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ADVANCED

CASE REPORT: CLINICAL CASE

Masson Tumor in the Left Atrial Appendage Presenting as Cardioembolic Cerebral Infarction

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ABSTRACT

A 70-year-old woman presented with aphasia caused by acute infarction in the left middle cerebral artery. Cardiac investigation revealed progressively increasing mobile mass in the left atrial appendage over 2 months (from 9 to 15 mm). Decision was made to proceed with mass resection, and pathological evaluation confirmed Masson tumor. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2020;2:1969–73) © 2020 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 70-year-old right-handed woman presented to our emergency department with acute aphasia that started a few hours before presentation. On examination, she had global aphasia and right hemiplegia. Her vital signs were normal, and she was in sinus rhythm. Cardiac auscultation revealed normal heart sounds and no cardiac murmurs/rubs. She did not have fever, weight loss, myalgias, or arthralgias.

PAST MEDICAL HISTORY

The past medical history included essential hypertension managed on metoprolol 25 mg twice daily, type 2 diabetes mellitus on metformin 500 mg twice daily, prior transient ischemic attack without any residual neurological deficits on clopidogrel 75 mg, and hyperlipidemia on simvastatin 5 mg daily. She had breast cancer in 1996 and underwent a right mastectomy with reconstruction followed by radiation therapy and remained in complete remission on anastrozole.

LEARNING OBJECTIVES

- To understand the importance of echocardiographic imaging in the work-up of cardiogenic stroke in the older adult population.
- To comprehend the pathophysiology of left atrial appendage masses.
- To recognize the pathogenesis of intravascular papillary endothelial hyperplasia.
- To understand that Masson tumor is curative but residual tumor can recur after resection; therefore, careful follow-up with echocardiography should be paramount.

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ABBREVIATIONS AND ACRONYMS

AF = atrial fibrillation

IPEH = intravascular papillary endothelial hyperplasia

LA = left atrium

LAA = left atrial appendage

TEE = transesophageal echocardiogram

DIFFERENTIAL DIAGNOSIS

Because of the acute nature of her symptoms, an acute cerebrovascular accident secondary to hypertension, type 2 diabetes mellitus, or cardiogenic causes due to paroxysmal atrial fibrillation (AF) or patent foramen ovale with deep venous thrombosis, vegetations caused by infectious endocarditis, or tumors were considered.

INVESTIGATIONS

Immediate head computed tomography without intravenous contrast revealed patchy acute infarcts in anterior part of left middle cerebral artery territory with hemorrhagic transformation in lateral left parietal cortex, which was stable on repeat imaging (**Figure 1**). Brain MR angiography revealed normal carotid arteries and normal intracranial circulation.

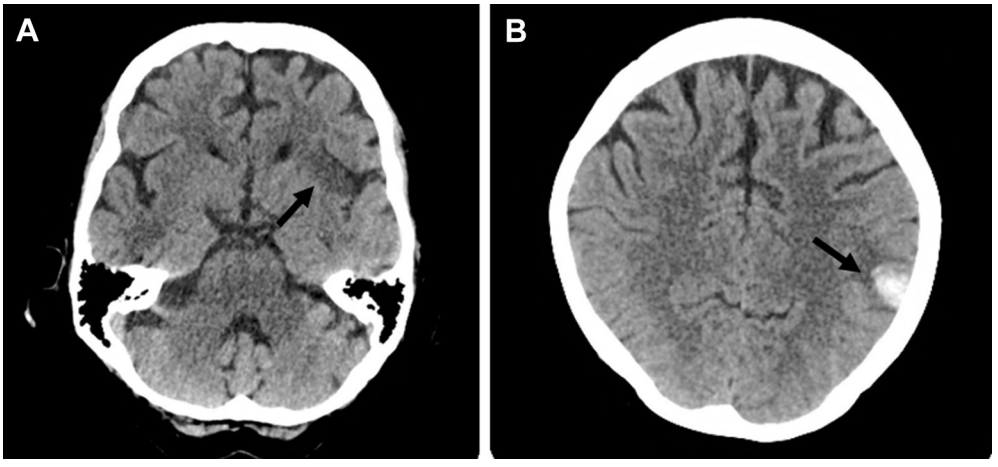
She was monitored on telemetry without documented episodes of any arrhythmias during the hospitalization for 5 days and 14 days in inpatient rehabilitation. She underwent transthoracic and transesophageal echocardiograms (TEE) that showed normal valvular function, preserved left ventricular ejection fraction with diastolic dysfunction, and a negative bubble study. However, a mobile mass with a stalk was seen in the left atrial appendage (LAA) (**Figure 2A**).

