Calcific cerebral embolus from calcific carotid stenosis

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ABSTRACT. We experienced a case of calcific cerebral embolus originated from calcific stenosis of the left internal carotid artery. A 64-year-old female presented with the right arm mild hypesthesia and weakness. Computed tomogram (CT) of the head and magnetic resonance imaging (MRI) demonstrated a hemorrhagic infarction in contact with spotty calcification on the left parietal lobe surface. A carotid angiogram disclosed approximately 50% stenosis of the left internal carotid artery (ICA), and a three-dimensional CT (3DCT) angiogram with a multiplanar reconstruction (MPR) image revealed calcification at the stenosis. No other cause for the calcific embolus other than the calcific carotid stenosis could be found. Calcific cerebral emboli are uncommon, and a case originated from calcific carotid stenosis is extremely rare.

Key words : calcific cerebral embolus — calcific carotid stenosis — MPR image

Calcific systemic emboli may occur spontaneously or traumatically (secondary to heart catheterization or cardiac valve surgery). Calcific cerebral emboli are uncommon, and only 25 cases having been reported in the literature.[1-14] Most of these cases involved embolization from a cardiac source. There have been only two previous cases of calcific cerebral emboli originated from calcific carotid stenosis, which were reported by Yock.[4] We report an experience of a calcific cerebral embolus case originated from symptomatic calcific carotid stenosis, and review previous literature.

CASE REPORT

A 64-year-female was admitted to our insitution with a sudden onset of mild right arm hypesthesia and paresis of one month's duration. She had been treated for hypertension and hyperlipidemia at another hospital for 13 years. Her blood pressure and a blood biochemistry examination were within the normal range, and there were no abnormalities on her electrocardiogram and echocardiogram. No carotid bruits were present. Initial head CT revealed a left parietal lobe infarction adjacent to a calcific material measuring 211 Hounsfield units (HU : 1000 scale). This calcific material clearly made contact with the brain surface and could be seen within the left middle cerebral artery (MCA) branch (Fig 1a, b). MRI

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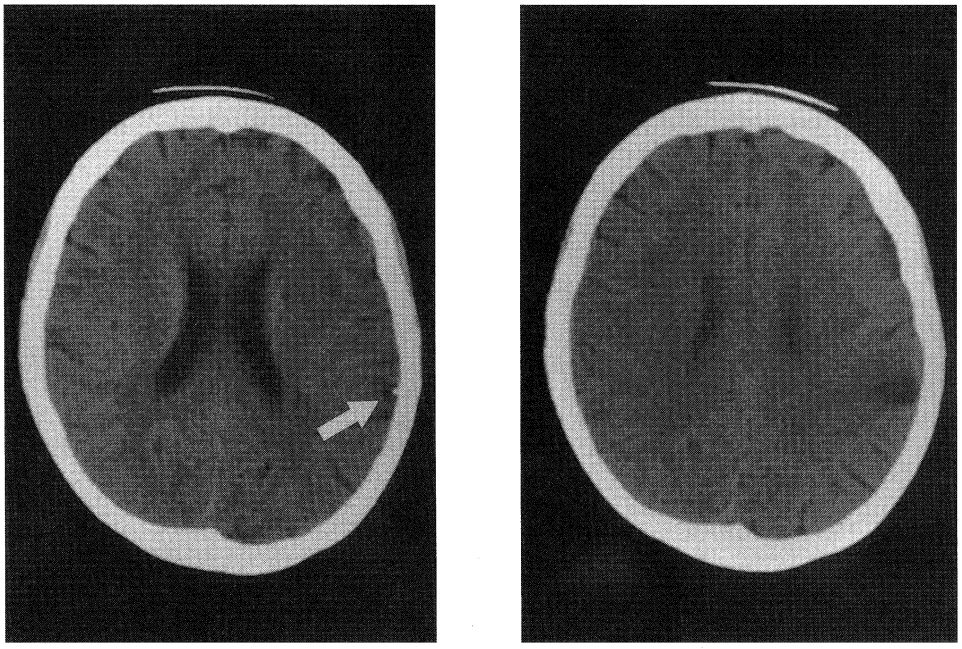


a b

Fig 1. A 64-year-old female presented with mild hypesthesia and weakness of the right arm.
a) CT shows a calcific density (arrow) that can be seen within a branch of the left middle cerebral artery.
b) An area of infarct making contact with the calcific density is present in the left parietal lobe.

