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MINI-FOCUS ISSUE: ELECTROPHYSIOLOGY

BEGINNER

CASE REPORT: CLINICAL CASE

Incessant Atrial Tachycardia as First Presentation of Cardiac Angiosarcoma

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ABSTRACT

Primary cardiac angiosarcomas are rare malignant tumors with a very poor prognosis. We present a case of a 48-year-old man with no previous cardiac history who developed an incessant focal atrial tachycardia complicated by tachycardia-mediated cardiomyopathy as a consequence of cardiac angiosarcoma. (**Level of Difficulty: Beginner.**) (J Am Coll Cardiol Case Rep 2021;3:619-24) © 2021 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/).

HISTORY OF PRESENTATION

A 48-year-old man presented to the emergency department with persistent tachycardia. He was found to be in sustained atrial tachycardia (AT) at a rate of 150 to 190 beats/min (Figure 1A). In faster AT, the P-wave axis was positive in leads I, II, III, aVF and appeared upright in lead V_1, whereas at slower rates, lead V_1 was biphasic positive or negative (Figure 1B). As such, AT was thought to be originating from the crista terminalis, the right superior pulmonary vein, or, less likely, the right atrial appendage (RAA) (1). Rate control and external cardioversion were unsuccessful; he was given 1 g intravenous amiodarone with restoration of sinus rhythm the following day (Figure 1C). Transthoracic echocardiogram (TTE) showed a newly depressed left ventricular ejection fraction (EF) of 30%, compared with 55% to 60% 5 months earlier. He was discharged on oral amiodarone 200 mg daily and metoprolol, with plans for ablation.

LEARNING OBJECTIVES

- To recognize the importance of multimodality imaging in the evaluation of a right atrial mass after catheter ablation.
- To identify the manifestations of cardiac angiosarcoma.

Five weeks later, a repeat TTE in AT showed a persistently depressed EF without masses or valvular dysfunction. He underwent catheter ablation after discontinuing amiodarone for 3 weeks. The 3-dimensional electroanatomic mapping of the right atrium with Ensite NavX (Abbott, St. Paul, Minnesota) showed the earliest site of activation in the anteroseptal superior vena cava (SVC)-right atrial (RA) junction (Figure 2A), with a negative unipolar signal and centrifugal activation. The small area of localized early activation with a negative unipolar signal, combined with the rate variability and incessant

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ABBREVIATIONS AND ACRONYMS

AT = atrial tachycardia

CMR = cardiac magnetic resonance

EF = ejection fraction

RA = right atrial

RAA = right atrial appendage

SVC = superior vena cava

TTE = transthoracic echocardiogram

nature of the tachycardia, identified the mechanism as a focal automatic AT. Application of radiofrequency energy at this site caused acceleration and successful termination of the tachycardia within 3 s (**Figure 2B**). Thereafter, tachycardia could no longer be induced. He was discharged on metoprolol. At 2-month follow-up, he was asymptomatic and arrhythmia-free. However, a repeat TTE obtained to reassess EF, now 4 months after the initial presentation, revealed a new 1.6 × 1.2 cm mass at the site of ablation and an EF of 35% (**Figures 3A and 3B**). He was hospitalized for an expedited work-up.

PAST MEDICAL HISTORY

The patient had a history of diabetes mellitus and hypertension.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis of an RA mass included thrombus and neoplasm. Imaging characteristics such as ill-defined borders, invasion through tissue planes, or contrast enhancement on computed tomography (CT) or cardiac magnetic resonance (CMR) are suggestive of malignancy.

INVESTIGATIONS

Computed tomography angiography of the chest demonstrated an irregular filling defect in the right atrium extending into the RAA, representing thrombus or neoplasm (**Figure 3C**). Lower extremity duplex imaging was negative for deep vein thrombosis.

