Accuracy of Computed Tomographic Angiography in the Diagnosis of Intracranial Aneurysms

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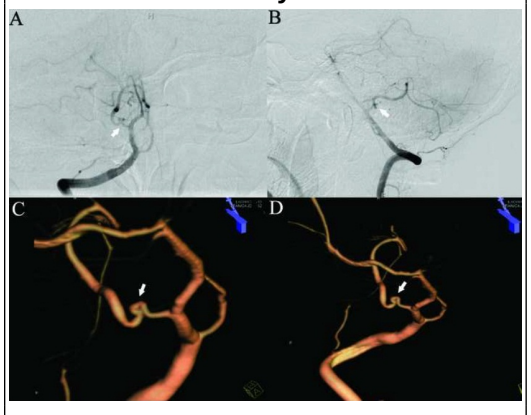
Introduction

Digital substraction angiography (DSA) remains the gold standard for intracranial aneurysm (IA) diagnosis. Use of computed tomographic angiography (CTA) to diagnose IAs continues to increase, however, previous data comparing CTA and DSA estimated CTA sensitivity at 93% and specificity at 77%. A prospectively acquired cohort of 112 patients with CTA diagnosis of IA who underwent confirmatory DSA was studied to re-evaluate the diagnostic accuracy of CTA for unruptured IAs.

PICA Vessel Loop Diagnosed by CTA as Aneurysm



PICA vessel loop seen on DSA (A and B) diagnosed by CTA as aneurysm. C and D show 3-D reconstruction of DSA.

Methods

Between 2007-2010 112 patients (75 females; mean age 53.2 years) with one or more unruptured aneurysms by CTA, who later underwent four-vessel DSA were identified. DSA and CTA results were compared to determine accuracy of CTA in diagnosing unruptured IAs. Results are reported as "inaccuracy rate" of CTA. Aneurysms missed by CTA but diagnosed by DSA (false-CTA-negatives) were recorded separately and analyzed by parent vessel and aneurysm size. Cases diagnosed by CTA but ruled out by DSA(false-CTA-positives) were further classified into completely negative or negative with an infundibulum.

Location of False-CTA-Positive Aneurysms

Location	No. of aneurysms
ICA	6 (22.2%)
Petrous ICA	1
Clinoidal ICA	2
Ophthalmic artery segment	1
Posterior communicating artery segment	2
ACoA	9 (33.3%)
ACA	2 (7.4%)
Distal ACA (A2,A3)	1
Proximal ACA (A1)	1
MCA	1 (3.7%)
Posterior Circulation	9 (33.3%)
Basilar artery bifurcation	7 (26%)
Posterior cerebral artery	1
Posterior inferior cerebellar artery	1

Aneurysms diagnosed by CTA but later ruled out by DSA

Size of False-CTA-Positive Aneurysms

Size	Total False Positives
Very small (0-5mm)	17 (63%)
Small (6-10mm)	1 (3.7%)
Medium (11-15mm)	0
Large (16-24mm)	0
*Size Unknown**	9

Size of aneurysms diagnosed by CTA but ruled out by DSA

Results

While CTA identified 117 anterior and 15 posterior circulation aneurysms, DSA identified 127 anterior and 7 posterior circulation aneurysms. DSA detected more very small(0-5 mm, 91 vs. 85), small(6-10 mm, 29 vs. 28), and medium(11-15 mm, 7 vs. 11) aneurysms than CTA. CTA detected more large aneurysms(16-24 mm) than DSA(3 vs. 1). In 27 cases, CTA identified an IA later ruled out by DSA(false-CTA-positive). Within this group DSA ruled out 18 aneurysms previously identified by CTA, and an infundibulum but not an aneurysm was identified in 9. Most "false-CTA-positive" aneurysms(33%) were located along the anterior communicating artery(ACoA), as well as in the posterior circulation(33%) and were classified as very small(63%) or small(3.7%). DSA identified additional aneurysms In 20 patients not found on CTA. The most common location of "false-CTA-negative" aneurysms was the ICA with 75.9%, mostly located in the cavernous ICA, followed by MCA aneurysms with 24.1%. Most false-CTA-negative aneurysms were classified as very small (96.6%).

Location of False-CTA-Negative Aneurysms

Location	No. of aneurysms
ICA	22 (75.9%)
Cavernous ICA	7 (24.1%)
Clinoidal ICA	2
Posterior communicating artery segment	5
Superior hypophysial segment	1
Ophthalmic artery segment	4
Anterior choroidal segment	1
ICA Bifurcation	2
ACA	0
MCA	7 (24.1%)
Posterior Circulation	0

Aneurysms diagnosed by DSA but missed by CTA

Results Summary

False CTA Positives: Aneurysms found on CTA but ruled out by DSA	27 cases of total 132 (20.5% of cases)
False CTA Negatives: Aneurysms missed by CTA but confirmed by DSA	29 cases of total 134 (21.6% of cases)

Conclusions

CTA results must be carefully evaluated as previously reported accuracy rates differ from those found in this study. Larger studies are needed to further elucidate this phenomenon.

Learning Objectives

To understand the sensitivity and specificity of CTA and DSA in the diagnosis of unruptured intracranial aneurysms. To evaluate the PPV and NPV of CTA in the diagnosis of intracranial aneurysms.

References

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