MANAGEMENT

With a provisional diagnosis of a LAA thrombus, she was anticoagulated with heparin and then switched to apixaban on discharge. A follow-up TEE 2 months later showed an interval increase in the size of the mass to 15 mm (**Figure 2B**, Video 1). Given the increase in mass size, a decision was made to proceed with mass resection during cardiopulmonary bypass surgery. Intraoperatively, the mass was noted to be in the LAA, pedunculated, ovoid, and matched the description noted in the TEE.

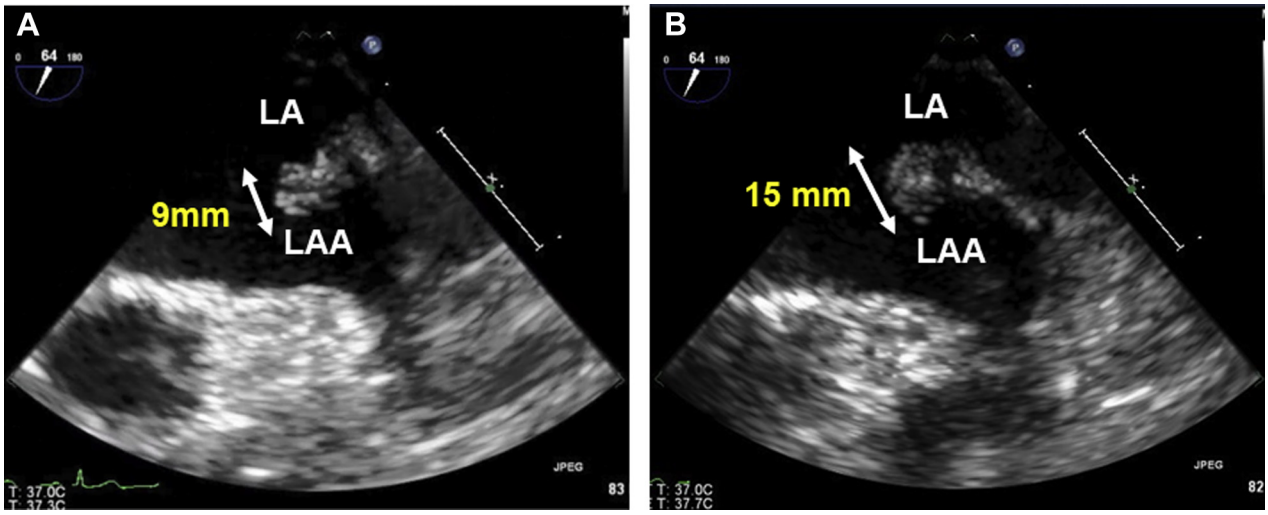
Pathological evaluation showed that the lesion was composed of multiple papillae lined by bland endothelial cells suggestive of papillary endothelial hyperplasia on hematoxylin and eosin stain (**Figure 3**). Careful histopathological evaluation was performed to distinguish Masson tumor from angiosarcomas and other common masses including papillary fibroelastoma. The tumor was positive for CD31, CD34, factor VIII-related antigen, and smooth muscle actin, which is commonly seen in Masson tumors (**Figure 4**), and CD105 negative, which excluded angiosarcomas. Moreover, the mass did not show any pleomorphism, increased mitotic activity, or necrosis. Papillary fibroelastomas are very similar to Masson tumors but have distinctive clusters of yellow-white hair like projections. They can be CD31 and CD34 positive; however, are typically smooth muscle actin negative.

FIGURE 1 Computed Tomography of the Head Without Contrast Showing Acute Infarct



Computed tomography without intravenous contrast revealed patchy acute infarcts in anterior part of left middle cerebral artery territory **(A, arrow)** and hemorrhagic transformation in lateral left parietal cortex **(B, arrow)**.

