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ORIGINAL ARTICLE

Diagnostic accuracy of contrast enhancement MRI versus CTA in diagnosis of intracranial aneurysm in patients with non-traumatic subarachnoid hemorrhage

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KEYWORDS

Contrast enhanced magnetic resonance angiography;
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Intracranial aneurysm

Abstract *Aim of the study:* The most common cause of spontaneous SAH is the rupture of cerebral aneurysm. So it is very important to exclude it from circulation as soon as possible using endovascular therapy. The aim was to determine whether contrast enhancement magnetic resonance angiography (CEMRA) is preferable to computed tomography angiography (CTA) in detection of intracranial aneurysm in patients presenting with non-traumatic subarachnoid hemorrhage (SAH).

Patients and methods: Twenty-five patients who presented with non-traumatic SAH underwent CEMRA and CTA for detection of aneurysms. Digital subtraction angiography (DSA) was used as standard of reference.

Results: CEMRA and CTA were done for all patients. A total of 22 aneurysms were detected in 25 patients. 15 patients with single aneurysm, 2 patients with two aneurysms, one patient with 3 aneurysms and in 7 patients no aneurysm was found. CEMRA and CTA angiograms were interpreted for the detection of aneurysms, site and size.

Conclusion: The diagnostic performance of CEMRA does not significantly differ from that of CTA in patients presenting with SAH.

1. Introduction

The most common cause of non-traumatic SAH is rupture of an intracranial aneurysm which accounts for about 85% of SAHs (1).

Intracranial aneurysms are present in about 2% of asymptomatic adults (2). Most aneurysms (80–85%) are located in the anterior circulation, commonly at the origins of the posterior or anterior communicating arteries or the middle cerebral artery bifurcation; posterior circulation aneurysms are most often seen at the basilar tip or posterior inferior cerebellar artery origin (1,2).

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Table 1 Reason for exclusion.

	No. of patients
Contraindication for one of the modalities	4
Patient with previous surgical clipping	1
Poor general condition	21
Refused the study	12
Total excluded	38

Table 2 Number of cerebral aneurysm.

Aneurysm	No. of patients (%)	No. of aneurysms
Single aneurysm	15 (83.3%)	15
Multiple aneurysm	3 (16.7%)	7
Total	18 (100%)	22

Table 3 Locations of intracranial aneurysm.

	No. of aneurysms
Internal carotid artery: posterior communicating artery, carotid tip and ophthalmic artery	5 aneurysms (21.5%)
Anterior cerebral artery: anterior communicating artery	6 aneurysms (29%)
Middle cerebral artery	7 aneurysms (31%)
Vertebrobasilar junction artery and basilar tip	4 aneurysms (18.5%)

Table 4 Comparison between CTA, CEMRA and DSA in detection of aneurysms.

	CTA	CEMRA	DSA
True positive	19	18	20
False negative	1	2	1
False positive	2	2	1

Table 5 Sensitivity, specificity, PPV, NPV and accuracy of CTA according to the size of the aneurysm.

Size of the aneurysm	Sensitivity	Specificity	PPV	NPV	Accuracy
> 5 mm	100%	100%	100%	100%	100%
< 5 mm	84.8	86	90	84	87
< 3 mm	75	94.4	79.1	74	95.6

Rupture risk is predicted by the aneurysm size and location, with risk increasing significantly for aneurysms greater than 7 mm in diameter, and an increased rupture risk is for those arising from the posterior communicating arteries or posterior cerebral circulation (3).

When SAH is diagnosed, selection of imaging modality is essential to ascertain whether a cerebral aneurysm is present or not (4,5).

CTA is the modality generally used for its logistic and diagnostic reasons. It is widely available on 24 h basis and for its cost effectiveness (6,7).

Some advantages have been recorded to MRA over CTA as follows: potentially harmful ionizing radiation is absent, and no iodinated contrast agent is administrated. However, flow dependant MRA sequences like time of flight MRA can suffer from signal loss, due to in place saturation or turbulent flow inside the aneurysm. CEMRA has shorter acquisition times than flow dependant MRA sequences and does not suffer from signal loss due to turbulent or slow flow or as a result from spin saturation in larger scan volumes. It might therefore be advantageous in the depiction of intracranial aneurysms (8,9).

CEMRA may be a preferable diagnostic tool. Besides its very small risk of nephrogenic systemic sclerosis or adverse reactions on gadolinium based contrast agents, the major disadvantage of MRA is that it requires transfer of the patient to the MRI room, where as additional CTA requires little extra effort since CT is the standard used to confirm the presence of SAH. Because catheter DSA is an integral part of the coiling procedure, and it is still the standard of reference for the detection of intracranial aneurysms, DSA is used as gold standard in this study (10,11).

In this prospective study the aim was to assess the accuracy of CEMRA in comparison with CTA in detection of intracranial aneurysms in patients with non-traumatic SAH.

1.1. Patients and methods

This study was conducted according to the guidelines of the Research Ethics Committee approval and informed consent was obtained from all patients.

From March 2013 to February 2014 all adult patients with diagnosed non-traumatic SAH were eligible for inclusion in this study. The inclusion criteria were as follows: all consecutive adult patients who had clinical symptoms of non-traumatic subarachnoid hemorrhage or cerebral aneurysm diagnosed by CT were eligible to enter the study. Diagnostic catheter DSA was performed within 3 days after CTA and CEMRA to all patients as standard of reference.

All patients who met the study inclusion criteria underwent CTA and an additional CEMRA study before endovascular therapy and within 48 h after CTA, however the CEMRA study did not delay the treatment.

The exclusion criteria were: absolute contraindication for one of the modalities, patients with previous surgical clipping or endovascular coiling of intracranial aneurysms, poor general condition and patients who refused to undergo the procedures (Table 1).

Thus, this prospective study was done on 25 patients (18 females and 7 males) with age ranging from 40 to 74 years (mean age was 58.7 ± 15.3).

1.1.1. CTA

CTA was performed on 4-slice multidetector – row spiral CT scanner (Toshiba Aquilion Tokyo, Japan). Scan parameters were: 120 kV, 200 mAs, collimation width 0.9 mm, pitch 0.67, field of view 230 mm, matrix 512 × 512. 0.5 mm slice