showed a hemorrhagic change and slight enhancement with Gd-DTPA administration in this lesion, but there was no evidence of the embolic source, such as a tumor or arteriovenous malformation. A left common carotid angiogram revealed approximately 50% stenosis at the orifice of the left ICA, and similar stenosis was recognized even on a 3DCT angiogram. An MPR image, which was a two-dimensional projection of the 3DCT, demonstrated calcific plaque at the stenotic lesion (Fig 2a, b, c). We considered it to be a calcific cerebral embolus from ipsilateral calcific carotid stenosis, and performed a left carotid endarterectomy. Plaque ulceration was recognized. A soft X-ray image of the resected plaque showed calcification (Fig 3a, b), as noted on the MPR image. Atherosclerosis and calcification were remarkable on pathological specimen. After the operation, she improved significantly and was discharged two weeks later with no symptoms.

DISCUSSION

Cerebral emboli are found occasionally and are common results of carotid plaque or cardiac atrial fibrillation. Other causes leading to such complication may be heart catheterization or therapeutic procedures. Calcific emboli, however, are uncommon, and calcific cerebral emboli are

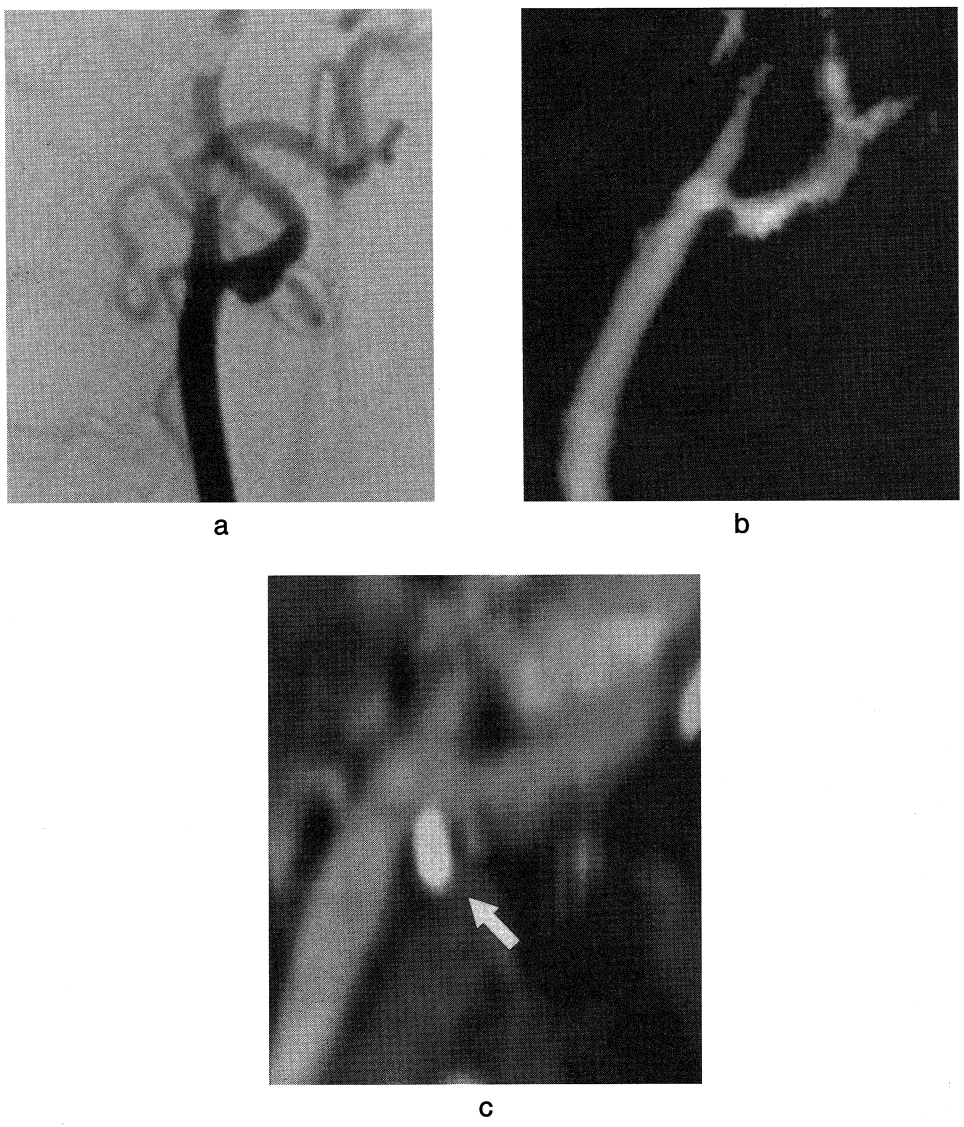
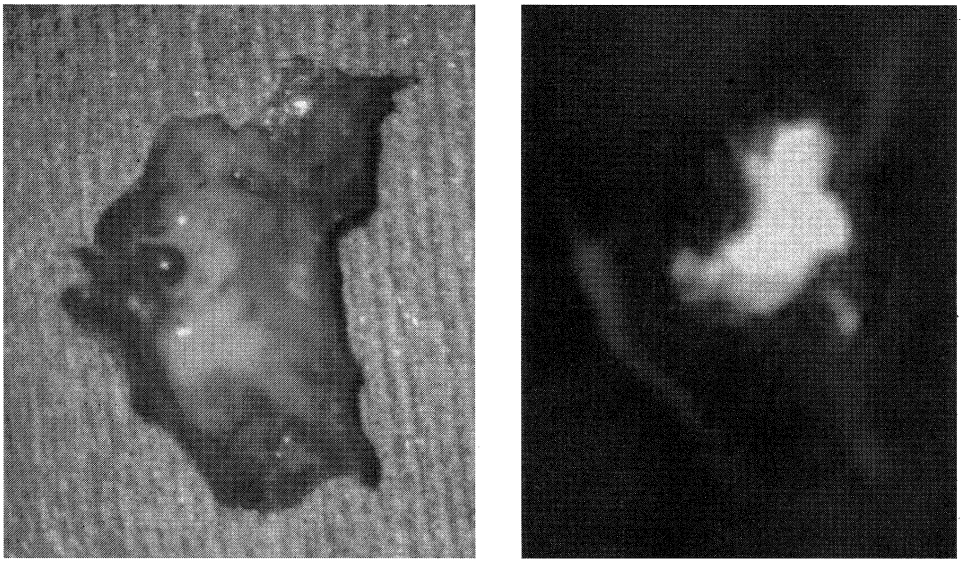


