Novel Insights from Clinical Experience

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Left Ventricular Diverticulum Associated with Neovascularization in an Adult

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Established Facts

- Ventricular diverticulum leads to myocardial ischemia, arrhythmias, endocarditis, heart failure, cardiac rupture etc.

Novel Insights

- Ventricular diverticulum leads to neovascularization, when it grows and reaches the epicardium.

Key Words
Neovascularization · Ventricular diverticulum

Abstract
We present a case of congenital left ventricular diverticulum, associated with neovascularization involving the distal segments of all the coronary arteries. There were no other thoraco-abdominal or cardiac anomalies. To our knowledge, this is the first reported case of ventricular diverticulum associated with neovascularization in an adult.

Introduction

Ventricular diverticulum [1] is rare, presumably congenital, asymptomatic, and is usually found incidentally during cardiac catheterization. We present the case of a 38-year-old obese man with history of hypertension and hyperlipidemia, and atypical chest pain. Multislice computed tomography was performed at another hospital, reporting chronic total occlusion of the left circumflex coronary artery with pseudo-aneurysm of the left ventricle. Cardiac catheterization was subsequently performed in our hospital. He was found to have a congenital left ventricular diverticulum in association with neovascularization.

Case Report

A 38-year-old obese man with risk of coronary artery disease and atypical chest pain for three months was referred to our hospital. Multislice computed tomography of the patient (fig. 1) performed at other hospital reported chronic total occlusion of the left circumflex coronary artery with collaterals from left anterior descending coronary artery, together with pseudo-aneurysm of the left ventricle.

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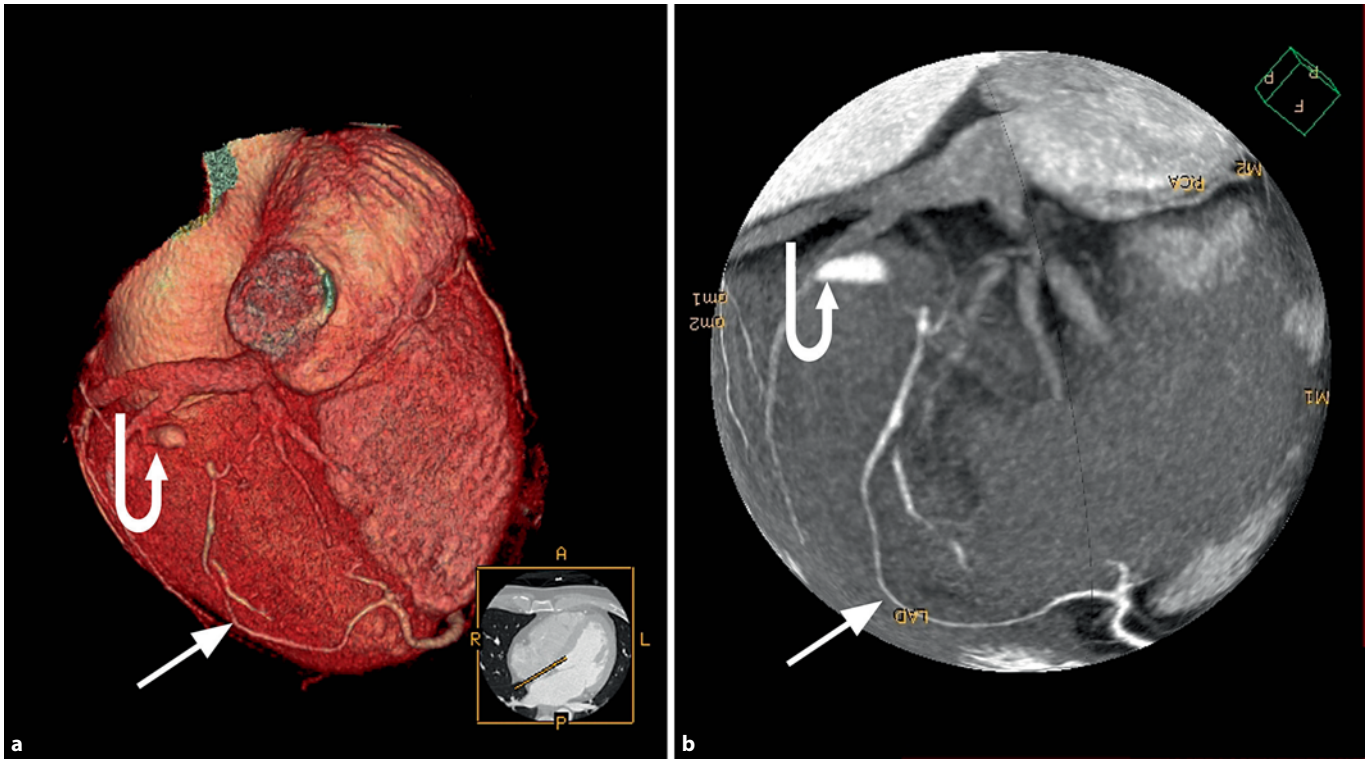

Fig. 1. 3D reconstruction (**a**) and multiplanar reformation (**b**) images of multislice computed tomography showing ventricular diverticulum (curved arrow) and neovascularization (arrow).

