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METASTATIC MELANOMA TO THE INTRACAVITARY LEFT VENTRICLE TREATED USING CARDIAC AUTOTRANSPLANTATION TECHNIQUE FOR RESECTION

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Abstract

Melanoma has a known propensity for cardiac metastasis. Most cases are associated with widespread metastatic disease and multiple sites of cardiac involvement and are not appropriate for surgical resection. When there is an isolated metastasis to the heart, the melanoma tends to involve the right heart. Rarely does melanoma metastasize only to the left ventricle. We present an unusual case of isolated metastasis of melanoma to the intracavitary left ventricle. This tumor was poorly responsive to chemotherapy, and a cardiac autotransplantation technique was used to achieve complete resection with pathologically negative margins.

Introduction

Metastasis from malignant melanoma is common, with up to 30% of patients developing metastatic disease.¹ When present, metastatic disease will involve cardiac structures up to 50% of the time.^{2,3} Most cardiac metastases from melanoma do not cause symptoms or evidence of cardiac dysfunction, leading to only 5% of cases being diagnosed antemortum.³⁻⁵ Cardiac metastatic melanoma usually presents with multiple small sites involving large areas of the heart, but the extent of involvement is poorly correlated with symptoms or cardiac dysfunction.⁴ Cardiac involvement with metastatic melanoma is almost always associated with widespread systemic disease.⁶

Systemic disease and lack of symptoms make the need for surgical resection of cardiac metastasis unusual but still necessary in selected cases. Intracavitary cardiac involvement with metastatic melanoma requiring surgical resection generally involves the right atrium.^{3,4,7-13} Surgical resection of right ventricular metastatic melanoma has been reported infrequently,¹⁴ and attempts at surgical resection of metastatic left ventricular melanoma have been rare. Rosario et al. reported an attempted surgical excision of melanoma metastatic to the left ventricle using left ventriculotomy, which was unsuccessful due to massive hemorrhage.¹⁵ Left ventricular metastatic melanoma presenting with ventricular tachycardia and resected via left ventriculotomy has been reported, but the patient required a left ventricular assist device and expired shortly after surgery.¹⁶ There is only one previous case of successful resection of intracavitary left ventricular metastatic melanoma that could be identified from the literature; this case used a left ventriculotomy for tumor exposure and resection.¹⁷ We present an unusual case of isolated intracavitary left ventricular metastatic melanoma unresponsive to chemotherapy and successfully resected with pathologically negative margins using the cardiac autotransplant technique to avoid left ventriculotomy through normal muscle.

Case report

A 61-year-old man presented in March 2006 with a supraclavicular melanoma. He underwent resection and sentinel lymph node biopsy, which showed a 3.5-mm thick melanoma with microscopic

metastatic disease in 1 of 3 sentinel lymph nodes. Subsequent axillary and posterior neck lymphadenectomy yielded 25 nodes, all of which were negative for metastatic disease. He received adjuvant interferon from June 2006 to June 2007. A PET scan in August 2007 showed a new 10-mm left upper-lobe nodule that was resected and proved to be metastatic melanoma with negative margins. He received systemic therapy with Temodar and thalidomide from February 2008 to February 2009, although he stopped the thalidomide early due to toxicity that resulted in neuropathy. In January 2010 during a surveillance chest CT scan, he was found to have a 2.5-cm intracavitary left ventricular mass suspicious for metastatic disease without evidence of metastatic disease at any other site (Figure 1). He received systemic biochemotherapy with cisplatin, velban, and temozolomide followed in a sequential manner with interferon and interleukin-2, completing 4 courses in April 2010 without significant tumor response. His case was discussed in the melanoma tumor board of The University of Texas MD Anderson Cancer Center, where he was receiving his care. Due to increasing toxicity of his systemic regimen, further biochemotherapy was not considered appropriate. Consideration