Fig 2. Images of the left carotid stenosis.
a) Left common carotid angiogram shows approximately 50% stenosis at the orifice of the internal carotid artery.
b) Three-dimensional CT angiogram shows the same stenosis.
c) Multiplanar reconstruction image demonstrates the calcification (arrow) at the stenosis.

extremely rare.

We found 15 published reports (26 cases) of calcific cerebral emboli (Table 1),[1-14] including our case. In 14 cases, the emboli were recognized on CT. In 11 cases, they were detected at autopsy. In one case, MRI showed a cerebral infarction, but it was merely surmised that there were cerebral emboli from evidence of calcific emboli in the spleen and myocardium.[14] The locations of the emboli were confirmed to be as



a b

Fig 3. The patient underwent a left carotid endarterectomy.
a) Gross specimen of the resected plaque.
b) Soft X-ray image of the resected plaque shows calcification similar to that in the multiplanar reconstruction image of the three-dimensional CT angiogram.

TABLE 1. Reported cases of calcific cerebral emboli

Ref. No.	No. of patients	Detection	Embolized locations (No.)	Source of emboli	Onset
1 (1963)	1	autopsy	MCA(1)	H	spontaneous
2 (1965)	1	autopsy	uncertain	H	catheterization
3 (1976)	1	autopsy	small vessels	H	spontaneous
4 (1981)	4	CT	ACA(2), MCA(4)	H (2 cases), C (2 cases)	spontaneous
5 (1986)	1	CT	MCA(1), PCA(1)	H	catheterization
6 (1987)	8	autopsy	uncertain	H	uncertain
7 (1989)	1	CT	MCA(1)	H	spontaneous
8 (1993)	2	CT	MCA(2)	H	spontaneous
9 (1993)	1	CT	ICA(1), MCA(1)	H	spontaneous
10 (1994)	1	CT	MCA(1)	H	catheterization
11 (1997)	1	CT and MRI	MCA(1)	H	spontaneous
12 (1998)	1	CT	MCA(1)	H	spontaneous
13 (2000)	1	CT and 3DCTA	MCA(1)	H	spontaneous
14 (2002)	1	MRI and autopsy	uncertain	H	spontaneous
Present case	1	CT	MCA(1)	C	spontaneous

