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Case Report

Cystic tumor of the atrioventricular node: an unexpected finding in an explanted heart

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Abstract

Summary: We report herein a unique case of cystic tumor of atrioventricular (AV) node (CTAVN), which, to our knowledge, is the first of its kind diagnosed in an explanted heart specimen and only the fourth diagnosed antemortem. Often, this rare tumor can only be diagnosed by careful gross examination and adequate sampling of AV node region. It is an important differential diagnosis in young patients with syncopal attacks and varying degrees of heart blocks. **Context:** CTAVN is a rare, benign tumor. Most cases have been reported in young females (mean age, 38 years). Patients typically present with conduction abnormalities including complete heart block leading to sudden cardiac death. Most cases have been identified at autopsy; no cases to our knowledge have been reported in an explanted heart. **Design:** A 19 year-old female presented to the cardiac transplant clinic for evaluation of severe congestive heart failure felt to be secondary to postpartum cardiomyopathy. The patient's history was significant for congenital heart block requiring placement of a permanent pacemaker at 12 years of age. At the time of this presentation, electrocardiogram revealed second-degree AV block, and two-dimensional echocardiogram showed lipomatous hypertrophy of the interatrial septum. Seven months later, orthotopic cardiac transplantation was performed. **Results:** On gross examination, the explanted heart weighed 500 g and had biventricular dilatation. Histologic sections of left and right ventricle revealed myocyte hypertrophy and interstitial fibrosis consistent with dilated cardiomyopathy. Sections from the AV node showed a lesion with morphological features of CTAVN. It was composed of cysts of varying sizes lined by transitional, cuboidal and squamous epithelium. Some cysts were filled with proteinaceous debris that were periodic acid Schiff-positive and diastase resistant. **Conclusions:** CTAVN occurs exclusively in the area of the AV node, tricuspid valve, and inferior atrial septum. These lesions are now believed to be endodermal in origin, although mesothelial origin was earlier proposed. We report herein a case of CTAVN, the first of its kind diagnosed in an explanted heart specimen and only the fourth diagnosed antemortem.

Keywords: Cystic tumor; Atrioventricular node; Explanted heart

1. Clinical history

A 19 year-old African-American female presented to the cardiac clinic with shortness of breath that developed with minimal activity and, occasionally, at rest. She also complained of 2-3 pillow orthopnea and occasional sharp nonexertional chest pain that resolved spontaneously. These symptoms had been present for about 2 months and had first begun a month after she gave birth to a healthy baby. The course of this pregnancy and delivery was uncomplicated, and she had gained 25 lb and now weighs 220 lb. Her past history was significant for congenital heart block, for which she had a permanent pacemaker inserted at the age of 12 years. At the time of this presentation, ECG revealed second-degree atrioventricular (AV) block and two-dimensional echocardiography showed lipomatous hypertrophy of the interstitial septum and an ejection fraction of 15%. She was diagnosed with congestive heart failure felt to be secondary to postpartum cardiomyopathy. After 7 months of medical treatment, she underwent cardiac transplant. Postoperatively, the patient's course was uneventful except for symptoms associated with transplant rejection, and she is currently on

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immunosuppression. Electrocardiography (ECG) performed 1 month post surgery showed normal sinus rhythm.

2. Pathologic findings

On gross examination, the explanted heart weighed 500 g. The right and left ventricles were markedly dilated, and the left ventricular wall appeared to be markedly thickened. No distinct mass or other lesions were noted. Histologic sections from the right and left ventricular walls showed marked interstitial fibrosis with hypertrophic and atrophic myocytes in disarray, consistent with dilated cardiomyopathy. Sections from interstitial septum showed normal appearing fat and degenerated cardiac myocytes, consistent with lipomatous hypertrophy. Sections from the AV node region (Fig. 1) revealed a lesion that was composed of dilated cystic duct-like structures of varying sizes that were lined by transitional, cuboidal, and squamous epithelium. The lining of each cyst was 1–2 cell layers thick, but some of the cysts showed stratification. The stroma surrounding the cysts showed fibrosis with chronic inflammatory infiltrate. Additional sections of tissue along the conduction system obtained to determine the extent of the tumor were noncontributory.