MANAGEMENT

On review of imaging studies, the mass was thought to be most likely thrombus because of its proximity to the recent site of intracardiac ablation, but neoplasm could not be definitively excluded. Further investigation with transesophageal echocardiogram was discussed, but the patient refused. Empirical anticoagulation with warfarin was initiated.

Three months later, he presented again, with pre-syncope and melena. He was given a diagnosis of cardiac tamponade and severe anemia with a hemoglobin value of 5.0 g/dl. Emergency pericardiocentesis yielded 250 ml of hemorrhagic fluid. A transesophageal echocardiogram demonstrated an interval increase in the RA mass (**Figure 3D**); CMR showed heterogeneous late gadolinium enhancement and extension of the mass from the SVC-RA junction into the pericardial space (**Figure 3E**). Flurodeoxyglucose-18 positron emission tomography confirmed abnormal hypermetabolic activity at the SVC-RA junction, as well as in the oral cavity, stomach, and lungs (**Figure 3F**). Histopathologic and immunohistochemical investigations of biopsy specimens were diagnostic of metastatic cardiac angiosarcoma (**Figure 4**).

DISCUSSION

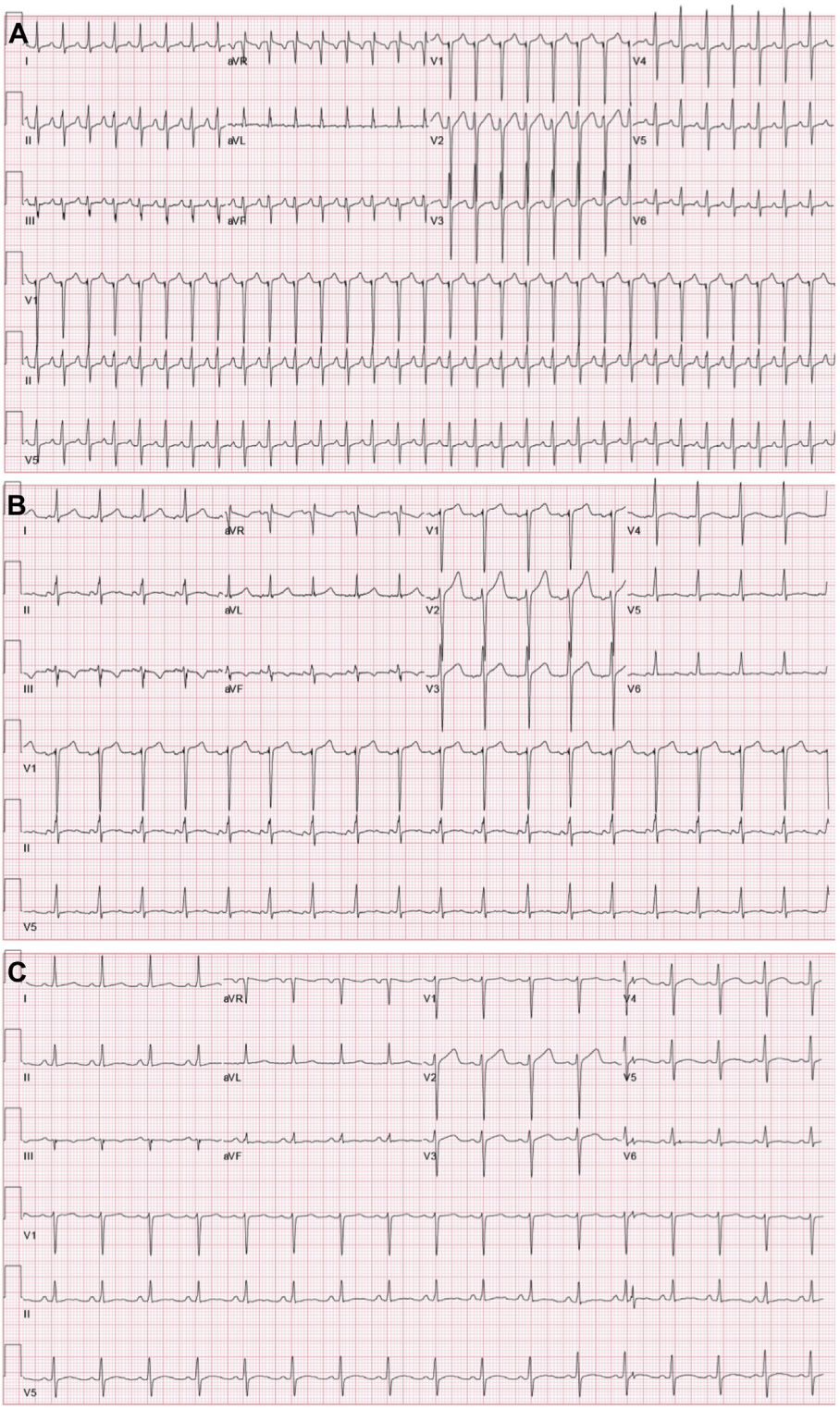
To our knowledge, this is the first reported case of incessant AT as the initial presenting sign of cardiac angiosarcoma. Focal ATs arise from preferential anatomic sites of origin, rather than at random. Approximately 75% of ATs originate from the right atrium, specifically around the crista terminalis (31%), the tricuspid annulus (22%), the perinodal region (11%), the coronary sinus ostium (8%), or the RAA (0.6%). Focal ATs from the left side most commonly arise from the pulmonary veins (19%), the interatrial septum (4%), and the left atrial appendage (0.6%) (2). The SVC and the SVC-RA junction are rare sources of focal AT (3). In our patient, electroanatomic mapping showed identical localization of the ectopic focus to the location of the primary angiosarcoma on multimodal imaging, again an atypical location for AT.

