# Accuracy of Computerized Tomography Angiography for the Detection of Intracranial Aneurysms in the Setting of Subarachnoid Hemorrhage

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Introduction: Computerized tomography angiography (CTA) is commonly used to diagnose intracranial aneurysms with reported sensitivities as high as 97-100%. Despite improvements in CTA, digital subtraction angiography (DSA) remains the gold standard for ruptured aneurysms. Studies validating CTA accuracy in ruptured aneurysms in the setting of subarachnoid hemorrhage (SAH) are scarce, and limited by small sample sizes. This study evaluated the diagnostic accuracy of CTA to detect intracranial aneurysms in the setting of SAH.

Methods: A single-center retrospective cohort of 643 SAH patients was reviewed. A total of 407 patients were identified whose diagnostic workup included both CTA and confirmatory DSA. A comparative analysis between CTA and DSA findings was conducted. Aneurysms missed by CTA but diagnosed by DSA were further stratified by size and location.
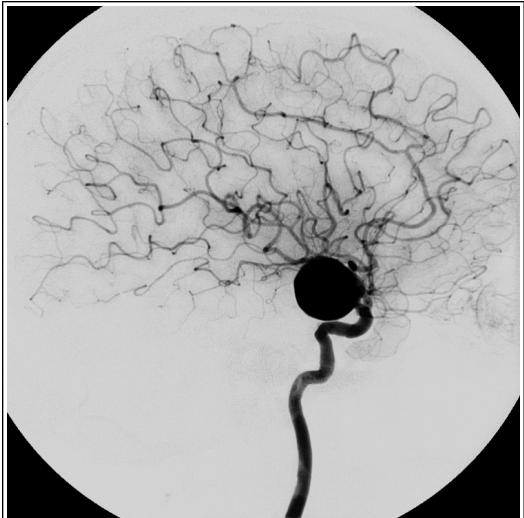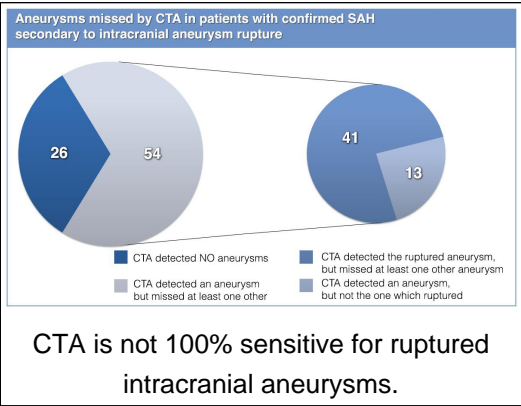

A large aneurysm demonstrated by DSA

Results

Aneurysms missed by CTA (location)

Location	Number of Aneurysms
Anterior circulation	**110 (88.7%)**
Proximal ACA (A1)	2 (1.6%)
Distal ACA (A2)	1 (0.8%)
Pericallosal	2 (1.6%)
Anterior communicating (ACom)	7 (5.6%)
Proximal MCA (M1)	16 (12.6%)
Distal MCA (M2)	8 (6.5%)
ICA	**74 (59.7%)**
- Cavernous ICA	18
- Clinoidal ICA	4
- Posterior communicating segment	19
- Superior hypophyseal segment	7
- Ophthalmic segment	11
- Anterior choroidal segment	12
- ICA bifurcation	3
Posterior circulation	**14 (11.3%)**
Posterior communicating-PCA	2 (1.6%)
PCA	1 (0.8%)
Basilar tip	3 (2.4%)
Superior cerebellar	1 (0.8%)
PICA	5 (4.0%)
AICA	1 (0.8%)
Vertebral	1 (0.8%)
Undocumented*	3*

While CTA identified 338 aneurysms, DSA detected a total of 443 aneurysms. False positive CTA results (n=22) were seen in 20 patients. Additionally, DSA identified 127 aneurysms in 80 patients that were missed by CTA.

Aneurysms missed by CTA (size)

Aneurysm size	Number of Aneurysms missed by CTA
Very Small (<5mm)	92 (83.6%)
- (<3mm)	- 68 (61.8%)
- (3-5mm)	- 24 (21.8%)
Small (5-10mm)	15 (13.6%)
Medium (10.1-15mm)	2 (1.8%)
Large (>15mm)	1 (1.0%)
Size unknown*	17*

Contingency tables for findings on CTA vs DSA

|	Number of Patients					Number of Aneurysms		
		DSA findings					DSA findings	
		+	-				+	-
CTA findings +	194	20	214		CTA findings +	316	22	338
CTA findings -	80	113	193		CTA findings -	127	113	240
	274	133	407			443	135	578

Of the aneurysms missed by CTA, 83.6% were determined to be very small (<5mm), three quarters of which were smaller than 3mm. The supraclinoid internal carotid artery (ICA) harbored 42% of all missed aneurysms. The sensitivity of CTA was equal to 34.0% for aneurysms smaller than 3mm in size, and 59.6% for aneurysms originating from the ICA. The overall sensitivity of CTA in the detection of aneurysms in the setting of SAH was found to be 70.8% per patient, and 71.3% per aneurysm.

Aneurysms missed by CTA in patients with confirmed SAH secondary to intracranial aneurysm rupture

26 | 54 | 41 | 13

CTA detected NO aneurysms
CTA detected an aneurysm but missed at least one other
CTA detected the ruptured aneurysm, but missed at least one other aneurysm
CTA detected an aneurysm, but not the one which ruptured

CTA is not 100% sensitive for ruptured intracranial aneurysms.

Conclusions

The accuracy of CTA in the diagnosis of intracranial aneurysms in the setting of SAH may be lower than previously reported. CTA has a low sensitivity for aneurysms smaller than 5mm, and in locations adjacent to bony structures. In addition, we conclude that CTA is not 100% sensitive for the detection of ruptured aneurysms.

Aneurysm missed by CTA but diagnosed by DSA
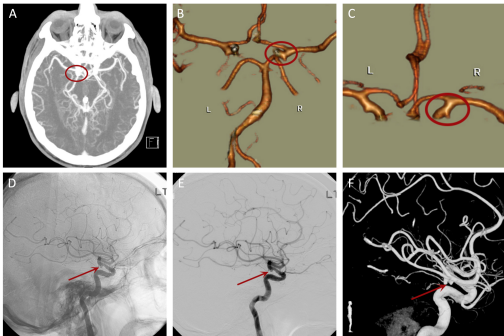
Imaging studies from a patient presenting with SAH. Images A-C are CTA and reconstructed 3DCTA, the results of which were indeterminant for aneurysms. Image D-F are the findings on DSA for the same patient, the results of which demonstrate a 2.4mm x 2.2mm anterior choroidal segment aneurysm.

References:
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