The tumor cells lining the cysts were positive for cytokeratin (Fig. 1C, D), epithelial membrane antigen (EMA) (Fig. 1E), carcinoembryonic antigen (CEA) (Fig. 1F) and B72.3 (murine antibody recognizing surface domain of TAG-72 antigen) but did not express calretinin (Fig. 1B), HBME and Wilm's Tumor 1 (WT1) (Fig. 1G), all markers of mesothelial origin. A diagnosis of CTAVN was rendered on the basis of morphology and immunohistochemical features.

3. Comment

Cystic tumor of the AV node is a rare primary cardiac tumor usually occurring at the base of the interatrial septum. There are approximately 70 case reports of this unusual tumor in medical literature, a vast majority discovered incidentally at autopsy. To our knowledge, ours is only the fourth case of CTAVN to be diagnosed antemortem [1–3] and the first in an explanted heart.

CTAVN was first reported in 1911 [4,5]. Wolf et al. [6] described it as "the smallest tumor which causes sudden death." Predominantly detected in young females, the tumor presents at all ages ranging from newborn to 86 years (mean age, 38 years) [7]. Patients usually present with syncopal attacks related to various degrees of heart block and sudden death due to arrhythmia or severe heart block [8]. James et al. [9] reports a high incidence of this tumor in the general population, but the majority of the affected individuals do not show any signs or symptoms and die in old age from other causes.

The first case of CTAVN in a pregnant woman was reported in 1972 by Lewman et al. [10]. The patient was a 19-year-old pregnant woman who had convulsions and syncopal attacks since the age of 3 years. She was diagnosed with complete heart block at the age of 16 years, and a permanent pacemaker was implanted. She died at 20 weeks of gestation following a syncopal attack. Our patient is a 19-year-old woman who developed second degree AV block at the age of 12 years for which she was treated with a permanent pacemaker. She was asymptomatic for approximately 7 years until she developed severe dilated cardiomyopathy 1 month after delivering a healthy baby, following an uncomplicated course of pregnancy.

According to James et al. [9] ventricular dilatation and dilated cardiomyopathy in these patients has been attributed to the result of complete heart block or arrhythmias. Agaimy et al. [11] described a case of a papillary fibroelastoma of the aortic valve occurring simultaneously with CTAVN. At autopsy, this tumor was found to prolapse into and occlude the right coronary ostium, leading to an acute, recurring myocardial infarction. Suarez-Mier et al. [12] described two accidental deaths cases in which AV node tumor was present as multiple foci and as an isolated cyst in the atrial septum.

Ford et al. [13] described CTAVN in a 37-year-old man with a third-degree AV block who developed congestive heart failure secondary to dilated cardiomyopathy and eventually died. He had a family history of sudden deaths due to cardiomyopathy. Our patient did not have any family history of cardiomyopathy. They also observed the association of CTAVN with the presence of dilated cardiomyopathy and proposed that this association may be genetic and not a mere coexistence of two distinct conditions.

On gross examination, most tumors range in size from 2 mm to 2 cm and appear as an area with small cysts filled with fluid. These are usually detected by transesophageal echocardiography (TEE) or magnetic resonance imaging (MRI). A TEE in our patient revealed lipomatous hypertrophy of the interatrial septum. A distinct tumor was not evident either by TEE or gross examination of the explanted heart. The majority of these tumors do not have any draining channels to epicardium or endocardium, and any change in size brought about by secretory functions of the lining cells can directly affect the AV node. The physiological mechanism that may regulate the secretory function is unknown.

Fig. 1. Cystic tumor of the AV node. Sections from the AV node with CTAVN were composed of dilated cystic duct-like structures of varying sizes, lined by squamous epithelium. The lining of each cyst is approximately 1–2 cell layers thick, but some of the cysts showed stratification. The stroma surrounding the cysts shows fibrosis with chronic inflammatory infiltrate. (i) Hematoxylin and eosin; original magnification ×40. (ii) Hematoxylin and eosin; original magnification ×400. Immunohistochemical characterization of CTAVN. The tumor cells lining the cysts strongly express cytokeratin (C and D), epithelial membrane antigen (E) and carcinoembryonic antigen (F) but are negative for calretinin (B), HBME (not shown) and WT1 (G), which are markers of mesothelial origin (original magnification ×400 for all images).