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Aneurysm

Clinical application of 16-row multislice computed tomographic angiography in the preoperative and postoperative evaluation of intracranial aneurysms for surgical clipping

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Abstract

Background: Sixteen-row multislice CTA has great potential for use in the studies of intracranial aneurysms. The aim of the study was to assess the clinical application of 16-row multislice CTA in the preoperative and postoperative evaluation of intracranial aneurysms for surgical clipping.
Methods: A total of 42 patients (45 aneurysms) underwent surgery using titanium clips. The CTA was performed with a 16-row multislice CT machine; detector slice, 0.75 mm; reconstruction interval, 0.40 mm; and timing determined by bolus trigger. The neuroradiologist independently evaluated the shape, size, and location of aneurysms; the relationship to other structures; and the presence of neck remnants and patency of the parent artery after clipping on MIP images, VR imaging, and thin-slab MIP and VR images.
Results: Sixteen-slice CTA clearly provided the shape and location of aneurysms, the size of the sac and the neck, and the relationship of aneurysms to bone structures and adjacent branch vessels; and this information would help the neurosurgeons find aneurysms and clip them successfully. Three clipped aneurysms with neck remnants were identified by the 16-slice CTA, and the parent artery could be reliably evaluated close to the clip.
Conclusion: Sixteen-slice CTA is a useful reference for patients undergoing surgical clipping of aneurysms and can provide much effective information to clipped aneurysms.

Keywords: Computed tomographic angiography; Intracranial aneurysm; Aneurysm surgery; Preoperative evaluation; Postoperative evaluation

1. Introduction

Approximately 10% of cases in which morbidity and mortality occurring after SAH from a ruptured intracranial aneurysm result from surgical complications such as major vessel occlusion and rebleeding [7]. Ideal positioning of the clip is key for the prevention of rebleeding from an aneurysm neck or dome remnant and for the preservation of the parent artery [3]. Therefore, the preoperative and postoperative assessment of aneurysms for surgical clipping is essential. Computed tomographic angiography is a noninvasive and accurate examination of the preoperative and postoperative assessment of clipped aneurysms [3,7,8,10,15,17]. At some institutions, CTA has replaced DSA in the preoperative evaluations of patients with intracranial aneurysms [2,4,10,15]. At present, there have been numerous studies emphasizing the diagnostic accuracy of aneurysms by comparing multislice CTA with DSA [3,7,11,14,16]. Nevertheless, the purpose of our study was to evaluate the clinical application of 16-row

Abbreviations: ACA, anterior cerebral artery; ACoA, anterior communicating artery; CTA, computed tomographic angiography; CVH, cerebroventricular hemorrhage; DSA, digital subtraction angiography; IH, intracerebral hematoma; MCA, middle cerebral artery; MIP, maximum-intensity projection; PCoA, posterior communicating artery; PCA, posterior cerebral artery; SAH, subarachnoid hemorrhage; VR, volume-rendering; 2D, 2-dimensional.

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multislice CTA in the preoperative and postoperative assessment of intracranial aneurysms for surgical clipping.

2. Patients and methods

Between January 2005 and October 2007, 42 patients (17 men, 25 women; age range, 37-77 years; mean age, 55 years) underwent surgery for clipping of a total of 45 intracranial aneurysms. Twenty-one of these 42 patients had SAH; 3 patients had SAH and CVH; 5 patients had SAH and IH; 2 patients had SAH, IH, and CVH; 6 patients had IH; 4 patients had IH and CVH; and the remaining patient had tumor. All surgeries were performed by the senior author (YY). Surgical clipping was offered only if one of the following factors was present: first, the anatomy shown on the angiogram appeared unfavorable for endovascular treatment; second, the aneurysm was partially thrombosed; and third, an IH was present with mass effect. Pterional craniotomies were performed for all aneurysms [3].

