED)

http://abstract.rsna.org/uploads/2020/20012477/20012477_tbok.jpg

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Disclosures:

Nothing to disclose:	Jennifer Soun
Nothing to disclose:	Sarah Quenet
Nothing to disclose:	Peter Chang

Nothing to disclose: Daniel Chow

Questions:

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Yes

If yes, please provide one email address:

jesoun@hs.uci.edu

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Yes