The patient had a history of hypertension and hyperlipidemia with regular outpatient management. He had no history of prior myocardial infarction or chest wall trauma. He did not smoke or drink alcohol.

At physical examination, his body temperature was 37 °C, pulse rate was 78 beats/min, respiratory rate was 20 breaths/min and blood pressure was 110/70 mm Hg. His breathing sound was clear, and heart rhythm was regular with no murmur. His abdomen was soft and peripheral pulses were intact. There was no peripheral edema, and a neurological examination was unremarkable. A complete blood count and blood chemistry profile was normal. Cardiac enzyme values were within normal limits. Chest X-ray was normal. Electrocardiography showed normal sinus rhythm. An echocardiogram demonstrated normal chamber size with normal left ventricular systolic function.

The patient then underwent cardiac catheterization. Left ventriculogram demonstrated a narrow neck ventricular diverticulum in the posteroinferior wall (fig. 2a, c). Coronary angiography showed a left dominant circulation, with normal coronary arteries. However, there were multiple diffuse neovascularizations involving distal segments of all the coronary arteries (fig. 2b, d). Based on these findings, the patient was diagnosed as having a congenital ventricular diverticulum associated with neovascularization. The decision to manage the patient medically was made, and he was discharged the following day.

Discussion

Ventricular diverticulum is a protrusion or saccular deformity of the ventricle, which is mostly described as a part of congenital malformation syndrome [2]. Congenital ventricular diverticulum is very rare malformation in adults [3]. It is usually isolated or associated with midline thoraco-abdominal defects or other cardiovascular malformations [3].

In our case, the findings of multislice computed tomography and cardiac catheterization clearly demonstrated a left ventricular diverticulum and ruled out significant coronary artery disease. The abnormal tortuous and dilated vascular structure was suggestive of neovascularization of the ventricular diverticulum, with communication to all coronary arteries.

Neovascularization is defined as the growth of new vessels, which occurs as a result of 3 different types of processes known as angiogenesis, arteriogenesis, and vasculogenesis [4]. Angiogenesis refers to the growth and development of new capillary blood vessels from pre-existing vasculature, usually stimulated by hypoxia, inflammation and ischemia [4]. Arteriogenesis is the pro-