2.1. Sixteen-slice CTA acquisition

All 42 patients underwent CTA with a 16-row multislice CT machine (Somatom Sensation 16; Siemens, Erlangen, Germany) based on a standardized protocol. An automatic fluoroscopic bolus-triggered system determined the optimal timing of the data acquisition, the region of interest was placed at the internal carotid artery, and scanning was started at 80 HU. Nonionic iodinated contrast material (XENETIX 350 mg I/mL; GUERBET, Aulnay-sous-Bois, France) was injected at a rate of 3 mL/s using a power injector (Medrad Stellant, Indiana, PA). The volume of iodinated contrast material in each study was generally 85 to 100 mL. The CTA was initiated 15 to 25.5 seconds (mean time, 17.6 seconds) after the start of an intravenous infusion of contrast material. The CTA data acquisition was performed according to the following protocol: spiral mode, 0.5 rotation per second; detector slice, 0.75 mm; table speed, 10 mm per rotation; reconstruction interval, 0.40 mm; and acquisition parameters, 120 kV/250 mA. A caudocranial scanning direction was selected, and the volume of coverage extended from the first cervical vertebra to the superior aspect of the frontal sinuses.

2.2. Image review

Because DSA was the criterion standard, CTA images were reviewed independently by one neuroradiologist blinded to the DSA findings. The review of the CT angiograms was performed on a workstation (Siemens Wizard) to allow interactive reconstruction and interpretation, which have proven to be more accurate than an isolated review of hard copy images [17]. The review evaluated axial raw images, MIP, VR, and thin-slab MIP and VR technique reconstructions. The slab thickness was arbitrarily applied from 5 to 25 mm in each case. The following parameters were assessed: the shape (saccular, fusiform, or irregular), orientation, neck, and location of aneurysms and the relationship to other structures such as bone, and the presence of neck remnants and patency of the parent artery. The 16-slice CTA images were classified into 5 confidence grades regarding the presence of a neck remnant, as follows: grade 1, definitely

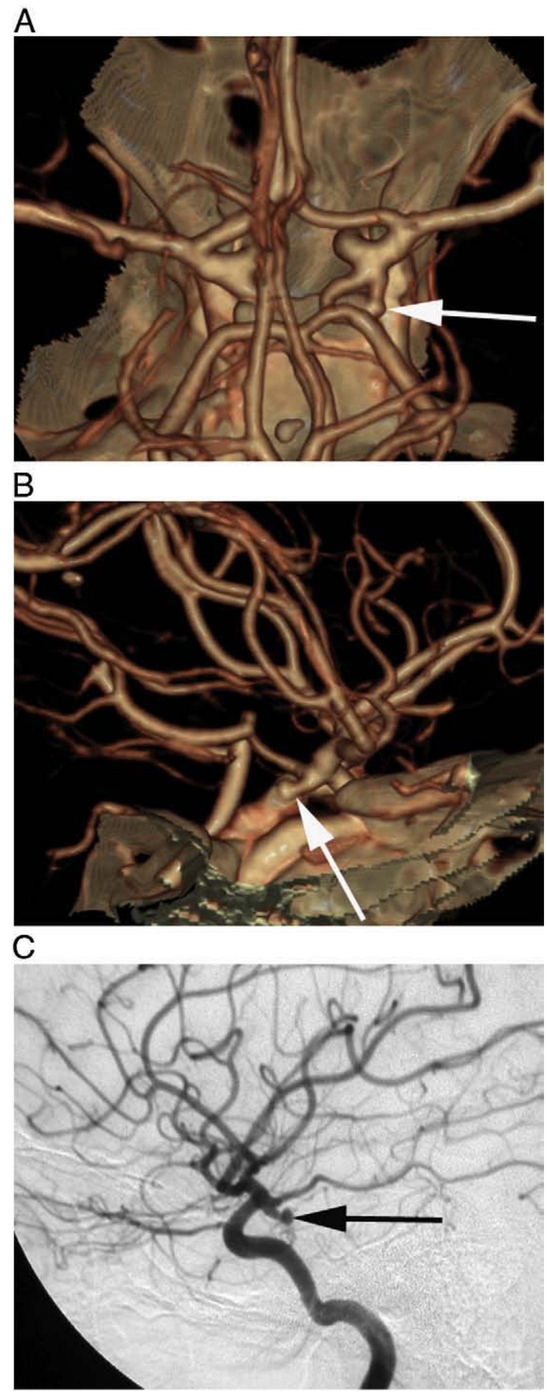

Fig. 1. Left PCoA aneurysm in a 55-year–old woman with SAH. The VR (A) images from CTA do not clearly display the left PCoA aneurysm (arrow). The primary reason for the missed aneurysm seemed to be the close proximity to bone. When CTA images are viewed retrospectively, the missed aneurysm is visible on the VR (B) images (arrow). The DSA (C) image clearly shows the aneurysm (arrow).