Abstract

Background: Left-ventricular diverticulum (LD) associated with patent ductus arteriosus (PDA) is extremely rare. We have not found any previous reports of the coexistence of these two malformations. Such an association presenting with chest pain mimicking an infarct aneurysm with angina or a takotsubo cardiomyopathy with chest pain is difficult to differentiate clinically. Here, we discuss several diseases characterized by left-ventricular apical protrusion with chest pain to familiarize clinicians with the differential diagnosis of these diseases.

Case presentation: A 58-year-old woman was referred to our hospital because of complaints of chest pain and dyspnoea, mainly on exertion. An electrocardiograph on admission showed a q-wave in lead I, a Q-wave in lead aVL, and an abnormal T-wave in the limb leads and leads V4 to V6. A transthoracic echocardiograph revealed a PDA and a protrusion arising from the apex of the left ventricle. The diagnosis on admission was PDA and coronary artery disease with infarct aneurysm. To evaluate the source of the chest pain, further evaluations were performed. Coronary angiography showed no abnormal findings. Left ventriculography confirmed the presence of an apical contractile out-pouching. Based on these findings, we revised the diagnosis as LD associated with PDA. The patient underwent transcatheter occlusion of the PDA and was discharged 3 days later. Unexpectedly, transcatheter occlusion resolved the paroxysmal chest pain in this case.

Conclusion: This is the first case report of LD combined with PDA. PDA should be considered in the list of differential diagnosis of chest pain. Several diseases characterized by left-ventricular apical protrusion with chest pain, such as LD, infarct aneurysm and takotsubo cardiomyopathy, can be misdiagnosed as one another. Therefore, it is important to familiarize clinicians with the differential diagnosis of these diseases.

Keywords: Left-ventricular diverticulum, Patent ductus arteriosus, Coronary artery disease, Angina pectoris

Background

Left-ventricular diverticulum (LD) is a rare anomaly of out-pouching from the left ventricular wall. In adults, LD can be misdiagnosed as other types of heart disease, such as infarct aneurysm and takotsubo cardiomyopathy [1]. Adult patent ductus arteriosus (PDA) is also rare. In PDA cases, the most common symptoms are dyspnoea and palpitation. It is extremely rare for chest pain to be the main clinical presentation. Here, we reported on an adult LD and PDA case presenting with typical “angina pectoris” relieved by PDA occlusion, which was misdiagnosed as coronary artery disease with infarct aneurysm.

Case presentation

A 58-year-old woman was referred to our hospital because of complaints of chest pain and dyspnoea, mainly on exertion. The symptoms started at age 18, when she developed progressive dyspnoea and stabbing chest pain located at the cardiac apex, which relieved itself at rest. When she was 35 years old, a PDA was identified with no other cardiac anomaly present.
Subsequently, the PDA was surgically ligated through the left chest. The patient led a normal life for 15 years, at which point she started to complain of chest pain and dyspnoea again.

There was no significant history of psychological stress. Blood pressure was 104/44 mmHg. An electrocardiograph (ECG) on admission showed a q-wave in lead I, a Q-wave in lead aVL, and an abnormal T-wave in the limb leads and leads V4 to V6 (Fig. 1a). A chest x-ray showed cardiomegaly with increased pulmonary vascularity. A transthoracic echocardiograph revealed a suspicious coarctation of the aorta, a PDA with moderate shunt and a contractile protrusion arising from the apex of the left ventricle (Fig. 2a to d). The maximum internal end-diastolic diameters of the muscular protrusion were 2.0 cm × 1.5 cm, and the protrusion beat simultaneously with the enlarged left ventricle with normal ventricular function (ejection fraction 66 %) and wall motion. The pulmonary artery systolic pressure was 41 mmHg estimated by echocardiograph through tricuspid regurgitation velocity. The diagnosis on admission was coronary artery disease with infarct aneurysm, recurrent PDA after surgical ligation and suspicious coarctation of the aorta.

Further evaluations were performed because of suspicions about the true coarctation of the aorta and coronary artery disease with infarct aneurysm, recurrent PDA after surgical ligation and suspicious coarctation of the aorta.

Muscular LD is generally regarded as a functional accessory chamber. Surgical resection may impair partial ventricular function, and this type of diverticulum is less likely to rupture than the fibrous type. Conservative treatment and anticoagulant are recommended. Therefore, a nonsurgical strategy with careful follow-up was performed in this case.

Discussion

In the present case, the typical “angina pectoris” and left ventricular apical protrusion are two major factors for the misdiagnosis as coronary artery disease with infarct aneurysm. It is important to familiarize clinicians with the differential diagnosis of diseases with these two factors. The differential diagnosis for chest pain in this patient included LD causing chest pain, severe pulmonary hypertension with angina pectoris, PDA causing chest pain, infarct aneurysm with angina pectoris and takotsubo cardiomyopathy with chest pain.

Muscular LD is very rare in adults and is often complicated by other congenital cardiac or extracardiac malformations. We have not found any previous reports on the
Fig. 2 Echocardiogram showing a left-ventricular diverticulum (LD), a PDA and a suspicious coarctation of the aorta (SCOA) (a to d). LV, left ventricle; RV, right ventricle; LA, left atrium; RA, right atrium; AAO, ascending aorta; AO ARCH, aortic arch; DAO, descending aorta.

