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Thrombus of the Internal Carotid Artery: The Contribution of Computed Tomographic Angiography to Clinical Management

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Abstract

Intraluminal thrombus adjunct to internal carotid artery plaque is a rare finding on traditional diagnostic imaging. Prompt diagnosis is important as it carries a high risk of recurrent stroke. We describe 2 symptomatic patients with severe stenosis on duplex scanning and internal carotid artery thrombus (ICAT) identified on subsequent computed tomographic angiography. Histology of the surgical specimen confirmed the composition predicted by computed tomography. Computed tomographic angiography can provide accurate diagnosis and characterization of internal carotid thrombus and lead to prompt therapeutic intervention.

Keywords

internal carotid thrombus; computed tomographic angiography; embolic stroke

Data from the North American Symptomatic Carotid Endarterectomy Trial (NASCET) study have demonstrated that the 30-day risk of recurrent stroke for symptomatic patients with internal carotid artery thrombus (ICAT), who are treated medically is 10.7% which is almost 5 times higher than in similar patients without intraluminal thrombus.^{1,2} The optimal diagnostic approach for this high-risk subgroup of patients is yet to be defined.³ In the literature, the prevalence of ICAT in patients with stroke ranges from 1/2000 (0.05%) by duplex ultrasound to 9/2250 (0.4%) by conventional angiography.^{4,5} We describe the first 2 cases of ICAT accurately defined by multidetector computed tomographic angiography (MD-CTA) imaging and correlated with intraoperative findings.

The first patient, a 59-year-old female, presented with a 2-week history of transient, recurrent episodes of left hemiparesis. Five years prior, she had radiation therapy to her neck for B-cell lymphoma. Magnetic resonance imaging (MRI) of her brain demonstrated multiple punctate ischemic infarcts in the right hemisphere. The second patient, a 68-year-old man, presented with acute left hemiparesis. Brain MRI showed a

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suba-cute stroke in the right middle cerebral artery distribution. Both patients had normal echocardiogram, electrocardiogram, and hypercoagulable studies. Carotid duplex ultrasound revealed significant right carotid artery stenosis (70%–99%) in both cases. In the first case, a MD-CTA confirmed a 70% carotid stenosis in the right internal carotid and revealed an associated 2-cm long pedicled thrombus (Figure 1A). The average computed tomographic number in the thrombus was 18 Hounsfield units (HU). In the second case, a MD-CTA showed a calcified plaque causing 80% stenosis of the proximal internal carotid artery and a 9-mm elongated thrombus attached to the plaque (Figure 2A). The average computed tomographic number in the thrombus was 73 HU. Both patients underwent urgent carotid thromboendarterectomy. In the first case, a 2-cm tan mobile thrombus attached to an ulcerated plaque at the carotid bulb was identified (Figure 1B), which on histology featured characteristics of organized thrombus consisting of platelets, fibrin, and neutrophils. In the second case, a dark red mobile thrombus measuring 1.1 cm attached to the distal end of the plaque was identified (Figure 2B). Histology showed fresh thrombus primarily consisting of erythrocytes attached to a ruptured plaque. Postoperatively, both patients had an uneventful recovery and almost complete resolution of neurologic symptoms at 3-month follow-up.

The choice of optimal diagnostic testing in symptomatic patients with suspected ICAT is challenging, and advanced imaging modalities may offer new possibilities. In both patients, the detailed information obtained by MD-CTA following detection of severe stenosis on duplex ultrasound allowed for accurate diagnosis and prompt surgical treatment that resulted in safe and complete removal of the ICAT. Tissue characterization and thrombus detection by noninvasive plaque imaging with MD-CTA is an important field of research.^{6,7} Thrombi rich in platelets, fibrin, and leukocytes are relatively resistant to thrombolysis and have CT numbers of $24 + 8$ HU, whereas thrombi rich in erythrocytes, which appear to be more susceptible to thrombolytic therapy, have computed tomographic numbers approximately $76 + 9$ HU.^{7,8} These reports correlate with the imaging and histology findings in both cases. Further research is needed to explore the full potential of MD-CTA in the imaging of complex vascular pathology.