Primary malignant tumors of the heart are extremely rare, with an autopsy incidence of 0.001% to 0.030% (4). Angiosarcomas are the most common, often occurring in the right atrium as a multicentric mass arising near the atrioventricular groove, with frequent pericardial involvement (4,5). The clinical presentation is often vague, with nonspecific symptoms and signs such as dyspnea, fatigue, and weight loss, sometimes accompanied by right-sided heart failure from direct tumor infiltration. With pericardial involvement, patients may also present with an enlarging pericardial effusion or in cardiac tamponade (5,6).

Cardiac angiosarcomas are aggressive malignant tumors with a high rate of metastasis at the time of diagnosis. The lungs and liver are the most common sites of metastasis. Prognosis is very poor, with reported mean survival of only 6 months (7,8).

Early diagnosis, critical to prevent tumor progression, is often delayed or overlooked because of the rarity of the disease. Imaging is key to early detection, with echocardiography the initial modality of choice. Computed tomography can help delineate tumor anatomy and metastases. CMR can further aid in soft tissue characterization, distinguishing tumor from thrombus, and detecting local invasion. On CMR and gross pathological examination, angiosarcomas often have both hemorrhagic and necrotic

FIGURE 1 **12-Lead Electrocardiograms**



The 12-lead electrocardiograms of the **(A and B)** atrial tachycardia and **(C)** baseline sinus rhythm. The P-wave axis is biphasic in leads aVR and V_1 and positive in lead I, suggesting a high crista origin of the atrial tachycardia.

