Double-chambered left ventricle discovered in patient with ruptured left ventricular aneurysm after myocardial infarction

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A thick-walled anomalous muscle shelf of double-chambered left ventricle.

Video clip is available online.

Central Message

Double-chambered LV is an extremely rare anomaly, especially in the adult population. We report a unique case of double-chambered LV discovered in a patient with ruptured LV true aneurysm.

See Commentaries on pages e195 and e197.

Double-chambered left ventricle (LV) is an extremely rare anomaly, especially in the adult population. Moreover, LV true aneurysm rupture after myocardial infarction in the setting of double-chambered LV has never before been reported. This case could be helpful for cardiologists and cardiovascular surgeons. We report a unique case of double-chambered LV discovered in an adult patient with a ruptured LV true aneurysm.

CLINICAL SUMMARY

A 55-year-old man presented with reported chest discomfort, shortness of breath, and syncope. On admission, he was in sinus rhythm with a heart rate of 120 beats/min, and his blood pressure was 70/40 mm Hg. A computed tomographic (CT) scan and an emergent echocardiography showed a massive pericardial effusion (Figure 1, A) and severe LV dysfunction. Hemorrhagic pericardial fluid (800 mL) was slowly drained, and hemodynamics immediately improved. Coronary angiography revealed a dissection of the distal left anterior descending coronary artery (Figure 1, B), and intra-coronary stent implantation was performed. Follow-up echocardiographic examination revealed a large outpouching of the LV apex that did not contract in synchrony with the ventricle (Video 1). A cardiac CT scan demonstrated a very large apical LV aneurysm with 2 distinct chambers separated by an abnormal muscle band (Figure 2). In

addition, the CT scan showed a rupture of the ventricular aneurysm and a contained extravasation into the pericardial cavity (Figure 3).

The patient underwent LV aneurysmectomy with an endoventricular patch repair. The aneurysm was very large and bulged in 2 directions (Figure 4, A, and Video 2). By making an incision in the large aneurysmal sac, we observed that the aneurysmal wall presented a thin layer of necrotic muscle and fibrous tissue, which is consistent with a chronic LV true aneurysm. We confirmed the presence of a thick-walled anomalous muscle shelf separating the apical LV aneurysm into 2 chambers, which proved that the LV aneurysmal change had occurred in a heart with a double-chambered LV. The anomalous muscle shelf was sufficiently wide, and both sides of the aneurysmal chamber were almost fully separated (Figure 4, B, and Video 2). In addition, there was a 3-cm separate aneurysm-like outpouching (Figure 4, C, and Video 2) at the anterolateral position from the apical aneurysm, which extended beyond the line of the large aneurysm. On physical examination of the inner wall, it had a very well-defined boundary

FIGURE 1. Initial computed tomographic scan and coronary angiography. A, Axial computed tomographic image shows a massive hemopericardium. B, Coronary angiography shows a dissection of the distal left anterior descending artery.

with a thin wall composed of mainly fibrous tissue with a few myocardial tissues, which obviously differs from the necrotic myocardium and scar tissue in the large aneurysm (Figure 4, D, and Video 2). The concealed rupture was most likely suspected to occur in this separate outpouching region. The large common anatomic defect of the aneurysm was closed with a Dacron polyester fabric patch. Postoperative CT scan showed the successful exclusion of the aneurysm and reconstruction of the LV. The patient was discharged on postoperative day 11 with no neurologic or cardiovascular sequelae and has been attending follow-up

appointments for 12 months at an outpatient clinic without any problems.

DISCUSSION

Double-chambered LV is a rare congenital anomaly characterized by the presence of 2 LV cavities separated by an abnormal muscle band. This condition in adult population is extremely rare, discovered incidentally during cardiac evaluations, and usually asymptomatic.¹ Double-chambered right ventricle (RV), in which the outflow tract of the RV is separated into a proximal high-pressure chamber and a distal low-pressure chamber, is more common than double-chambered LV. It can be caused by the presence of anomalous muscle tissue, hypertrophy of the endogenous trabecular bands, or an aberrant moderator band, all of which will typically result in progressive obstruction of the outflow tract of RV.² Several subtypes of abnormal muscle band have been described, such as anomalous parietal band dividing the RV, apical muscle shelf originating from the septomarginal trabeculation and extending toward the ventricular apex, and hypertrophy of apical trabeculations.² On the other hand, in terms of double-chambered LV, only a few cases have previously been described, and there is no definitive guideline that clarifies the morphologic nature of this anomaly. Albertucci and colleagues³ reported an adult patient with a large submitral ridge of muscular and fibrous tissue that divides the LV into 2 chambers, a high-pressure inflow chamber and a low-pressure outflow chamber.³ In most other case reports, however, abnormal muscle band attached to the LV lateral wall or within the