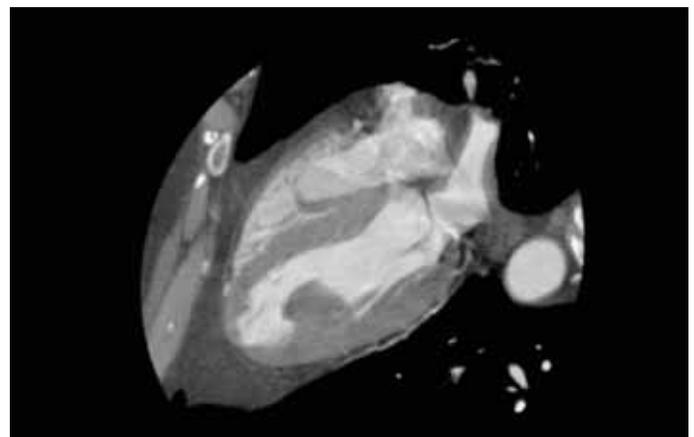


Figure 1. Cardiac CTA showing intracavitary left ventricular mass.

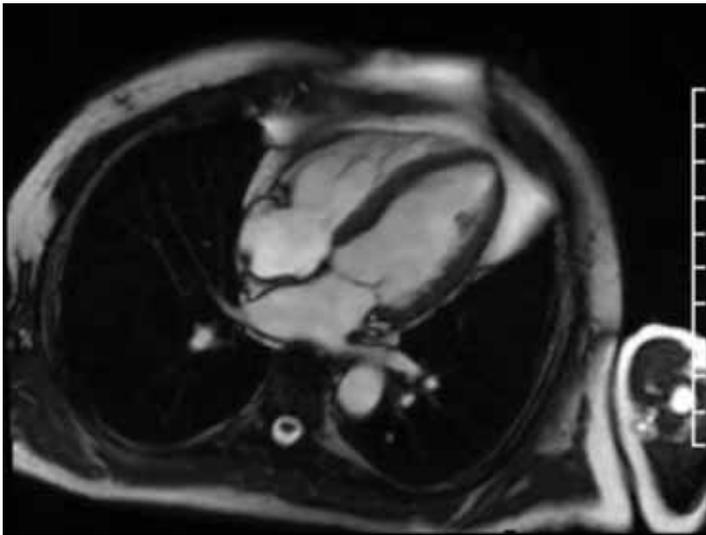


Figure 2. Cardiac MRI showing intracavitary left ventricular mass.

of surgical resection was recommended, and the patient was referred to the Methodist DeBakey Heart & Vascular Center.

After discussion at The Methodist Hospital thoracic tumor board, surgical resection was deemed appropriate considering this apparent isolated metastatic site and the toxicity of his current medical regimen. Cardiac MRI was obtained and revealed an isolated mass deep within the left ventricular cavity (Figure 2). The mass was 1.4 cm x 1.2 cm and attached to the inferolateral wall of the left ventricle. The mass was isodense on both T1 and T2, with hypoperfusion in first-pass imaging and moderate delay in contrast enhancement. These features were consistent with metastatic melanoma but both myxoma and fibroelastoma remained in the differential. Coronary arteriography was normal.

The patient underwent surgery in July 2010. Cardiopulmonary bypass was established with distal ascending aortic arterial cannulation and venous cannulation directly into the superior vena cava (SVC) and inferior vena cava (IVC) at the right atrial junction. Cardiac standstill was achieved with aortic cross clamp and 10 cc/kg of cold antegrade blood cardioplegia. The interatrial groove was widely opened and the interior of the left ventricle examined through the mitral valve orifice, but adequate tumor visualization could not be achieved. The SVC was then completely transected to allow greater left atrial mobilization and left ventricular visualization, but this was still inadequate for complete tumor resection. The IVC/right atrial junction was then divided as was the ascending aorta just beyond the sinotubular ridge and the pulmonary artery just proximal to the bifurcation. The left atrium was then transected just anterior to the pulmonary veins, and the heart was removed from the chest and placed in a bucket of ice slush. Ex vivo examination of the left ventricular cavity via the mitral valve orifice allowed complete visualization and easy surgical access to the entire left ventricular cavity. The intraventricular tumor could be well visualized and was resected without problem with a rim of normal myocardium. Frozen section and eventual permanent section showed the tumor to be melanoma and the margins to be free of microscopic disease. Tumor resection involved some of the base of the posteromedial papillary muscle, and this was repaired with pledgetted 4-0 polypropylene suture. The heart was then sutured back into orthotopic position, 200 cc of warm blood cardioplegia was given, and the cross clamp was removed. Spontaneous cardiac activity resumed, and the patient was weaned from cardiopulmonary bypass without difficulty. His postoperative

course was uneventful. Current imaging shows no evidence of intracardiac disease. Metastatic workup is negative at this time and the patient remains well without any limitations. (To access a video of the surgery online, visit www.debakeyheartcenter.com/journal/video.)

