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IMAGING VIGNETTE

INTERMEDIATE

CLINICAL VIGNETTE

Cardiac Metastasis of Neuroendocrine Tumor Without Cardiovascular Symptoms

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ABSTRACT

A 72-year-old man with a stage IV small intestinal neuroendocrine tumor presented to our cardiology clinic as a referral for an abnormal positron emission tomography-computed tomography scan with an intense gallium uptake in the heart. Follow-up cardiac magnetic resonance was suggestive of myocardium infiltration by the neuroendocrine tumor with late gadolinium enhancement and T_1 time elevation. (**Level of Difficulty: Intermediate.**)
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A primary cardiac tumor can be benign or malignant and is generally considered less common than the secondary type of cardiac tumor, which is a metastasis from surrounding organs, typically lung, breast, esophagus, and pancreas, as well as lymphoma and leukemia.[1] Neuroendocrine tumors (NETs) are rare malignant tumors with a reported annual incidence of 2.25 per 100,000 population. NET invasion of the heart is a very rare complication, and we present a case of NET with cardiac metastasis.

CASE REPORT

A 72-year-old man with a stage IV small intestinal neuroendocrine tumor (NET) presented to our cardiology clinic (Ruby Memorial Hospital, West Virginia University, Morgantown, West Virginia, USA) as a referral for an abnormal full body gallium-68 (^{68}Ga)-dotatate positron emission tomography-computed tomography (PET-CT) scan. His only symptom was chronic fatigue. Vital signs and physical examination were normal. High-sensitivity troponin and B-type natriuretic peptide values were within the normal range. An electrocardiogram (ECG) showed normal sinus rhythm without acute ischemic or suggestive serial changes from the previous ECG.

A review of the PET-CT scan demonstrated a focus of intense gallium uptake in the heart, approximately in the inferior interventricular septum, and raised suspicion of an active NET. Most NETs overexpress somatostatin receptors that accept ^{68}Ga to their binding sites. Thus, higher activity on ^{68}Ga imaging suggests a higher tumor burden and a potential target of somatostatin analogue. Additional suggestive foci of radiotracer uptake concerning for metastatic NETs were recognized in the liver and small bowel loop in the right midabdomen

