International Journal of Cardiovascular and Thoracic Surgery
2021; 7(6): 75-77
http://www.sciencepublishinggroup.com/j/ijcts
doi: 10.11648/j.ijcts.20210706.14
ISSN: 2575-4866 (Print); ISSN: 2575-4882 (Online)

Surgical Resection of Atypical Metastatic Melanoma to the Atriocaval Junction

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To cite this article:
Vitalis Chukwuebuka Osuji, Maha Mohammed Alkhuziem, Daniel John Beckman. Surgical Resection of Atypical Metastatic Melanoma to the Atriocaval Junction. *International Journal of Cardiovascular and Thoracic Surgery*. Vol. 7, No. 6, 2021, pp. 75-77.
doi: 10.11648/j.ijcts.20210706.14

Received: November 3, 2021; **Accepted**: November 19, 2021; **Published**: November 25, 2021

Abstract: Background: Metastatic tumors to the heart include lymphomas, sarcoma, leukemia, and melanoma. Of these, metastatic melanoma is the most common, and are usually hematogenous, where metastatic lesions can be present in the left ventricle, right atrium, and/ or the right ventricle. Objective: We present an atypical metastatic melanoma pattern, where cardiac metastasis originated by direct extension from the adjacent gastric mesentery. We also present our trans-cardiac resection approach, which was the safest way to access the cardiac metastasis intra-operatively without disrupting the tumor. Method: This was an incidental intraoperative finding, and no formal study methods were employed. During the operation, the atrium was opened via standard procedures. The point of tumor adherence to the posterior atrial wall was identified and resected. The tumor was found to extend by a pedicle into the mesentery of the gastric pull-up. Result: The outcome of this procedure was favorable. The tumor was completely resected, along with the adjacent heart and mesenteric tissues. The edges of the atrial tissues were cryoablated to eliminate any micro-invasion, and at 2-week follow-up, patient indicated significant improvement in pre-operative symptoms. Conclusion: Our patient's metastatic melanoma presented as a solitary metastasis to the right atrial caval junction. Trans-cardiac resection of the tumor was affected with deep hypothermic circulatory arrest without complications. We recommend this as the safest way to access the tumor at the atrial caval junction.

Keywords: Cardiovascular Surgery, Metastatic Melanoma, Atrial Caval Junction, Recommended Surgical Resection, Case Report, Cardiac Metastasis

1. Introduction

Melanoma is a highly aggressive and unpredictable disease. It can metastasize to the heart as often as 64% in cases with advanced disease [1, 2]. Other sites of metastasis include the liver, bone, and brain [3]. Once metastasis to other organs occur, malignant melanoma is defined as stage IV, with a poor prognosis. In addition to melanoma, other metastatic tumors to the heart include lymphoma, sarcoma, and leukemia [4]. Cardiac metastasis from malignant melanoma occurs in extensive disease and is a late manifestation of disseminated disease. Although melanoma in the heart has been observed in a large majority of patients post-partum, finding patients presenting with early symptoms are rare [5, 6]. Therefore, it is recommended that unsuspecting patients should be offered screening with ECG, troponin levels, and BNP, and in cases of abnormalities, an echocardiogram should be conducted [7, 8].

Some clinical presentations of metastatic melanoma to the heart include dysrhythmia, myocardial dysfunction, pericardial effusion, and heart failure [9]. Long-term survival depends on various factors such as tumor stage, response to systemic treatments, surgical options, and pre-existing comorbidities. Therefore, early diagnosis of cardiac metastasis is desirable, as this could improve prognosis and could be a necessary step in averting morbidity and mortality from cardiac failure. Studies [9] have found that the most common locations of metastatic melanoma to the heart

include the left ventricle (41.9%), right atrium (35.5%), and right ventricle (19.4%). In this report, we present a case of an atypical metastatic pattern of melanoma to the heart, as well as our trans-cardiac approach to surgical excision.

2. Case Report

Our case is a 54-year-old Caucasian male with a history of melanoma, initially diagnosed in 2006. He was in a motor vehicle accident in 2015, which led to an evaluation with an abdominal computed tomographic (CT) scan that showed a liver mass. Upon further evaluation with fluorodeoxyglucose positron emission tomographic (PET) scan in January 2016, demonstrated abnormal uptake in the caudate lobe of the liver. After biopsy of two peritoneal lymph nodes and a diaphragmatic lesion which were positive for metastatic melanoma an extensive abdominal procedure was planned. The patient was evaluated by ophthalmology, and dermatology and no cutaneous or ocular source of primary melanoma was identified. He was started on immunotherapy. In 2017, he underwent surgery involving resection of the medial liver mass, with a left lobe hepatectomy, partial right hepatectomy, esophageal gastrectomy (Ivor Lewis Procedure), cholecystectomy, and retrohepatic Inferior Vena Cava (IVC) resection. Following the operation, he lost a significant amount of weight but was otherwise doing well.