FIGURE 2 Transesophageal Echocardiography Revealed a Mobile Mass in the Left Atrial Appendage



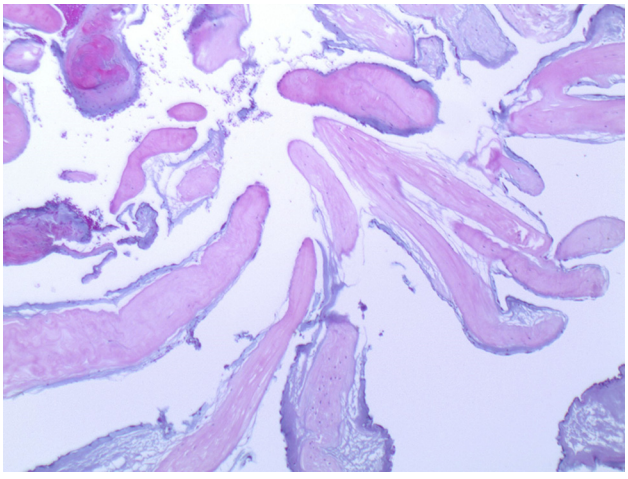
Transesophageal echocardiography showing a mobile (9 mm) mass in the LAA **(A)** and follow-up transesophageal echocardiography 2 months later showing a mobile mass (15 mm) with stalk formation in the LAA **(B)**. LA = left atrium; LAA = left atrial appendage.

DISCUSSION

Masson tumor was first described in 1923 by the French pathologist Pierre Masson and later termed intravascular papillary endothelial hyperplasia (IPEH) (1). In 1983, Hashimoto et al. (2) described 3 forms of Masson tumor: 1) a primary form arising in a dilated vascular space; 2) a secondary or mixed mass arising from a pre-existing vascular lesion; and 3) an extravascular mass that appears within hematomas. IPEH is a rare vascular growth that may occur in any location in the body, with a predilection for the skin of the head, neck, fingers, and trunk (3). To the best of our knowledge, this is one of the very few case reports of Masson tumor located in the LAA. Therefore, it is extremely rare for it to be located in the LAA (4).

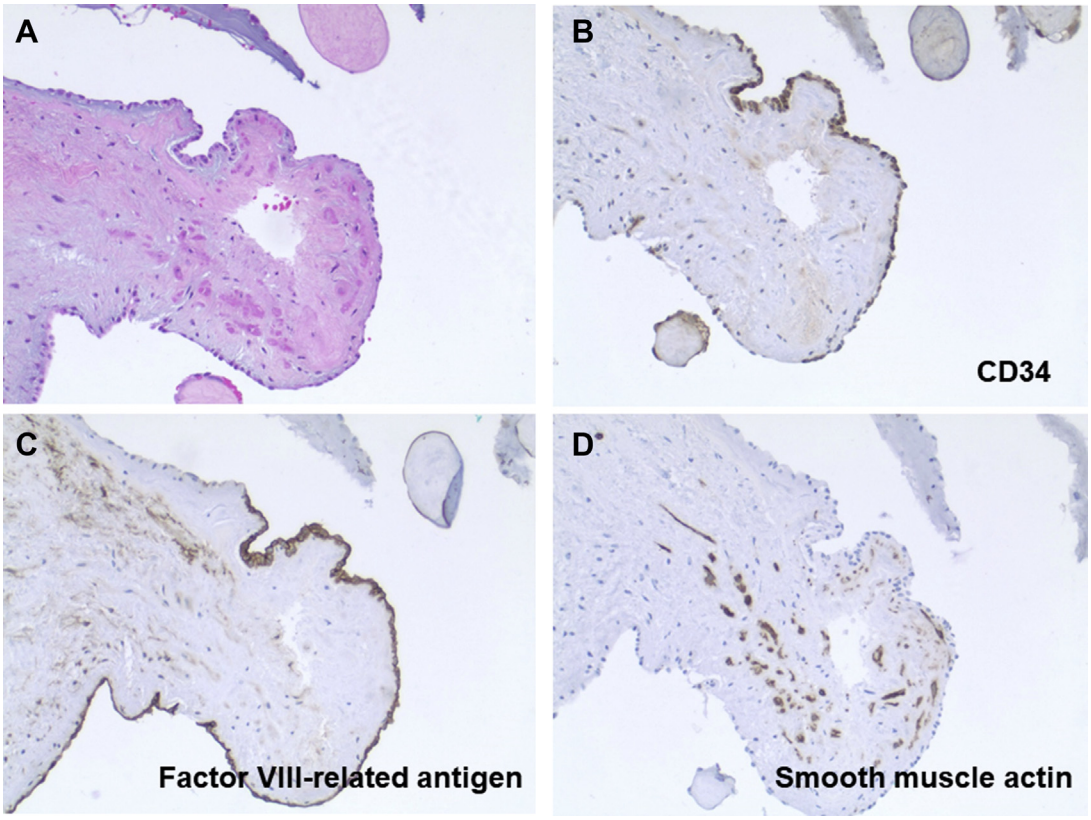
Although Masson tumors rarely occur in the LAA, it is very logical for endothelial lesions to occur in this location, because the LAA is the only cardiac structure in the left atrium (LA) derived from the primitive atrium (5). Thus, the LAA has a more trabecular lining, whereas the rest of the LA cavity has a smooth endocardium. The LAA functions as a contractile reservoir and decompression chamber as it undergoes suction during ventricular systole and acts like a vessel during diastole (6). It has been postulated that cardiomyopathy or AF leading to decreased function, increased filling pressures, and remodeling of the LAA are major risk factors for blood stasis and thrombi formation (7). However, limited data suggests that patients with isolated elevated end-diastolic pressures without LA or LAA enlargement, can lead to LAA thrombus formation in the absence of AF (8). In our patient's case, she did not have any history of AF, left ventricular dysfunction, or LA enlargement, which makes this case of Masson tumor much more difficult to explain. Risk factors for Masson tumor are still unknown; they can occur

