Effect of AI-Assisted Reading on Radiologist Performance in Cerebral Aneurysm Detection: Influence of Aneurysm Location and Size

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Purpose

To evaluate the impact of an AI-assisted reading software(DEEP:NEURO)on radiologist performance in detecting cerebral aneurysms on time-of-flight MR angiography(TOF-MRA), focusing on diagnostic performance and the influence of aneurysm location and size.

Materials and Methods

This retrospective study employed a multi-reader multi-case (MRMC), counterbalanced crossover design. 443 cases were collected (184 positive containing 249 aneurysms, 259 negative). Six radiologists reviewed each case under AI-assisted and unassisted conditions, separated by a 4-week washout, with the order counterbalanced between readers. The reference standard was established from DSA reports by clinicians blinded to the reading sessions. Per-lesion true positives required matched anatomical location (side and vessel); when reader detections at one location exceeded the reference count, the lesion with the largest reference diameter was preferentially matched. Sensitivity was analyzed by aneurysm location and by maximum diameter: <3mm, 3–5mm, 5–7mm, and ≥7 mm.

Results

With AI assistance, patient-level sensitivity increased from 0.766 to 0.842, specificity decreased from 0.649 to 0.603, and accuracy was essentially unchanged from 0.698 to 0.702. Per-lesion sensitivity improved with AI for anterior circulation aneurysms, including ICA from 0.66 to 0.76, MCA from 0.69 to 0.84, ACA from 0.55 to 0.62, and PCA from 0.45 to 0.75, whereas posterior circulation aneurysms showed decreased sensitivity, including VA from 0.38 to 0.32 and BA from 0.60 to 0.56. By maximum diameter, AI produced the greatest gains for small aneurysms, including <3 mm from 0.43 to 0.59 and 3–5 mm from 0.65 to 0.79, modest gains for 5–7 mm from 0.86 to 0.90, and a slight decrease for ≥7 mm from 0.74 to 0.69.

Conclusion

AI-assisted reading improved overall sensitivity for cerebral aneurysm detection at the cost of a modest specificity decrease. Benefits were most pronounced for small aneurysms less than 5 mm and anterior circulation aneurysms, while posterior circulation vertebrobasilar artery aneurysms and large aneurysms 7 mm or greater showed no improvement, suggesting current AI limitations in these subgroups. Thus, AI assistance can be helpful for detecting small anterior circulation aneurysms most often missed conventionally but requires careful reader review for posterior circulation and large aneurysms.