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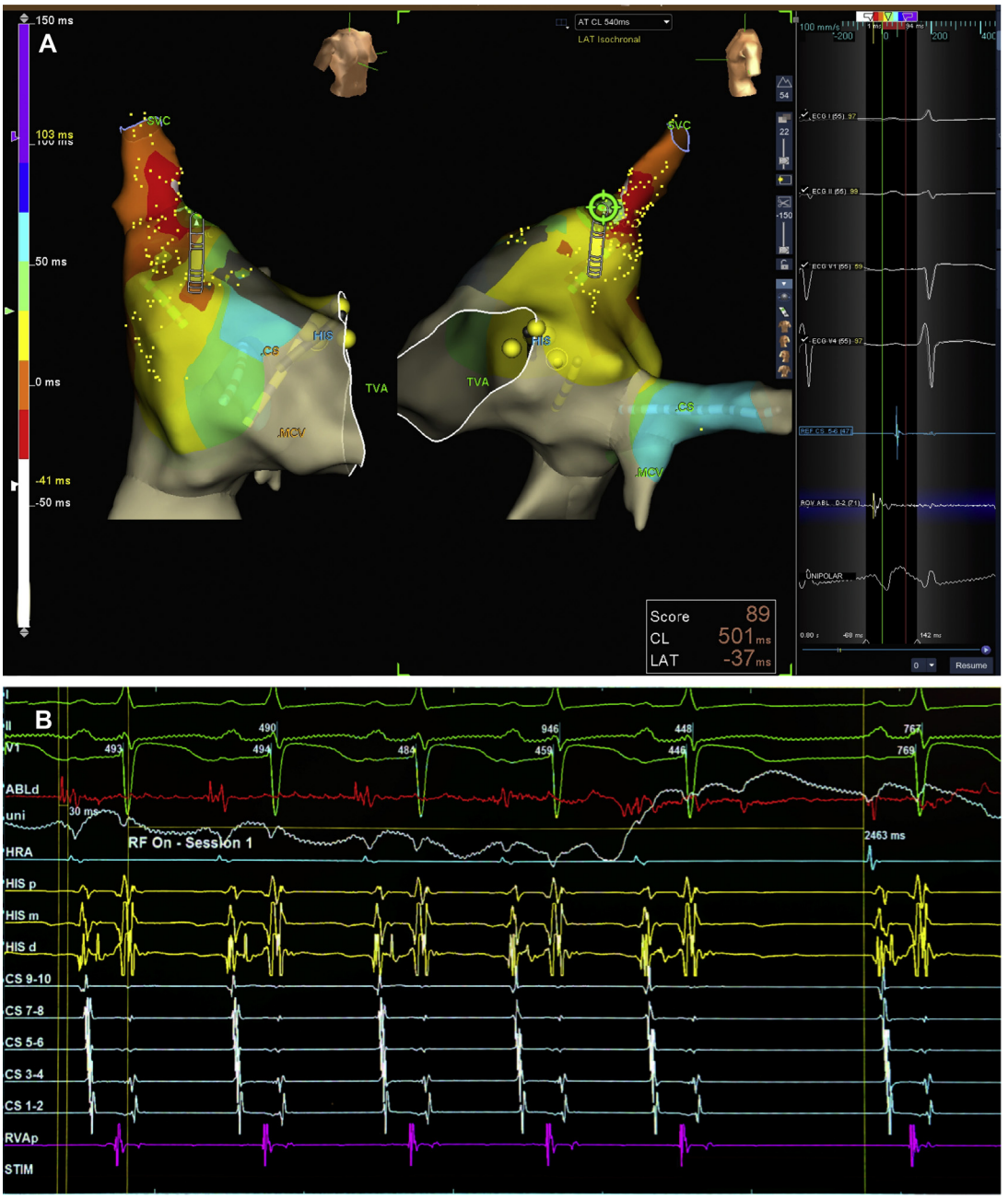
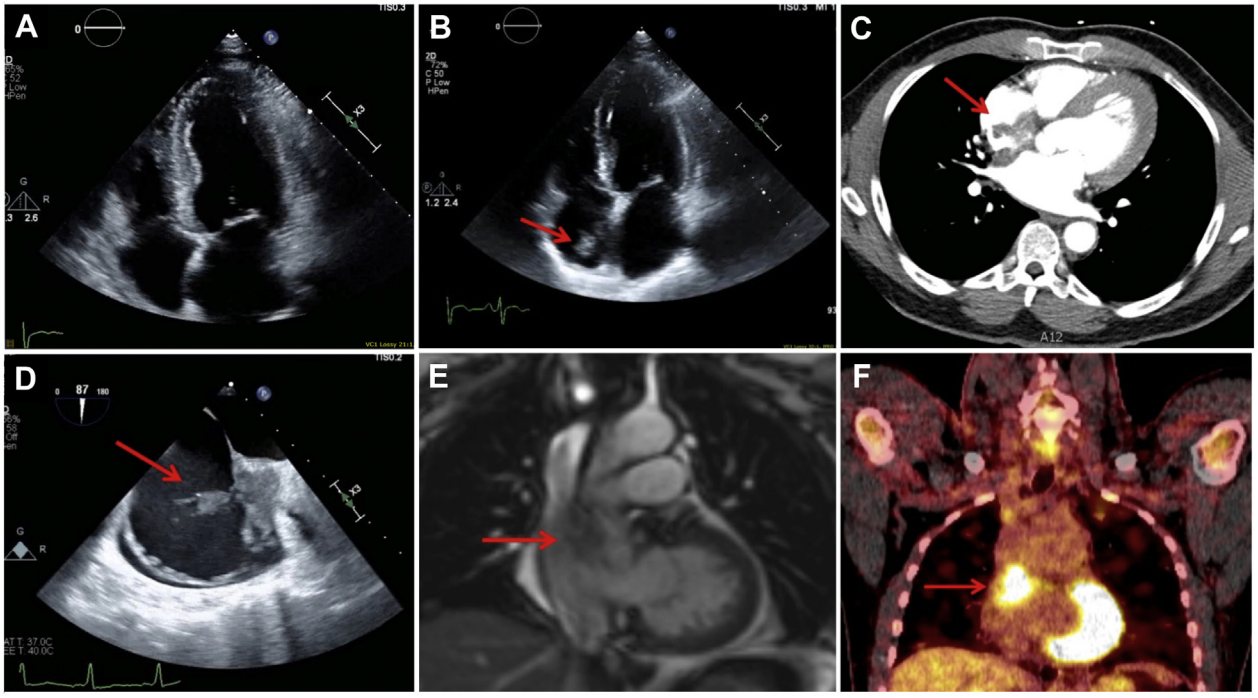
FIGURE 2 3-Dimensional Electroanatomic Activation Map