Fig. 3 Helical CT showing a PDA, a LD at the cardiac apex and a SCOA of no collateral circulation (a to d).
The coexistence of LD and PDA. Muscular diverticulum is generally found at the apical region and is seldom seen at the basal region [2, 3]. Most left ventricular diverticula are asymptomatic. Only a few reported cases presented with chest pain, and most of them were associated with coronary artery disease. Diverticulum as the cause of chest pain is extremely rare [4, 5]. In this case, the patient was symptom-free after PDA closure, although LD existed. Therefore, LD was not the primary cause of the chest pain.

Angina pectoris related to severe pulmonary hypertension is rarely reported in PDA patients. Because of extrinsic compression of the left main coronary artery, a massively dilated pulmonary artery caused by severe pulmonary hypertension can lead to significant myocardial ischaemia [6, 7]. In the present case, mild pulmonary hypertension-related chest pain is rare. The LA and LV were not significantly dilated. Therefore, the diverticulum was not the primary cause of angina pectoris.
aphy looked slightly like a resistance. Moreover, the ventricle apical protrusion (Fig. 4c and d). No emotional stress, normal cardiac enzyme values and a normal ECG ST-segment shape in the ventriculography should also be considered because the left ventricular row mouth. Takotsubo cardiomyopathy with chest pain was a normal ECG ST-segment, synchrony of the diverticulum, in patient, were a normal ECG ST-segment, synchrony, normal ventricular wall motion, and normal coronary artery and muscular wall, and a normal coronary steal and left-ventricular overload caused by PDA closure. The fact that chest pain and dyspnea were symptom-free. The mechanism of the chest pain is unclear, but may be related to the PDA left-to-right shunt. PDA should be considered in the list of differential diagnosis of chest pain.

Several diseases are characterized by left-ventricular apical protrusion accompanied by chest pain. LD with chest pain in an adult is often difficult to distinguish from left-ventricular infarct aneurysm with angina pectoris. The important diagnostic characteristics of diverticulum, in this patient, were normal ECG ST-segment, syncrony, normal ventricular function and wall motions, and the apical protrusion was contractile. A Helical CT showed lobulated LDs of sphere, sphere-like, lobulated, cord, and takeotsubo ballooning are usually larger than 2 to 3 cm. However, the neck diameters of an infant aneurysm and takeotsubo ballooning are usually larger than 2 to 3 cm. However, the neck diameters of an infant aneurysm and takeotsubo ballooning. The mechanism of the chest pain is unclear, but may be related to relatively lower perfusion pressure (diastolic pressure = 44 mmHg) of the coronary arteries before the PDA shunt. Looking the CT scan as well as the PDA angiogram did not show a distinct epicardial vascular supply but rather a tight muscular neck. This might explain the relatively immediate symptom relief after closing the duct. The cause of the chest pain is not clear. Although much hypertension (41 mmHg) of the coronary arteries before PDA closure, the chest pain was directly resolved first by PDA surgical ligation and later by transcatheter occlusion suggests that the chest pain was directly related to the PDA left-to-right shunt. PDA closure is considered in the list of differential diagnosis of chest pain.

Conclusion

Several diseases are characterized by left-ventricular apical protrusion accompanied by chest pain. LD with chest pain in an adult is often difficult to distinguish from left-ventricular infarct aneurysm with angina pectoris. The important diagnostic characteristics of diverticulum, in this patient, were normal ECG ST-segment, syncrony, normal ventricular function and wall motions, and the apical protrusion was contractile. A Helical CT showed lobulated LDs of sphere, sphere-like, lobulated, cord, and takeotsubo ballooning. The mechanism of the chest pain is unclear, but may be related to relatively lower perfusion pressure (diastolic pressure = 44 mmHg) of the coronary arteries before the PDA shunt. Looking the CT scan as well as the PDA angiogram did not show a distinct epicardial vascular supply but rather a tight muscular neck. This might explain the relatively immediate symptom relief after closing the duct. The cause of the chest pain is not clear. Although much hypertension (41 mmHg) of the coronary arteries before PDA closure, the chest pain was directly resolved first by PDA surgical ligation and later by transcatheter occlusion suggests that the chest pain was directly related to the PDA left-to-right shunt. PDA closure is considered in the list of differential diagnosis of chest pain.
Abbreviations
LD: Left-ventricular diverticulum; PDA: Patent ductus arteriosus;
ECG: Electrocardiograph; CT: Computed tomography; SCOA: Suspicious
coarctation of the aorta; LV: Left ventricle; RV: Right ventricle; LA: Left atrium;
RA: Right atrium; AAO: Ascending aorta; AO ARCH: Aortic arch;
DAO: Descending aorta; PA: Pulmonary artery.

Competing interests
The authors declare that they have no competing interests.

Authors’ contributions
HQ collected important background information and drafted the manuscript.
TQL and DW treated the patient during hospitalization. Transthoracic
echocardiography was performed by HYW. QL conducted the diagnosis and
critically reviewed the manuscript. All authors read and approved the final
manuscript.

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