Left Atrial Diverticula and Myocardial Bridging: Echocardiographic and Cardiac Computed Tomography Findings

Massimo Bolognesi¹,*, MD, Diletta Bolognesi, MD²

Abstract
Diverticula of the left atrium and myocardial bridge of a coronary artery are relatively rare anatomical variants of unknown etiology. The coexistence of the two abnormalities in the same patient is a rare case. We report here our experience of a 41-year-old woman who underwent clinical examinations for palpitations and dizziness, in whom Cardiac Computed Tomography (CCT) revealed the presence of a left atrial diverticulum associated with a deep myocardial bridge of the left anterior descending artery. Left atrial diverticula and myocardial bridge represents a rare cluster of anatomical variants. CCT has the ability to identify and characterize anatomical structures in detail; this becomes of importance when diagnostic doubts arise during preliminary assessment of the patient via electrocardiography and echocardiography.

Keywords — Cardiac Multidetector Computed Tomography (MDCT), echocardiography, left atrial diverticula, myocardial bridge.

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I. INTRODUCTION

Diverticula of the left atrium are relatively rare malformations of unknown etiology (probably associated with embryologic development) and may be associated with arrhythmias, thromboembolism, or mitral valve regurgitation¹. Left atrial diverticula appear most of the times like a pouch of the atrial wall and they have not been reported in association with other cardiac abnormalities². Myocardial bridge of a coronary artery is anatomical variant characterized by an intra-myocardial course of a segment of a coronary vessel which may be partially or completely surrounded by the myocardium.

This variant is more frequent than previously thought, and its reported incidence varies from 1.5% to 16%³. These malformations are not uncommon and are frequently observed incidentally through cardiac imaging performed by Cardiac Computed Tomography (CCT)⁴. The presence of both these abnormalities has not been reported in literature. The authors describe a case of left atrial diverticulum and myocardial bridge in a 41-year-old woman, accidentally detected by CCT, performed to exclude the presence of atrial masses such as atrial myxoma as suspected on echocardiography examination.

II. OUR EXPERIENCE

A 41-year-old woman patient was referred to our center by her primary care physician for clinical evaluation of postprandial palpitations, dizziness and slight fainting. Twelve-lead ECG showed T-wave inversion on precordial leads while an exercise stress test revealed a normalization of the ventricular repolarization abnormalities that reappeared in the recovery phase. A subsequent Two-dimensional Trans Thoracic Echocardiography showed normal size and morphology of the cardiac chambers with preserved global contractility. No valvular abnormalities were present. In parasternal view it was detected the presence of a slight oval-shaped small echo density such as a large mass measuring 1.0 cm, which was coherent with left atrial thrombus or myxoma moving towards the mitral valve during the diastolic phase (see arrows on two images of Figure 1; video 1). Echocardiography sub-costal views confirmed the presence of a mass in the left atrium (Figure 2 – Panel B; video 2), but it also indicated another abnormality of the left atrial anterior-superior wall suggestive for atrial diverticula (see Figure 2 – Panel A). So as to exclude with certainty the presence of a left atrial myxoma and to confirm the suspect of left atrial diverticulum of the antero-superior wall CCT was performed. The CCT scan, showed normal anatomy of the epicardial coronary arteries without luminal narrowing but revealed the presence of a deep myocardial bridging in the middle segment of the left anterior descending artery (Figure 3 – Panel B). In addition, CCT also revealed the presence of a cystiform diverticulum of the antero-superior left atrial wall (approximately 5×5×10 mm), with irregular surface (Figure 3 Panel A – Figure 4), and its anatomical relations with left
atrium and pulmonary vein. A marked trabeculation with deep recesses similar to the non-compaction myocardium were visible at the level of the free wall of the right ventricle near the apex (Figure 2 Panel B).

Echocardiography findings of left atrial mass

![Echocardiogram images](image)

**Figure 1:** TTE PLAX view shows in both figures a large mass (blue arrows) measuring 0.5 × 0.5 x 1.0 cm in the left atrium that could represent a thrombus or myxoma that moves toward the mitral valve in diastole.