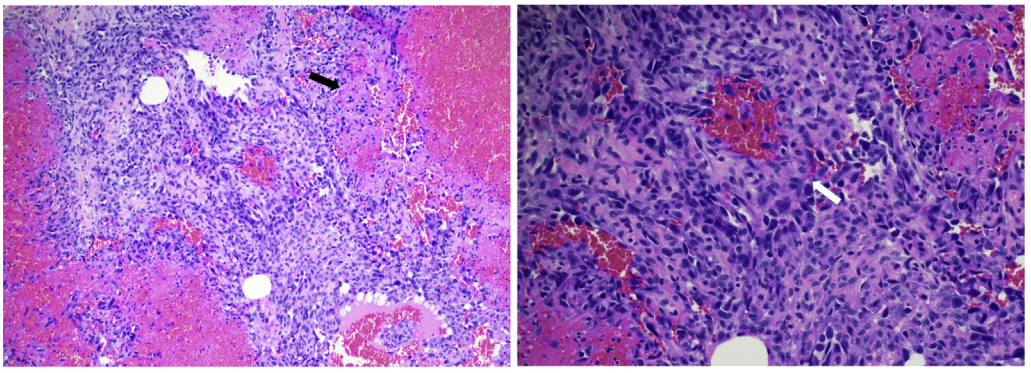
(A) Electroanatomic activation map of the right atrium acquired in atrial tachycardia (Ensite NavX system, Abbott, St Paul, Minnesota). The earliest area of activation was the 30-ms pre–P-wave. The successful ablation site was along the anteroseptal superior vena cava–right atrial junction. **(B)** Intracardiac tracings at the successful site, with termination within 3 s of radiofrequency ablation. ABLd = ablation distal; CS = coronary sinus; CL = cycle length; HIS = His bundle; HRA = high right atrium; LAT = local activation time; MCV = middle cardiac vein; RF = radiofrequency; RVA = right ventricular apex; STIM = stimulus; TVA = tricuspid valve annulus.

