

Case Report

Two in One: Echocardiographic Features of Right-Ventricular Diverticulum and Left-Ventricular Aneurysm in the Same Patient

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

ABSTRACT

Ventricular diverticulum is a rare congenital heart defect that is usually found incidentally upon imaging, such as 2-dimensional transthoracic echocardiogram. We report a case in which an isolated right-ventricular diverticulum and a left-ventricular aneurysm were both found on transthoracic echocardiogram in the setting of a pulmonary embolism. This case highlights how to distinguish between an aneurysm and a diverticulum based on wall motion on echocardiogram, as well as potential complications that may arise from either anomaly.

RÉSUMÉ

La présence d'un diverticule ventriculaire est une malformation cardiaque congénitale rare qui est habituellement détectée par accident lors d'un examen d'imagerie, par exemple une échocardiographie transthoracique bidimensionnelle. Nous exposons le cas d'une patiente présentant un diverticule ventriculaire droit isolé et un anévrisme ventriculaire gauche qui ont été décelés lors d'une échocardiographie transthoracique en contexte d'embolie pulmonaire. Nous expliquons comment faire la distinction entre un anévrisme et un diverticule en se fondant sur le déplacement de la paroi à l'échocardiographie, ainsi que les complications qui peuvent découler de ces deux anomalies.

A 90-year-old woman with no prior cardiac history originally presented to the emergency room with right hip fracture requiring surgery. After surgery, the patient became hypoxic and hypotensive, and developed paroxysmal atrial flutter. Troponin I peaked to 3.48 ng/mL (normal range: < 0.034 ng/mL), and an electrocardiogram (ECG) showed new-onset ST elevations and Q waves in the anterior leads (Fig. 1B) that were not there during initial ECG (Fig. 1A). A computed tomography pulmonary angiogram showed a left lower subsegmental pulmonary embolism as well as an apical left-ventricular (LV) aneurysm. It also showed multivessel calcifications of the coronary arteries. A transthoracic echocardiogram (TTE) showed an apical LV aneurysm (systolic bulging at the apex), an ejection fraction of 20%-25%, and a contractile right-ventricular (RV) diverticulum with otherwise normal RV wall thickness and chamber size. Although most ventricular diverticula are incidentally found

and are located in the left ventricle, we describe a case in which an isolated contractile RV diverticulum and a LV aneurysm were both found via a TTE in the same patient. On real-time review of the TTE, the diverticulum in the right ventricle contracts synchronously with the RV chamber, whereas the LV aneurysm bulges with each systole (Fig. 2, A and B; Videos 1-3 , view video online). A single 4-chamber view in real time clearly distinguishes the ventricular aneurysm with its paradoxical wall motion vs a contractile ventricular diverticulum (Video 1 , view video online). Left heart catheterization was not pursued per the patient's and family's request, so the decision was made to transition the patient to comfort measures and later discharge home.

Cardiac ventricular diverticulum is a rare condition that causes an outpouching of the ventricle. Diverticula can be congenital or acquired and are normally classified pathologically into 2 groups: muscular and fibrous type.¹ Muscular-type diverticula are characterized by the presence of all 3 cardiac muscle layers and usually mimic ventricular contraction during systole, whereas fibrous-type diverticula contain little to no muscle fibers and usually remain dyskinetic or akinetic during systole. Although diverticula can occur anywhere along the ventricle, aneurysms are usually more apical. Ventricular aneurysms typically occur after an ischemic event, myocarditis, or trauma. A ventricular aneurysm is characterized by an area of akinesis and thinning

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See page 720 for disclosure information.

Novel Teaching Points

- Ventricular diverticula and ventricular aneurysms are malformations that both can be detected on a TTE.
- Wall motion of diverticula and aneurysms can be differentiated on a TTE, but further characterization must be obtained through cardiac magnetic resonance imaging or histopathology.
- Aneurysms may manifest as persistent ST elevations on ECG.

with systolic outpouching. In some instances, the fibrous-type diverticula may actually appear to be an aneurysm based on its wall motion. In these cases, histopathologic exam can distinguish between the two. Although most isolated ventricular diverticula are benign, they can sometimes cause adverse events, such as thromboembolism, chest pain, or tachyarrhythmias such as ventricular tachycardia.² In terms of treatment, surgical resection is the preferred choice in symptomatic patients, such as those with heart failure symptoms, whereas asymptomatic patients can be managed conservatively with close follow-up of size with serial TTEs.³ In our patient, even though the RV diverticulum did not contain a thrombus, we were not able to exclude the possibility that the diverticulum may have been the source of pulmonary embolism. The need for prophylactic anticoagulation in patients with ventricular diverticula is not well established owing to the rarity of the condition. Per Rad et al., anticoagulation is generally considered for those who have

large apical hypokinesia and fibrous diverticula, especially when they occur after systemic embolization.⁴

In our patient, we believe that the LV aneurysm was not a true incidental finding but rather an acquired anomaly from a new ischemic event. When the patient first arrived to the hospital, her initial ECG showed no ST elevations or Q waves in the anterior leads. However, once she developed hypotension and new-onset tachyarrhythmias, her ST elevations became more evident in the anterolateral leads, along with elevated troponin I. Additionally, her computed tomography pulmonary angiogram showed multiple calcifications of coronary arteries, strongly suggesting underlying coronary artery disease. However, the patient did not undergo further evaluation with a coronary angiogram to rule out an acute coronary artery lesion, so we cannot definitively exclude Takotsubo syndrome. Regardless, the wall motion abnormality behaved functionally like an LV aneurysm on review of the TTE.

