“Metastatic” embolic lesions and enlarging pseudoaneurysms associated with cardiac myxoma

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Myxoma is the most common primary cardiac tumor, with a reported incidence of 0.5 cases per million people. The initial triad of symptoms includes obstructive cardiac signs present in 60%, constitutional systemic symptoms in 30%, and embolic manifestations in 30%–40% of the cases. The left atrium is the most common location of these tumors. There is high prevalence of systemic embolism, with cerebral involvement accounting for half of the cases.¹

Neurologic complications of cardiac myxoma include cerebral infarction, intraparenchymal and subarachnoid hemorrhage related to pseudoaneurysms, and invasive “metastatic” masses. Cerebral embolism is at the root of these complications.¹ Few cases demonstrating all of these complications in the same patient have been reported (table).^{2–5}

Case report

A 59-year-old man presented with a transient episode of left hemiparesis. MRI of the brain showed multiple bilateral supra- and infratentorial infarctions predominantly located in the gray-white matter interphase (figure, A). An echocardiogram revealed a 3.5-cm mobile mass in the left atrium. Pathology of the uneventful surgical resection disclosed a benign myxoma.

Twelve months later he presented with new-onset partial somatosensory seizures. Neuroimaging showed progression of the lesions, which now were nodular and hyperdense and thought to be hemorrhagic transformation (figure, C). A cerebral digital subtraction

Practical Implications

Cardiac myxoma-related cerebral embolism should be considered in the differential diagnosis of multiple embolic brain lesions.

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Table Reported cases of coexisting intracranial “metastatic” lesions and aneurysm formation associated with cardiac myxoma

Reference number	Age at presentation, y	Sex	Interval to neurologic manifestations onset	Other sites of recurrence	Treatment	Outcome
Our case	59	Male	13 months	Left ventricle	Surgical resection of the cardiac lesion and conservative for the intracranial lesions	Progression of the intracranial lesions, neurologically stable
2	41	Female	Progressive	Bone (pelvis and femur)	Surgical resection of the intracranial lesions	Stable lesions after surgical resection of the intracranial tumor
3	18	Male	4 months	No	Resection of a hemorrhagic aneurysm and an intraparenchymal mass; follow-up of the unruptured aneurysms with CT	Not described
4	45	Male	17 months	No	Surgical resection of 2 intraparenchymal lesions	No recurrence of the resected tumors and stabilization of the remaining lesions; minor neurologic deficit
5	45	Female	36 months	No	Conservative (not specified)	Progression of one of the intracranial parenchymal lesions, neurologic improvement

angiogram (DSA) depicted multiple distal pseudoaneurysms involving bilateral cortical branches of the anterior, middle, and posterior cerebral arteries (figure, F and G, left).

A follow-up echocardiogram at 16 months demonstrated a new 1-cm mass in the left ventricle. The patient underwent a second surgical resection and recurrent benign myxoma was confirmed.

Follow-up neuroimaging studies 36 months after the initial presentation showed persistent hyperdense lesions in the gray-white matter interphase with interval progression, vasogenic edema, and development of “metastatic” masses (figure, E). A repeat DSA demonstrated enlargement of the previously seen pseudoaneurysms and newly developed ones (figure, F and G, right). Follow-up echocardiogram was unremarkable.

Forty-one months later the patient was neurologically stable with occasional headaches. Conservative management of the intracranial lesions was elected based on the patient’s clinical stability despite the neuroimaging evidence of progression.

DISCUSSION

Neurologic complications of cardiac myxoma likely represent a continuum of the same pathologic process. The risk of cerebral embolization has been associated with the morphology of the tumor (pedunculated, mobile, and villous) and the activation of acute phase reactants. The production of interleukin-6 (IL-6) can induce overexpression of proteolytic enzymes such as matrix metalloproteinases, which have been linked with extracellular matrix remodeling,

Figure Imaging

(A) Diffusion-weighted imaging from 2010 shows supra- and infratentorial embolic lesions. (B-E) Corresponding images from axial CT of the head and brain and MRI (fluid-attenuated inversion recovery and T1 postgadolinium) (2010-2013). Corresponding images from cerebral digital subtraction angiography (2012-2013) in the anteroposterior views, anterior (F) and posterior (G) circulations, obtained over 4 consecutive years demonstrate multiple hemoragmic lesions and pseudoaneurysms with interval progression in size and number over time.

prompting tumor tissue embolization. Definitive evidence has not been demonstrated; indeed, elevations in IL-6 may be associative rather than causative.⁶

The embolized myxoma cells remain viable and invade the elastic lamina of the vessel wall, progressively destroying and weakening the arterial wall, leading to pseudoaneurysm formation.^{1,2} Pseudoaneurysms do not include all 3 layers of the vessel wall, explaining higher friability, instability, and propensity for growth and rupture.³ Further transgression of myxoma cells through the vessel wall may lead to chronic recurrent bleeding and/or formation of the "metastatic" masses that are typically situated in the areas of prior embolism.¹

"Metastatic" masses may persist after surgical resection of the primary cardiac myxoma. Notably, patients may present with neurologic symptoms even years after the cardiac myxoma resection. As in our case, the cerebral lesions continued to progress, suggesting behavior

independent from the original cardiac myxoma. Persistent lesions following myxoma resection have at times been attributed to intraoperative tissue manipulation with embolism or malignant transformation.⁴

On MRI there are multiple foci of heterogeneous T1 and T2 signal intensity with blooming artifact on gradient-recalled echo, T2*-weighted, and susceptibility-weighted imaging sequences. These features may be explained by the accumulation of degradation products due to chronic recurrent hemorrhage and/or the proteinaceous myxoid matrix produced by the tumor. These lesions enhance intensely because of the slow flow within the pseudoaneurysms and loss of blood-brain barrier, likely due to local inflammation.⁷

There is no consensus on the management of intracranial lesions due to the relative rarity of cases. Treatment options based on case reports include chemotherapy, radiotherapy, and combined therapies, with mixed results.⁷ Surgical removal of parenchymal lesions is suggested in cases of an isolated lesion with easy surgical access, symptomatic intracranial bleeding or mass effect, or when no clear diagnosis is available.^{3,4,7} Due to the number of lesions and their friable nature, microsurgical clipping of pseudoaneurysms is of unclear benefit and not without risks.^{3,7} In case of pseudoaneurysm rupture, surgical evacuation of the hematoma with clip ligation of the lesions has been described.³

Our case illustrates a rare and long-standing neurologic complication from a cardiac myxoma. After the presenting cerebral ischemic events and following surgical resection of the cardiac tumor, pseudoaneurysms and “metastatic” masses developed and continued to progress over months despite minimal clinical compromise. Given the rarity of these complications, the management of these lesions poses an unsolved dilemma. We opted to continue with conservative management given his stable neurologic status.

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