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IMAGING VIGNETTE

INTERMEDIATE

CLINICAL VIGNETTE

Computed Tomography Tissue Characterization of Pediatric Cardiac Tumor

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ABSTRACT

Little is known about tissue characterization of cardiac tumors by dedicated cardiac computed tomography (CT) protocols in pediatric patients. We report using arterial and delayed CT acquisitions to characterize a large left ventricular free wall tumor in a 12-year-old female with congenital mitral insufficiency and an automatic implantable cardioverter defibrillator. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2023;21:101962) © 2023 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/).

BACKGROUND

Cardiac computed tomography (CT) is the only resort for diagnostic cross-sectional imaging in patients not suitable for cardiac magnetic resonance imaging (MRI) due to implantable devices. Cardiac CT can help assess cardiac tumors for valuable spatial information, cardiac function, myocardial and tumor tissue characterization for early perfusion, differential attenuation, and delayed iodide-based contrast uptake.[1-3]

However, clinicians have very limited experience in the assessment of cardiac tissue characterization with delayed enhancement CT techniques among children.

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We report a 12-year-old female who presented following an episode of ventricular tachycardia. She has a prior history of severe congenital mitral valve regurgitation and a left ventricular mass described as a hamartoma with no clear histological diagnosis. Because of burden of significant ventricular ectopy and runs of sustained ventricular tachycardia, an automated implantable cardioverter-defibrillator (AICD) was placed for primary prevention at 6 years of age. Transthoracic echocardiogram at her current presentation revealed severe mitral valve regurgitation and a hyperechoic tumor mass.

After medical stabilization, the patient presented for cross-sectional imaging to define the tumor mass, extent, cardiac involvement, and tissue characterization to aid in preoperative planning. A cardiac MRI did not provide diagnostic imaging (**Figure 1A**) due to the presence of severe metallic artifact secondary to her AICD.