VIDEO 1. Echocardiography reveals a large outpouching of the left ventricular apex that did not contract in synchrony with the ventricle. Video available at: [https://www.jtcvs.org/article/S0022-5223\(19\)31413-8/fulltext](https://www.jtcvs.org/article/S0022-5223(19)31413-8/fulltext).

FIGURE 2. Cardiac computed tomographic scan showing an apical left ventricular aneurysm derived from double-chambered left ventricle. A, Three-dimensional computed tomographic reconstruction shows a large apical left ventricular aneurysm after myocardial infarction. B, Reconstructed 2-chamber view shows 2 parallel chambers separated by an incomplete thick-walled muscle band (*arrow*) in the apical left ventricular aneurysm. C, Axial computed tomographic image shows 2 distinct chambers separated by the anomalous muscle band (*arrow*). LV1, Septal chamber of double-chambered left ventricle; LV2, lateral chamber of double-chambered left ventricle.

apex has been described, which definitely separates the LV cavity into 2 parallel chambers, both connected by a common outflow segment.^{4,5} In the case presented here, we observed that prominent hypertrophied apical trabeculations fused together and formed an wide apical muscle shelf. It seems to be similar to anomalous muscle shelf that can be shown in double-chambered RV.²

Double-chambered LV in the adult population is not commonly associated with other congenital abnormalities and is thought to be a nonprogressive disease. Although there are no definite data regarding prognosis or outcomes, conservative treatment is recommended in most cases, unless double-chambered LV causes inlet and outlet

obstruction or presents serious complications requiring surgical intervention.^{1,3-5}

The late rupture of LV true aneurysm is extremely uncommon, because the fibrous scar after myocardial infarction is usually strong and is able to withstand the LV pressure.⁶ In the case presented here, however, the patient presented with a concealed rupture of ischemic LV true aneurysm in the setting of double-chambered LV. He had a small separate outpouching in the aneurysm, which had a well-defined boundary. We cautiously suppose that a pre-existing structural defect in the double-chambered LV might have been aggravated by myocardial infarction, changed to the small outpouching, and affected the rupture of LV. Masci and associates⁴ suggested that the structure of

FIGURE 3. Reconstructed 4-chamber view of cardiac computed tomographic scan showing concealed rupture of the left ventricular aneurysm after myocardial infarction. A, *Arrow point* shows a rupture of the ventricular aneurysm. B, *Arrow point* shows a contained extravasation into the pericardial cavity.

FIGURE 4. Intraoperative findings showing double-chambered left ventricle. A, A large apical left ventricular aneurysm bulging in 2 directions (arrows). B, The forceps indicate a thick-walled anomalous muscle shelf separating both chambers in the left ventricular aneurysm. The anomalous muscle shelf was sufficiently wide, and both sides of the aneurysmal chamber were almost fully separated. C, The arrow point indicates a 3-cm separate outpouching that extended beyond the line of the large aneurysm. D, The inner wall of the small outpouching lesion, which differs from the necrotic myocardium and fibrotic scar tissue, in the large aneurysm after myocardial infarction. The white arrow indicates thin, fibrous tissue. The yellow arrow indicates the remnants of muscular ridges. LV1, Septal chamber of double-chambered left ventricle; LV2, lateral chamber of double-chambered left ventricle.

the accessory chamber of double-chambered LV may be characterized by a thin wall and exhibit morphologic mixture with other congenital anomalies. In addition, some authors have featured images showing definite

recesses of what appeared to be a structural defect originated from an accessory chamber of double-chambered LV.^{4,5} We report here a unique case of double-chambered LV discovered in an adult patient with ruptured LV true aneurysm after myocardial infarction.

VIDEO 2. Video of the operation showing a double-chambered left ventricle and a small outpouching lesion. Video available at: [https://www.jtcvs.org/article/S0022-5223\(19\)31413-8/fulltext](https://www.jtcvs.org/article/S0022-5223(19)31413-8/fulltext).

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