CT, computed tomogram ; MRI, magnetic resonance image ;
3DCTA, 3 dimensional CT angiogram ; H, heart ; C, carotid artery

follows ; 15 regions in the MCA, two regions in the anterior cerebral artery (ACA), one region in the ICA, and one region in the posterior cerebral artery (PCA). Eighteen of these regions were in the anterior circulation,

and were considered to be associated with hemodynamics. Most of the occurrences in the MCA may have been related to development of the ACA A1 segment and the posterior communicating artery. Our case presented less dominancy of the left A1 segment and the adult type of posterior communicating artery on a cerebral angiogram.

The embolic source was cardiac valvular disease (calcification of the mitral and/or aortic valve) in 23 of the 26 cases. Two cases of calcific carotid stenosis that may have led to calcific cerebral emboli were reported by Yock.[4] However, there was uncertainty about the presence of calcific carotid stenosis in one case. And the other one was identified as carotid calcification by neck plain X-ray alone. It was considered that there was insufficient proof of the carotid source. In our case, however, there was no evidence of the embolic source except for calcific carotid stenosis. In addition, the presence of calcific plaque was obvious on a soft X-ray image and by pathological examination.

Emboli have also been seen on CT as focal high density images simply due to dense fibrin, platelets or a thrombus without associated calcification.[4] Our case could be distinguished from such coagulation, because the Hounsfield unit of the embolus on the head CT was 211. We believe this is the first report of a calcific cerebral embolus from carotid calcification with confirmation in detail.

Calcification of carotid stenosis has been detected in 81.7% of the cases by plain X-ray images,[15] in 97.5% by plain CT,[16] and in 53.1% by 3DCT angiograms with an MPR image.[17] The detection rate of calcification on 3DCT angiograms with an MPR image is low in comparison with those for other examinations, because it is hard to discriminate small calcifications from contrast media. However, calcification of carotid stenosis is frequently recognized. In our case, the calcification was not detected on a nedk plain X-ray image, but calcific carotid stenosis was confirmed by the MPR image of a 3DCT angiogram. Detection of carotid stenosis by a 3DCT angiogram is difficult when there is strong calcification. The MPR image, which disinguishes calcification from contrast media, makes the relation clear between stenosis and calcification. The use of this method may improve the assessment of calcific carotid stenosis. For the accurate evaluation of calcific carotid stenosis, 3DCT angiograms with an MPR image are useful.

Calcific emboli originated from cardiac source, such as a calcific aortic stenosis which is a common valvular problem in the elderly,[7] are found occasionally. And it had been reported that a postmortem pathological study showed calcific systemic emboli in one-third of them.[1] However, it is usually not symptomatic.[1] Calcific emboli seem to be quite small and are considered to be subclinically silent.

A number of studies have described that asymptomatic emboli occur frequently in an ipsilateral cerebral artery with carotid stenosis.[18-20] These studies have suggested that asymptomatic emboli are clinically important and that they increase stroke risk. Calcification of carotid stenosis is recognized frequently and it may be the cause of calcific cerebral emboli. Regarding the risk of emboli from carotid stenosis, Hutchinson *et al*,[21] in a study using a transcranial doppler, reported that spontaneous cerebral emboli ensued in 52% of symptomatic cases. The presence of spontaneous cerebral emboli

may be predictive of a greater risk of future stroke.[21] In 15 of the 26 reported cases, calcific cerebral emboli were observed to have occurred spontaneously (Table 1).

Although calcific cerebral emboli originated from calcific carotid stenosis are extremely rare, detection of calcific carotid stenosis is necessary when head CT reveals calcific material in branches of the cerebral artery.

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