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ABBREVIATIONS AND ACRONYMS

AICD = automatic implantable cardioverter defibrillator

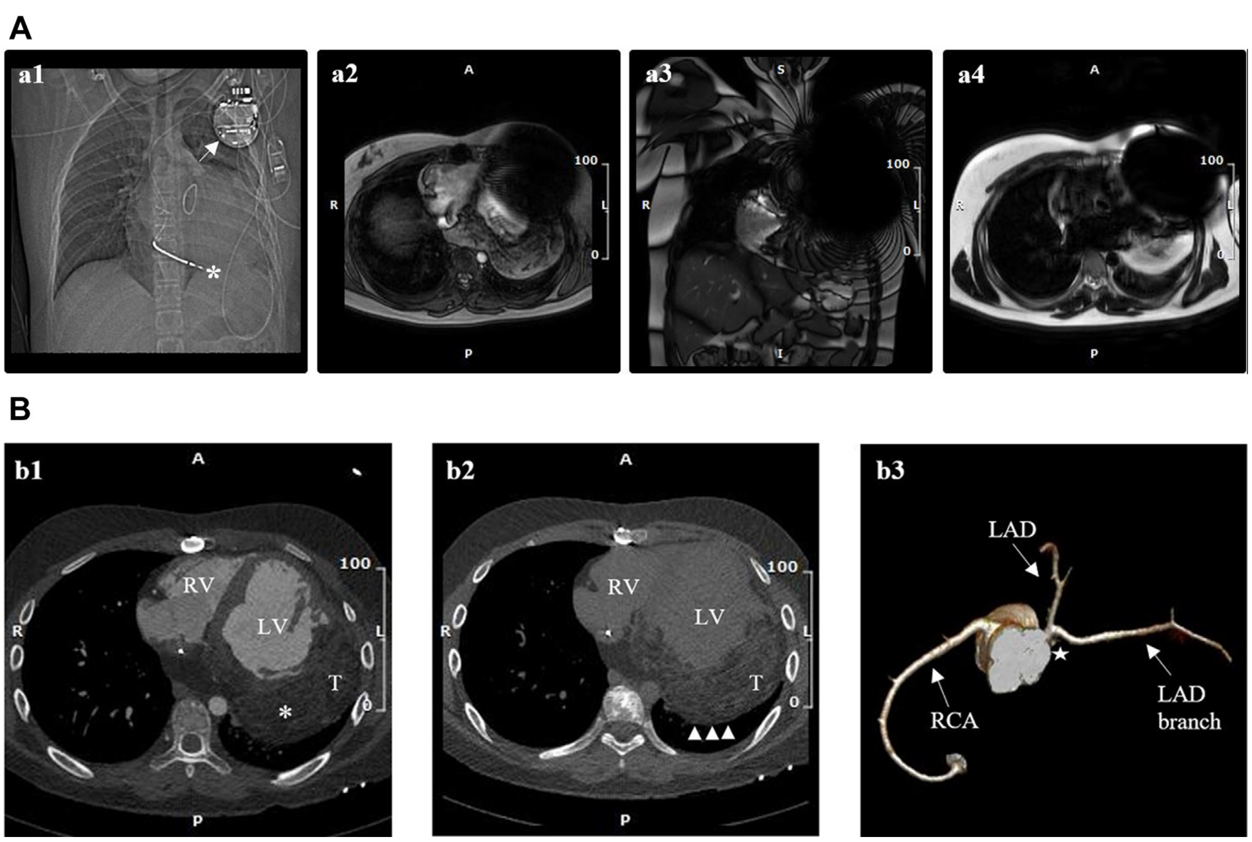
CT = computed tomography

MRI = magnetic resonance imaging

A cardiac CT was performed using Somatom Force dual-source scanner (Siemens Medical Solutions) with prospective-gated technique. An initial dose of 1 mL/kg of iodixanol was administered at a rate of 3 mL/s, followed by a slow administration of 0.3 mL/kg of contrast over 1 minute. Early arterial images were obtained using prospective electrocardiogram gating between 35% and 70% of the cardiac cycle. Delayed enhancement images were obtained at 35% of the cardiac cycle after 9 minutes of contrast administration.

A large hypoattenuated mass with low Hounsfield unit scale value was noted on the early phase within the left hemithorax infiltrating into the posterolateral left ventricular myocardium (Figure 1B). There was no significant vascularity or calcification within the mass. The left circumflex artery was not visualized, and its absence was confirmed by cardiac catheterization. The mass appeared heterogenous with differential attenuation and enhancement of the tissue on the delayed acquisition was suggestive of fat attenuation (low Hounsfield unit scale value) admixed with fine septa of fibrosis. The patient underwent mitral valve repair. An incisional biopsy of the tumor was obtained during surgery (Supplemental Figure 1) which showed mature adipocytes without nuclear atypia, intermingled with myocytes or entrapped myocytes. There was a lobular pattern with thin fibrotic septa, consistent with histological diagnosis of a lipoma. Our CT

FIGURE 1 Imaging of a 12-Year-Old Female Patient With a Large Left Ventricular Wall Mass



(A) Severe metallic artifact from automated implantable cardiac defibrillator (AICD) on different sequences of magnetic resonance imaging (MRI) precluding diagnostic image quality. **(a1)** Chest radiograph depicting position of AICD in the left pectoral region **(arrow)** and transvenous lead tip in the right ventricle **(asterisk)**. **(a2)** Axial view of gradient echo MRI sequence. **(a3)** Coronal view of steady-state free precession MRI sequence. **(a4)** Axial view of T1-weighted black blood sequence on MRI. **(B) (1b)** Cardiac computed tomography (CT) imaging. **(b1)** Axial reconstructed image from arterial phase acquisition demonstrates no contrast uptake by the tumor **(asterisk). (b2)** Axial reconstructed image from delayed acquisition after 9 minutes of contrast administration shows heterogenous enhancement of the left ventricular (LV) tumor **(arrowheads). (b3)** Volume rendering of coronary arteries showing complete absence of left circumflex coronary artery **(star).** The left coronary artery continues as left anterior descending artery (LAD) and gives rise to a prominent LAD branch. RCA = right coronary artery; RV = right ventricle; T = cardiac tumor involving LV free wall.

findings of hypoattenuation and nonvascularity on early acquisition and low attenuation mixed with scattered areas of delayed enhancement were consistent with histological diagnosis of lipoma.

In conclusion, cardiac CT delayed enhancement tissue characterization can be used in children if cardiac MRI is not feasible. Our case is an example where one-stop-shop cardiac CT imaging with an arterial acquisition followed by delayed enhancement protocol provided useful information for coronary imaging, tumor extension, and tissue characterization.

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KEY WORDS cardiac lipoma, cardiac tissue characterization, computed tomography, iodide-based delayed enhancement, pediatric cardiac tumor

APPENDIX For a supplemental figure, please see the online version of this paper.