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ABBREVIATIONS AND ACRONYMS

CMR = cardiac magnetic resonance

ECG = electrocardiogram

NET = neuroendocrine tumor

PET-CT = positron emission tomography-computed tomography

^{68}Ga = gallium-68

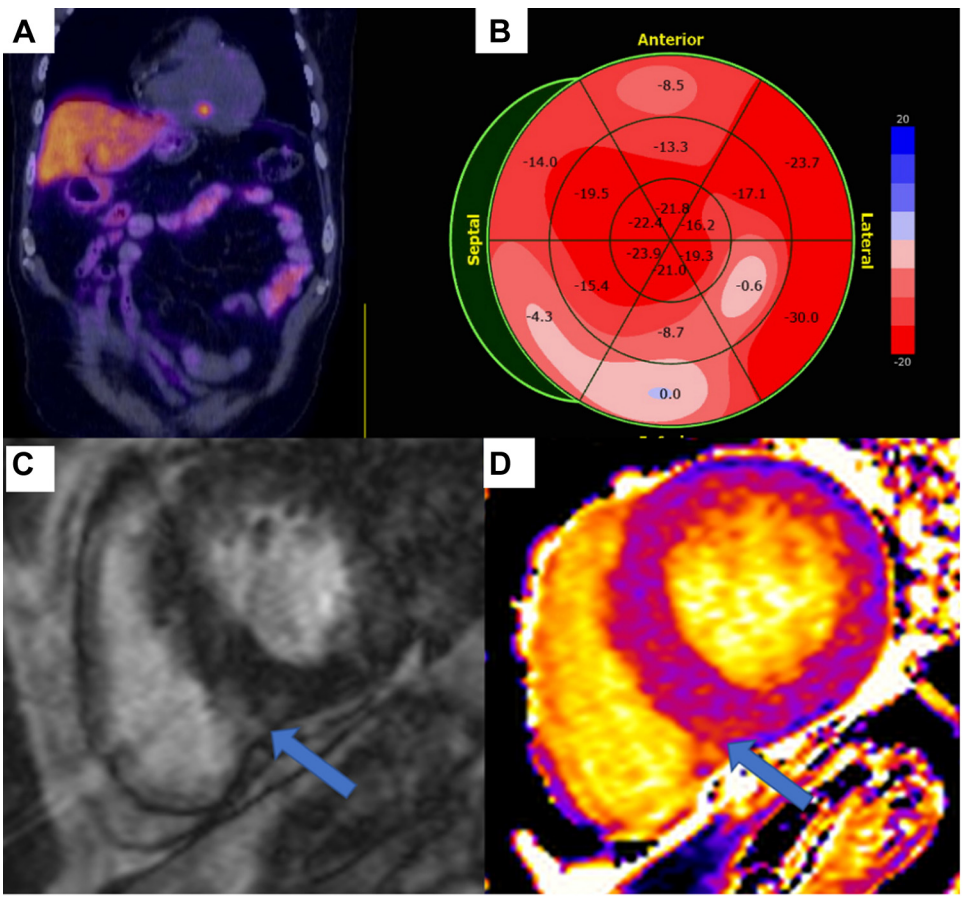
(Figure 1A). A transthoracic echocardiogram demonstrated left ventricular ejection fraction of 64%, septal bulge, and a significant strain reduction in the basal inferoseptum (Figure 1B). Cardiac magnetic resonance imaging (CMR) was performed for tissue characterization. There was late gadolinium enhancement in the basal inferoseptum at the inferior right ventricular insertion point (Figure 1C) and elevation of T_1 time at 1,200 milliseconds (Figure 1D). These findings were suggestive of NET infiltration of the myocardium.

The patient did not report any cardiac symptoms. As a result, there was no intervention performed. Ultimately, the patient was given a diagnosis of chronic myelomonocytic leukemia and was referred to palliative medicine.

DISCUSSION

Cardiac metastasis is rare and is most frequently observed in patients with late, widespread tumors. Malignant tumors of the skin, lung, and breast are the most frequently implicated in cardiac metastasis.[2] Of these malignant diseases, two-thirds typically spread to the pericardium and one-third spread to the epicardium and, less commonly, to the myocardium. NETs are considered rare; the prevalence in the United States is 6.98 per 100,000 population.[3]

FIGURE 1 Cardiac Metastasis of Neuroendocrine Tumor



(A) Radioactive uptake in the bowel and inferior portion of the heart. **(B)** Peak systolic strain at the inferoseptal wall. **(C)** Late gadolinium enhancement present in the basal inferoseptum **(arrow). (D)** T_1 color map showing phase-sensitive inversion recovery sequences demonstrated late gadolinium enhancement in the basal inferoseptum at the inferior right ventricular insertion point **(arrow)** and was consistent with myocardial fibrosis.

Clinical presentation depends on the site and size of the metastasis. NET with cardiac metastasis is typically asymptomatic from a heart standpoint, but there is a recently reported case[4] where the patient presented with heart failure at the time of diagnosis. Metastasis to the left ventricle accounts for 53% of cases, compared with only 7% of metastasis to the intraventricular septum.

Echocardiograms can be challenging if the metastasis is small and localized. Clinicians should be aware of the rare location of NET metastasis, and our clinical vignette highlights the importance of tomographic imaging using PET-CT and CMR to detect such cardiac metastasis at an early stage.

CONCLUSIONS

NET rarely metastasizes to the heart. Complications include ventricular outflow obstruction, arrhythmias, heart failure, and cardiac arrest, and interventions are typically targeted to treating these sequelae. Anatomical characterization of these lesions by CMR is helpful in assessing and predicting the risk of complications and therapeutic guidance.

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KEY WORDS cardiac metastasis, neuroendocrine tumor