FIGURE 3 **Multimodality Imaging of Cardiac Angiosarcoma**



(A) Transthoracic echocardiogram 4 days before ablation without a right atrial mass. **(B)** Transthoracic echocardiogram 2 months post-ablation showing a new right atrial 1.6 × 1.2 cm echodensity **(arrow)**. **(C)** Computed tomography angiography of the chest, showing a multilobular filling defect **(arrow)** with areas of hyper-attenuation representing intermixing of contrast-enhanced blood. **(D)** Transesophageal echocardiogram, midesophageal bicaval view, showing a large right atrial mass **(arrow)** with a nonmobile component at the superior vena cava-right atrial junction and a smaller, oscillating component mass extending into the interatrial septum, pericardial fold, and around the superior vena cava. **(E)** Cardiac magnetic resonance imaging showing a heterogeneous right atrial mass **(arrow)** extending into the superior and transverse pericardial sinus. **(F)** Positron emission tomography and computed tomography showing intense hypermetabolic activity along the superior vena cava-right atrial junction **(arrow)** and innumerable pulmonary lesions with moderate fluorodeoxyglucose uptake.

FIGURE 4 **Histopathologic Examination of Chest Wall Biopsy**



Microscopic examination showing characteristic freely anastomosing vascular channels lined by atypical endothelial cells **(white arrow)** and areas of necrosis **(black arrow)**. Neoplastic endothelial cells vary in appearance, with numerous elongated to plump endothelial cells, some appearing epithelioid. CD31 and CD34 stains were also positive (not shown), additionally supporting the diagnosis.

components, resulting in heterogeneous signal intensity with a "cauliflower" appearance on CMR (9). Definitive diagnosis relies on histological examination of tissue.

Given the rarity of cardiac angiosarcomas, treatment guidelines are not well established. Complete surgical resection with neoadjuvant chemotherapy is preferred but rarely possible because most cases are diagnosed in late stages, with locally invasive disease and distant metastases (4).

When a new mass was discovered on a post-ablation echocardiogram, thrombus was thought to be more likely than neoplasm. Given its proximity of the mass to the site of recent endovascular injury from ablation, the rapidity with which it formed, and the patient's young age, an anchoring bias may have formed for the more benign diagnosis. However, thrombus formation from radiofrequency ablation is uncommon, with an estimated incidence of 0.6% (10). This, as well as underrecognition of angiosarcomas, contributed to a missed opportunity for early diagnosis and management of this rare but aggressive malignant disease. An intracardiac mass should prompt further evaluation with imaging, including CMR, to establish a diagnosis and should not be presumed to be or treated as thrombus. Even though the patient had no mass visible on TTE just 4 days before ablation, the tumor was likely already present at a histological level, leading to potential cellular myocardial disarrangement that created a substrate for arrhythmia formation. Although the possibility that the AT was unrelated to his tumor cannot be ruled out, the likelihood of these 2 rare events being unrelated is low.

FOLLOW-UP

At 3 weeks following histopathologic diagnosis, the patient died of acute hypoxemic respiratory failure, before palliative chemotherapy could be initiated.

CONCLUSIONS

This case highlights the importance of recognizing tumors as a potential cause of incessant arrhythmias, particularly ectopic ATs arising from an atypical site. Angiosarcoma is the most common primary malignant tumor of the heart and carries a poor prognosis. Increased awareness and early recognition of this rapidly fatal condition are essential to improve prognosis.

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