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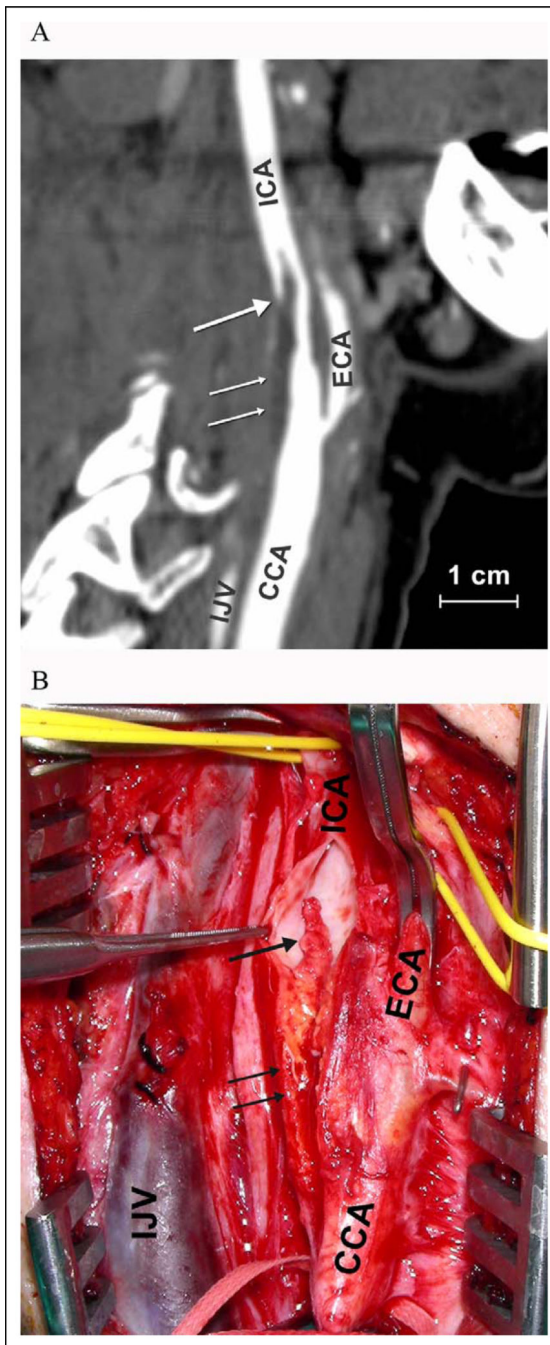


Figure 1.

A, Patient 1: MD-CTA, sagittal view of the right carotid bifurcation. A 2-cm long mobile thrombus (thick arrow) attached proximally to a mildly calcified plaque (thin arrows). B, Intraoperative findings after arteriotomy: a mobile thrombus (thick arrow) attached to an ulcerated plaque (thin arrows) at the carotid bulb was identified. CCA indicates common carotid artery; ECA = external carotid artery; ICA = internal carotid artery; IJV = internal jugular vein; MD-CTA = multidetector computed tomographic angiography.

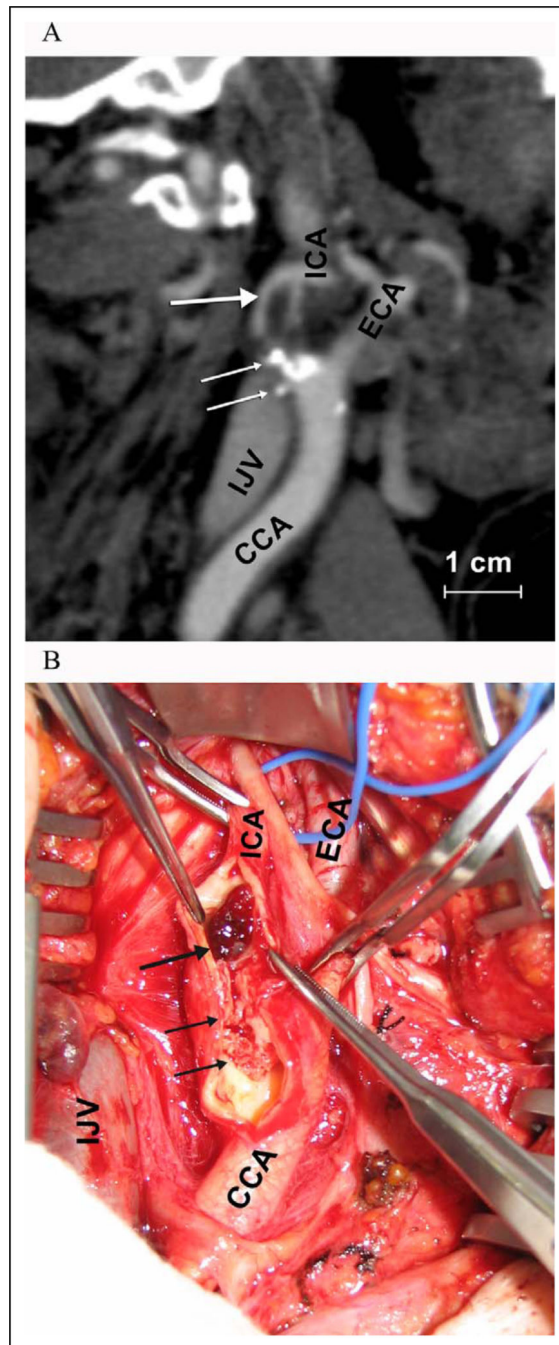


Figure 2.

A, Patient 2: MD-CTA, sagittal view of the right carotid bifurcation. A mobile lesion measuring 9 mm (thick arrow) proximally attached to a highly calcified plaque (thin arrows) was identified. B, Arteriotomy confirmed a mobile thrombus (thick arrow) attached to an ulcerated calcified plaque (thin arrows) at the carotid bulb. CCA indicates common carotid artery; ECA = external carotid artery; ICA, internal carotid artery; IJV = internal jugular vein; MD-CTA = multidetector computed tomographic angiography.