Discussion

The first case report of melanoma in the English literature was by Dr. William Norris in 1820 and included a description of the melanotic heart.¹⁸ Melanoma continues to have the highest rate of cardiac metastasis of any tumor.^{2,4,19} Most of these cases of cardiac metastasis do not cause symptoms of cardiac dysfunction and are not diagnosed antemortum.^{4,20,21} The increasing use of noninvasive imaging in cancer follow up, however, has caused an increase in the number of cases of cardiac melanoma diagnosed in living patients. Most of these are multiple small tumors without symptoms, and most are associated with significant other systemic disease in which surgery is inappropriate. As seen in our patient, medical management can be toxic and the tumor nonresponsive. Surgical therapy can be considered in patients with embolic events, congestive heart failure based on obstruction of intracardiac flow, or mobile masses likely to embolize. Surgery is also a reasonable option for the rare patient with isolated cardiac disease that is anatomically completely resectable. Patients in poor condition with Karnofsky scores below 80% are unlikely to do well.¹⁰

For patients considered for surgery, the anatomic site and extent of the tumor will dictate the possible approaches. Complete resection except in extreme palliative cases should be the goal, as incomplete resection has been associated with a 12.5% early and 100% late mortality.²² In most cases, surgical resection of metastatic melanoma to the heart has involved the right atrium.^{3,4,7-13} Pioneering work in complex cardiac tumors has been done by Dr. O.H. Frazier, who has described complex resection in 2 right ventricular melanoma cases.¹⁴ Metastatic melanoma likely favors the right heart due to the fact that it may spread hematogenously, whereas in order to get to the left side of the heart, the melanoma needs to bypass both the capillary beds in the liver and the lung. Patients who have metastatic melanoma to the left side of the heart commonly have metastatic disease in the rest of the body and usually succumb to the disease.

As described earlier, there are few reports of patients with left ventricular metastatic melanoma undergoing surgical resection. Excluding our case, there are 3 reported in the literature, and only 1 patient survived operative resection. This patient had an intracavitary metastatic melanoma that was treated with a left ventriculotomy through normal muscle for successful tumor excision and closure of the ventriculotomy with a Dacron patch. Other cases of left ventricular melanoma resection were unsuccessful.¹⁷ One patient underwent left ventriculotomy, resection, and primary closure but died after the operation due to hemorrhage.¹⁵ Another patient had primary resection and reconstruction and then expired from left ventricular failure after ventricular assist device placement.¹⁶ The one surviving patient, like our patient, had a metastatic melanoma to the lung prior to having the metastasis to the left ventricle. Thus, patients with metastasis to the lung may be a group more likely to have a lesion in the left ventricle. Perhaps the group of patients who are undergoing metastatic melanoma resection of the lung should have an echocardiogram or cardiac MRI to evaluate for mass in the left heart.

Several surgical approaches to intracavitary left ventricular tumors can be considered. Cardiac transplantation has been described for complex malignant cardiac tumors but yields a mean survival of only 12 months.²³ Our group has avoided orthotopic cardiac transplantation due to this poor outcome and a lack of donor organs. We use right ventriculotomy to excise right ventricular tumors as described by Frazier, but we prefer

to avoid ventriculotomy through normal muscle on the left side whenever possible. For small benign tumors, a transaortic approach has been used successfully by our group.²⁴ Large, complex, and benign left ventricular tumors have not been amenable to a transaortic approach, but a transmitral valve approach using cardiac autotransplantation has worked well.²⁵ Primary sarcoma of the left ventricle tends to be large and complex to resect. A transmitral valve approach using cardiac autotransplantation has been successfully used in 2 such cases and demonstrates the flexibility this approach offers for complex tumor resection.²⁶⁻²⁸ We have previously described cardiac autotransplantation as an approach to left-sided cardiac tumors and our results with this approach.^{26,28-34} In our patient, the cardiac autotransplant approach allowed complete visualization and the surgical flexibility to achieve complete pathologic excision of an isolated left ventricular metastasis.

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