In February 2021, he underwent a PET scan which showed a hypermetabolic lesion at the inferior cavoatrial junction, with no evidence of additional disease recurrence or progression. He underwent Endoscopic Ultrasound (EUS) and biopsy, which demonstrated malignant melanoma. He was referred to cardiothoracic surgery for possible resection. A transesophageal echocardiogram (TEE) indicated an ejection fraction (EF) of 66% and confirmed the intraatrial component of the tumor. His cardiac catherization results were pertinent for luminal irregularities of the distal left anterior descending, and 30% stenosis of the mid left anterior descending. Cardiac Magnetic Resonance Imaging (MRI) showed a right atrial mass at the inferior cavoatrial junction with possible extra-cardiac extension.

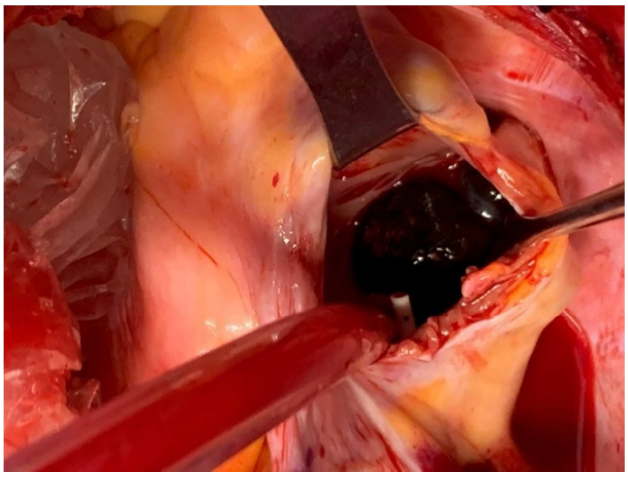

Figure 1. *Intraoperative photograph showing metastatic melanoma that adheres to the atriocaval junction of the heart.*

Figure 2. *Macroscopic view of metastatic melanoma.*

An operation was performed. The patient was placed under general anesthesia and placed on cardiopulmonary with a single atrial cannula and cooled to 20 degrees C. Following the removal of the atrial canula, an incision was made in the atrium along the sulcus terminalis just below the area of the sinus node down towards the IVC. After the atrium was opened, the point of adherence to the posterior atrial wall was identified and resected. The tumor extended by a pedicle into the mesentery of the gastric pull-up (figure 1). The tumor was completely resected, along with the adjacent heart and mesenteric tissues. The edges of the atrial tissues were cryoablated to eliminate any micro-invasion. The circulatory arrest time was less than 40 minutes. Pathologic examination revealed a 1.6 x 1.5 x 0.9 cm and 4.4 x 1.8 x 1.7 cm sized tumor, which was black in color (figure 2). A diagnosis of uveal type of melanoma was suspected.

The patient's postoperative course was uneventful. He was discharged from the hospital on the 5th postoperative day and was referred to oncologic cardiology for continued immunotherapy. He would return to the clinic in two weeks for post-op follow-up in satisfactory condition.

3. Discussion

This patient's past surgical history is pertinent for esophageal gastrectomy (Ivor Lewis technique) performed for resection of metastatic melanoma. Intra-operatively, the tumor extended by pedicle into the gastric pull up's mesentery implying that the cardiac metastasis most likely originated by direct extension from the adjacent gastric mesentery. The mesenteric portion of the resected specimen contained surgical staples, which further supports the possibility of direct extension into the cardiac structures. Cardiac metastases of melanoma to the heart are usually hematogenous [9]. They commonly present as multifocal lesions in the left ventricle, right atrium, and/ or the right ventricle. However, our patient's tumor presented as a

solitary metastasis to the right atrial caval junction. Transcardiac resection of the tumor was affected with deep hypothermic circulatory arrest without complications. We felt this was the safest way to access the metastasis at the atrial caval junction without disrupting the tumor.

Overall, studies have shown that surgery is the recommended first option for treatment of oligometastatic melanoma, even with modern systemic therapies such as Ipilimumab, Nivolumab, and high dose IL-2 [10-13]. In their review, Sondak and Gibney point out that the complete response rate to surgery in stage IV cancer is 90%, which is the highest complete response rate in any stage IV trial [14]. Other studies have shown similar results [15]. However, this case study focuses on identifying the safest way to access cardiac metastasis of melanoma, and while it is not a prognostic study intended to determine survival benefit with surgical management, our patient returned to clinic in two weeks, indicating significant improvement in pre-operative symptoms.

IRB Approval and Consent

Prior to journal submission, we received confirmation from the Indiana University IRB and compliance officer that IRB submission and approval is not required for this case study. However, verbal consent was granted by patient prior to hospital discharge.

Conflict of Interest: N/A

The authors have declared that no competing interests exist.

Acknowledgements

The authors would like to thank the hardworking nurses and circulators at Indiana University School of Medicine's Methodist Hospital. The authors would also like to note that this study was not funded.

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