FIGURE 3 Pathology of Left Atrial Appendage Mass



Multiple papillae lined by bland endothelial cells suggestive of papillary endothelial hyperplasia on hematoxylin and eosin stain. Original magnification × 100.

FIGURE 4 Immunohistochemistry Stains of Left Atrial Appendage Mass



Papillary cores of hyaline tissue (original magnification ×400) with hematoxylin and eosin stain **(A)**, CD34 **(B)**, factor VIII-related antigen **(C)**, and smooth muscle actin **(D)** stains.

sporadically, or in situations of vascular stasis. Therefore, we can speculate that Masson tumor may have formed in an organized thrombus during undetected episodes of paroxysmal AF.

The pathogenesis of IPEH is still unclear. Inflammation and vascular stasis related to thrombus formation, typically within a vein or artery, stimulate histiocytic release of endothelial basic fibroblast growth factor and support the formation of endothelial hyperplasia (9). In contrast to thrombi, Masson tumors can develop in patients on anticoagulation therapy. In our patient's case, the differentiation of IPEH from other vascular malignant tumors, such as angiosarcoma, was essential, especially in light of its apparent growth over a short period of time. Masson tumors are cured by surgical excision, whereas angiosarcoma, for example, is a malignant tumor that is capable of metastasis and may require surgery with adjuvant chemotherapy. Several criteria are important in differentiating IPEH from malignant angiosarcoma including intraluminal lesion origin, minimal necrosis, similarity to organized thrombus, and lack of pleomorphic and mitotic activity in cells, such as in our patient (10). In addition, Masson tumor is typically positive for CD31, CD34, smooth muscle actin, and factor VIII-related antigen (10).

Because the LA appendage is structurally complex and varies morphologically among individuals, it can be challenging to diagnose LAA pathology using imaging (5). Three-dimensional echocardiography with Doppler and contrast agents enable analysis of the vascular patterns of cardiac tumors: malignant tumors exhibit higher vascularity than benign tumors, whereas thrombi are avascular. TEE is currently used as the gold standard modality to diagnose and exclude LAA masses. It has a sensitivity of 92% in comparison to intraoperative observation, which is

98% sensitive with positive and negative predictive values of 100% and 86%, respectively (11).

FOLLOW-UP

The patient tolerated the surgical procedure well and was discharged 7 days after cardiac surgery on long-term apixaban. On her 3-month follow-up, her TEE did not show mass recurrence.

CONCLUSIONS

This case highlights a rare case of Masson tumor, and the importance of performing multimodality imaging for appropriate diagnosis and treatment. LAA is a common site for thrombi because of its complex anatomic, histological, and functional characteristics. Blood stasis is one of the hallmark reasons for increased thrombi formation, which can result in endothelial hyperplasia or IPEH. Histological examination provides the mainstay in achieving a definitive diagnosis. Complete resection of Masson tumor is curative but tumor can recur. Therefore, careful follow-up with echocardiography in the process of investigating the etiology for cardiogenic cerebral infarction is paramount.

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AUTHOR RELATIONSHIP WITH INDUSTRY

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KEY WORDS cardio-oncology, cardioembolic disease, echocardiography, left atrial appendage, Masson tumor, multimodality imaging, stroke, vascular stasis

APPENDIX For supplemental videos, please see the online version of this paper.