**Left Atrial Diverticula mimicking atrial mass**

![Echocardiogram images](image)

**Figure 2:** TTE Subcostal view – Panel A shows a small outward pouching structures (yellow) in the antero-superior atrial wall; Panel B shows a large mass in left atrium (false image) and a marked trabeculation with deep recesses at the free wall of the right ventricle near the apex.
**Figure 3:** MDCT shows in Panel A a left atrial diverticulum and in Panel B a Myocardial Bridge on DA.

**Figure 4:** A 64-slice CT multiplanar reformatted image (MPR, oblique coronal plane) showing the left atrial diverticulum (arrow) at the antero-superior left atrial wall and its anatomical relations with left atrium and pulmonary vein.

**Video 1:** 2D Trans Thoracic Echocardiography in Parasternal long axis view shows a large mass in the left atrium that moves toward the mitral valve in diastole from the posterior-superior chamber.

**Video 2:** 2D Trans Thoracic Echocardiography in Subcostal long axis view shows a large mass in left atrium (false image) and left atrial diverticula in the antero-superior wall.
III. DISCUSSION

CCT is a robust and well-established imaging modality that provides accurate anatomical imaging of the heart and surrounding structures. CCT is a clinical tool that delivers mainly information about coronary artery patency and has a very high negative predictive value for the exclusion of obstructive coronary artery disease. 5. CCT is also extensively used, due to its anatomical capabilities, in the assessment of congenital heart disease, pulmonary vein assessment prior to ablation, aortic annulus assessment prior to percutaneous or trans-apical graft, and so forth. Recently routine evaluation by CCT has revealed the existence of sac-like structures in the left atrium. These left atrial diverticula are cyst-shaped protuberances that project outward from the heart cavity and are composed of simply one muscle layer. Few studies have investigated left atrial diverticula, and these are mainly rare variations identified under pathological conditions. Whether left atrial diverticula are more common in patients with atrial fibrillation (AF) or might even be a substrate for AF is yet unknown. They were described as having the same histological construction as that of a normal LA wall, but no pathophysiological explanation is recognized. To our knowledge, this is the first reported case in literature of left atrial diverticulum, which mimics the presence of a mass as detected by echocardiography. In literature there are cases of atrial septal aneurysm mimicking atrial masses, but evidence has never been shown of atrial diverticula that resembled left atrial mass.

The present case is interesting and unique for varied reasons: 1) the false imaging seen to two-dimensional trans-thoracic echocardiography (2D TTE) that resembled an atrial mass; 2) the difficulty in detecting a diverticulum of the left atrium by using 2D TTE may be the misinterpretation of a pulmonary vein in sub-costal windows. The discovery of multiple cardiac anomalies such as a left atrial diverticulum, a myocardial bridge and a small atrial septal defect, is now possible due to new and modern cardiovascular imaging techniques such as CCT, which will help clarify the clinical questions that arise with first level instrumental investigations including electrocardiography (ECG) and echocardiography. The finding of left atria diverticula is interesting and could have implications when evaluating patients with atrial fibrillation, or prior to radio frequency catheter ablation procedures, or when evaluating patients for possible sources of emboli from cardiac chamber. The finding of myocardial bridging is equally interesting to justify the electrocardiographic evidence of precordial T-wave inversion, because several recent studies have demonstrated the importance of clinical complications, including ischemia and acute coronary syndromes, arrhythmias (including ventricular tachycardia) supraventricular tachycardia, atrioventricular conduction blocks induced by exercise, which can cause sudden death.

IV. CONCLUSIONS

Nowadays the role of cardiac computed tomography is clearly defined in establishing the diagnosis of coronary heart abnormalities. Especially to detect congenital heart anomalies such as atrial diverticula and myocardial bridging, and this report, even with all the limitations of the case (involving the reliability of the methodology and operator experience) confirm the need to use these newer imaging techniques when there are doubts in the echocardiographic examination and clinically in general.

The authors declare that a written informed consent was obtained from the patient (or other approved parties) for publication of this report and accompanying images.

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REFERENCES