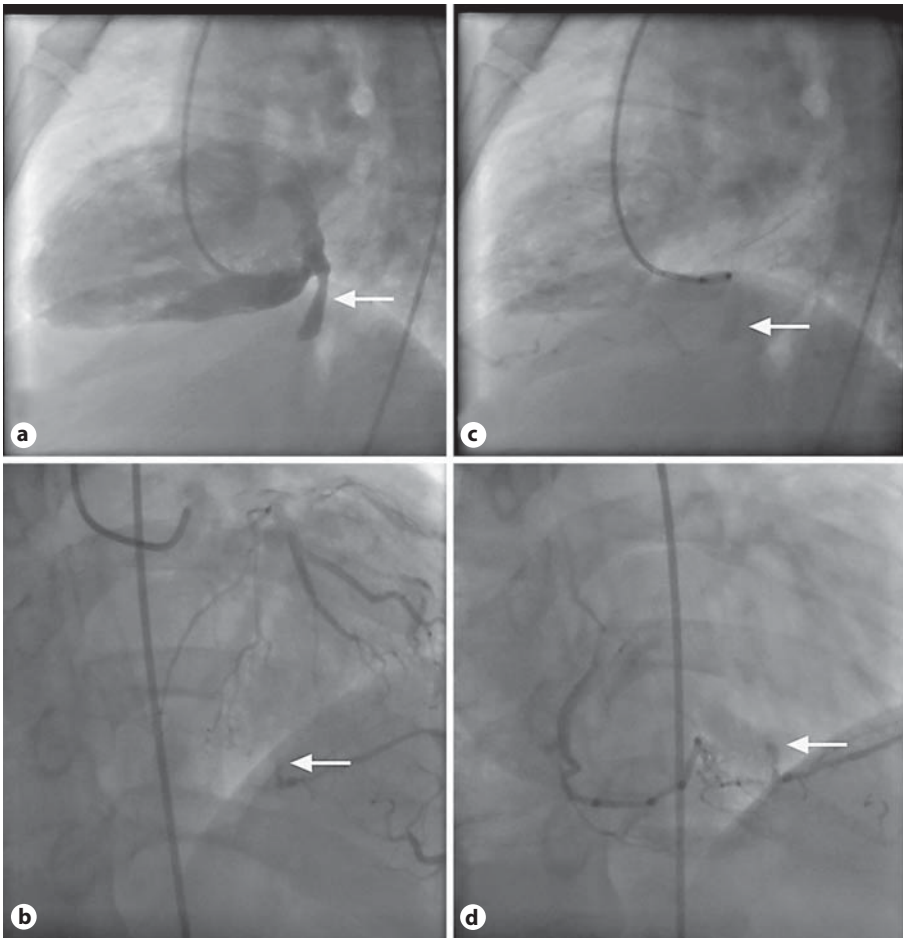

Fig. 2. Left ventriculography showing ventricular diverticulum (arrow) with neovascularization involving the coronary arteries (**a**, **c**). Coronary angiography showing neovascularization involving the left (**b**) and right (**d**) coronary arteries supplying the ventricular diverticulum (arrow).

cess of maturation or de novo growth of collateral conduits, usually stimulated by increased shear stress at site of arterial occlusion [4]. The clinical presentation of our patient is thus not compatible with angiogenesis or arteriogenesis as the cause of neovascularization.

Vasculogenesis refers to the process of in situ formation of blood vessels from endothelial progenitor cells [4]. It is known that the epicardium is a source of vascular progenitors containing precursors for fibroblasts, endothelial and smooth muscle cells [5]. We therefore believe that when the ventricular diverticulum grows and reaches the epicardium, as in our case, it may promote neovascularization by the process of vasculogenesis.

Possible etiologies of left ventricular diverticulum include developmental abnormalities, viral infections, and coronary anomalies leading to myocardial ischemia [3, 6, 7]. Since our patient had atypical chest pain and normal coronary arteries, and acquired etiology such as infection, ischemia and trauma was ruled out, we believe that his anomaly is probably congenital.

Ventricular diverticulum may be complicated by chest pain, myocardial ischemia, cardiac arrhythmias, sudden death, endocarditis, systemic emboli, heart failure, cardiac rupture and intraventricular obstruction [3, 8–10]. Whether or not the above cardiovascular complications may promote neovascularization by the process of angiogenesis from the coronary arteries to supply the ventricular diverticulum awaits further elucidation. Moreover, the incidence of coronary abnormalities in patients with ventricular diverticulum needs further evaluation.

In our case, both ventricular diverticulum and neovascularization are clearly demonstrated. There are no other thoraco-abdominal or cardiac abnormalities. This anomaly, to the best of our knowledge, is the first reported case of congenital ventricular diverticulum in association with neovascularization involving all coronary arteries. The clinical significance of and treatment strategies for ventricular diverticulum with or without neovascularization are worth further study.

References

1 Okereke OU, Cooley DA, Frazier OH: Congenital diverticulum of the ventricle. J Thorac Cardiovasc Surg 1986;91:208–214.
2 Hallali P, Iung B, Davido A, Binet JP, Leriche H, Corone P: Congenital divaerticulum of the right ventricle: report of two cases associated with other congenital heart defects. Am Heart J 1989;117:957–959.
3 Walton-Shirley M, Smith SM, Talley JD: Left ventricular diverticulum: case report and review of the literature. Cath Cardiovasc Diagn 1992;26:31–33.
4 Tirziu D, Simons M: Angiogenesis in the human heart: gene and cell therapy. Angiogenesis 2005;8:241–251.
5 Smart N, Risebro CA, Melville AAD, Moses K, Schwartz RJ, Chien KR, Riley PR: Thymosin induces adult epicardial progenitor mobilization and neovascularization. Nature 2007;445:177–182.
6 Gembruch U, Steil E, Redel DA, Hansmann M: Prenatal diagnosis of left ventricular aneurysm. Prenat Diagn 1990;10:203–209.
7 Treistman B, Cooley DA, Lufschanowski R, Leachman RD: Diverticululm or aneurysm of left ventricle. Am J Cardiol 1973;32:119–123.
8 Duygu H, Ozerkan F, Alcin M: Congenital left ventricular diverticulum as a cause of chest pain in an adult. Cardiol Young 2007;17:450–451.
9 Kosar F, Sahin I, Gullu H: Isolated large true contractile left ventricular diverticulum mimicking ischemia in an adult patient: a case report. Heart Vessels 2005;20:85–87.
10 Pradhan M, Dalal A, Kapoor A, Kumar S, Manisha R: Fetal left ventricular diverticulum presenting as dysrhythmia: Diagnosis and management. Fetal Diagn Ther 2008;23:10–14.