Computed Tomography Angiography for intracranial aneurysm diagnosis

- Inconsistency of AI in intracranial aneurysm detection with varying dose and image reconstruction
- Intra-Sylvian versus intracerebral haematoma associated with ruptured middle cerebral artery aneurysm: initial and follow-up imaging features
- A rare case of Fahr's disease with posterior circulation (basilar tip) aneurysm- pathophysiology, management, and complications
- Intracranial vertebral artery dissection without hemorrhagic presentation
- Development of a deep-learning algorithm for etiological classification of subarachnoid hemorrhage using non-contrast CT scans
- Deep learning-based fine-grained assessment of aneurysm wall characteristics using 4D-CT angiography
- Cost-effectiveness of population-wide screening for intracranial aneurysms revisited in light of potential diagnostic developments
- Invisible Until It Burst: Unexpected Subarachnoid Hemorrhage From a Rapid-Onset Infectious Aneurysm in a Patient With Endocarditis

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Retrospective diagnostic accuracy study with prospective internal and external validation, using an artificial intelligence model for aneurysm detection on CTA

Pettersson et al. in a paper presents itself as a landmark achievement in generalizable AI for brain aneurysm detection on CTA [1]. — a lofty claim that withers under scrutiny.

1. Misleading claims of novelty:

The authors assert they developed the “first” generalizable model for aneurysm detection. This conveniently ignores a decade of prior work in multi-institutional model development and transfer learning, some of which have demonstrated external validation metrics on par or superior to those presented here. Labeling this model as “first” is not only inaccurate — it’s disingenuous.

2. Training data bias and circular validation:

The training cohort spans nearly two decades from a single institution, yet includes only untreated, unruptured aneurysms without “extensive cerebrovascular disease.” In other words, the model was trained on a cherry-picked, idealized dataset — and then celebrated for its generalizability. That’s like training a dog to fetch in a hallway and then praising its performance in an open field.

3. External validation is neither rigorous nor representative:

The external validation dataset comes from a single international center and consists of only 303 scans — a drop in the bucket relative to the heterogeneity seen in global clinical practice. The model's performance may be “on par” with radiologists, but that equivalence rests on hand-picked metrics

(e.g., Dice scores and lesion-level sensitivity) that hide critical errors such as false positives in surgically altered vessels or overlapping vascular anomalies.

4. Overreliance on weak metrics:

Dice score? Fine. But not when it's used as the backbone of a clinical validation argument. For a detection task — particularly one meant to influence surgical or endovascular decisions — the clinical relevance of a 0.76 Dice score is highly questionable. Where are the outcome-level validations? Where are the interrater comparisons across pathologies?

5. The "publicly testable platform" distraction:

A flashy web-based platform does not equate to scientific robustness. Offering public access to a black-box model might seem progressive, but without transparency in model weights, training labels, preprocessing pipelines, and interpretability tools, it's just another tech demo — not a validated clinical tool.

6. Real-world utility is still unproven:

The model missed 12.5% of aneurysms that radiologists caught — and this was on idealized CTA scans. What happens in the real world with metal artifacts, suboptimal contrast boluses, or tortuous anatomy? The paper, unsurprisingly, doesn't say. Instead, it rushes to declare "state-of-the-art performance," a term better reserved for peer-vetted, multi-center, prospective trials — not internal performance tables.

Conclusion:

This article contributes to a growing genre of AI papers that promise revolution while delivering a slightly shinier wheel. Far from breaking new ground, it repackages known limitations with exaggerated confidence, wrapped in buzzwords and frontloaded with self-congratulation. Until the model proves itself across true clinical heterogeneity, under real-world constraints, and with open-source scrutiny, its claims of "generalizability" remain just that — claims.

Computed tomography angiography is slowly replacing digital subtraction angiography as the first-line technique for the diagnosis and treatment planning of intracranial aneurysms, but digital subtraction angiography is still required in patients with diffuse subarachnoid hemorrhage (SAH) and negative initial computed tomography angiography [2].

Computed tomography angiography (CTA) is increasingly used for the detection, characterization, and follow-up of intracranial aneurysms.

A lower threshold to request a CT angiogram may render a patient population that differs from previous studies primarily evaluated with conventional angiography.

All CTA studies performed over a 10-year period at a large neurovascular referral center were reviewed for the presence of an intracranial aneurysm. Patient demographics, mortality, CTA

indication, aneurysm location, size, and rupture status were recorded.

2927 patients with aneurysms were identified among 29 003 CTAs. 17% of the aneurysms were ruptured at the time of imaging, 24% of aneurysms were incidentally identified, and multiple aneurysms were identified in 34% of patients. Aneurysms most commonly arose from the supraclinoid internal carotid artery (22%), the middle cerebral artery (18%), and the anterior communicating artery (13%). Male sex, age <50 years, aneurysms >6 mm, and aneurysms arising from the anterior communicating artery, posterior communicating artery, or the posterior circulation were independent predictors of aneurysm rupture. Independent mortality predictors included male sex, posterior circulation aneurysms, intraventricular hemorrhage, and intraparenchymal hemorrhage.

These results indicate that aneurysms detected on CTA that arise from the anterior communicating artery, posterior communicating artery, or the posterior circulation, measure >6 mm in size, occur in men, and in patients aged <50 years are associated with rupture.

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DSA identifies vascular pathology in 13% of patients with CTA-negative SAH. Aneurysms or pseudoaneurysms are identified in an additional 4% of patients by repeat DSA following an initially negative DSA. All patients with CT-negative SAH should be considered for DSA. The pattern of SAH may suggest the cause of hemorrhage, and aneurysms should specifically be sought with diffuse or perimesencephalic subarachnoid hemorrhage [4].

Bone-subtraction CTA is as accurate as DSA in detecting cerebral aneurysms after SAH, provides similar information about aneurysm configuration and measures, and reduces the average effective radiation dose for vascular diagnostics by 65%. Diagnostic equivalence in association with dose reduction suggests replacing DSA with bone-subtraction CTA in the diagnostic work-up of spontaneous SAH [5].

In view of the aggressive natural history of posterior circulation traumatic intracranial aneurysm (TICA), deSouza et al., recommend that CTA of the head and neck vessels be performed for cases

presenting with post-traumatic disproportionate cisternal and or third ventricle or fourth ventricle SAH. In the event of initial CTA being negative, repeat CTA and if negative DSA should be performed between 5 to 7 days, with a low threshold for further repeat at 10 days if a traumatic dissection is still suspected. Close monitoring for hydrocephalus and vasospasm is required during hospital admission and significant therapy input is likely to be required post discharge from acute care [6].

Paraclinoid aneurysm

High-resolution thin-cut CTA is a fast and crucial tool for diagnosing paraclinoid aneurysms. The optic strut (OS) serves as an effective landmark in CTA source images for distinguishing between intradural and extradural paraclinoid aneurysms. The distal dural ring (DDR) is supposed to be located 2 mm above the base of the OS in axial planes [7].

1)
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