In conclusion, ventricular diverticula and aneurysms are both malformations (congenital or acquired) that can be detected on a TTE. We previously reported an LV diverticulum in a patient with congenital pulmonic stenosis but now describe a patient with both an RV diverticulum and an LV aneurysm.⁵ Upon literature review, there has been no documented case in which both a diverticulum and aneurysm were found concurrently in the same patient.

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Disclosures

The authors have no conflicts of interest to disclose.

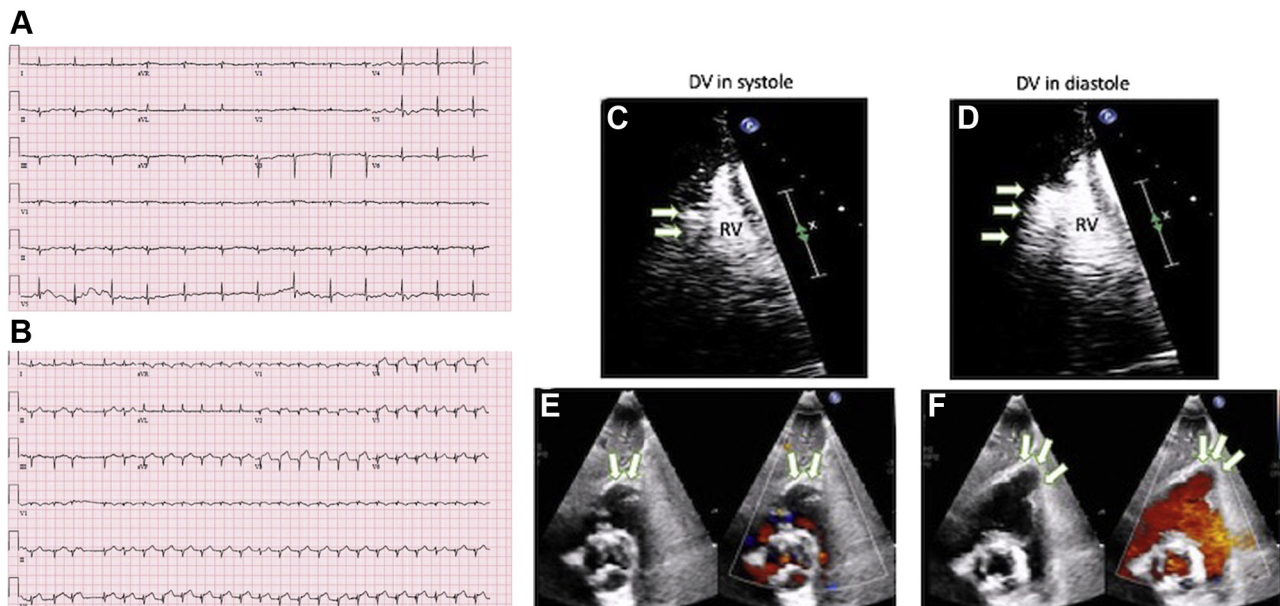


Figure 1. Apical 4-chamber view of right-ventricle (RV) diverticula and left-ventricle (LV) aneurysm in (A) systole and (B) diastole. RV-focused apical 4-chamber view with contrast of RV diverticula in (C) systole and (D) diastole. Short-axis view of RV diverticula in (E) systole and (F) diastole, with Doppler obtained from subxiphoid window. **Orange arrows** denote LV aneurysm; **white arrows** denote RV diverticula. LA, left atrium; RA, right atrium.

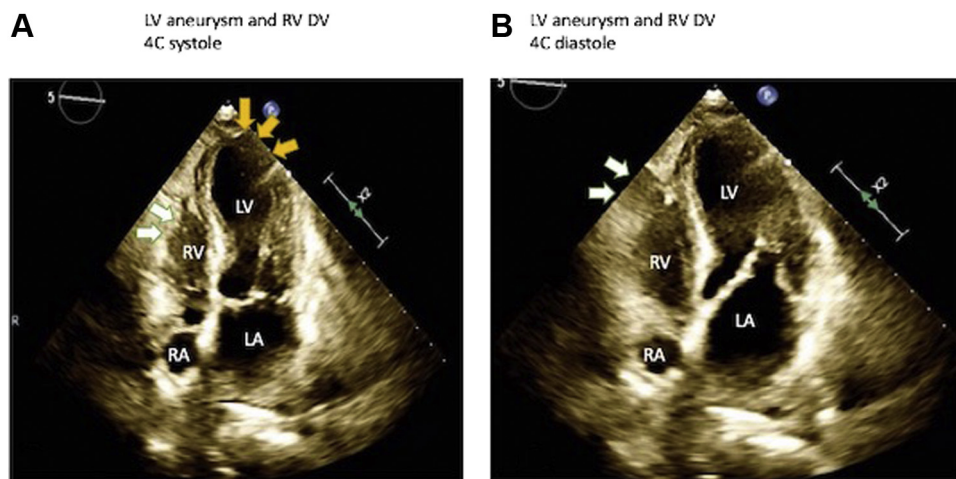


Figure 2. (A) Initial electrocardiogram upon arrival. (B) Electrocardiogram obtained when the patient initially had hypotension and tachycardia.

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Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Open* at <https://www.cjopen.ca/> and at <https://doi.org/10.1016/j.cjco.2020.07.019>.