Multimodal imaging of a left anterior descending artery fistula with a dissecting interventricular septal aneurysm: a case report

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Case presentation

A 37-year-old male attended for evaluation of an interventricular septal (IVS) mass incidentally discovered during a routine physical examination. On admission he was hypertensive at 153/85 mm Hg) with heart rate 93 bpm. Electrocardiogram findings revealed occasional premature ventricular contractions with horizontal ST-segment depression and T-wave inversion, suggestive of myocardial ischaemia. Laboratory results were normal. Transthoracic echocardiography (TTE) identified a well-defined, ovoid mass within the inferior segment of the IVS, appearing as a complex solid-cystic mass lesion. The mass measured approximately 35 × 31 × 40 mm^3 (anteroposterior × transverse × longitudinal) [Fig 1a]. The left ventricular apical cavity was compressed by the mass. Colour Doppler imaging showed blood flow within the lesion, with diastole filling and systole outflow (Fig 1b). Notably, the cystic cavity exhibited minimal changes during the cardiac cycle. Continuous-wave Doppler at the lesion (Fig 1c) revealed bidirectional blood flow across systole and diastole. Tracking revealed a 4.3-mm dilated coronary artery branch at the heart's apex as the flow's source, with no proximal stenosis or dilation in the coronary arteries. Contrast TTE (cTTE) detected a small (1-2 mm) left anterior descending (LAD) artery fistula within the IVS, with delayed cystic enhancement relative to the left ventricle but simultaneous with the IVS myocardium post-contrast, and no infiltration of the solid component (Fig 1d-e, SV1). These findings indicated the presence of a coronary artery fistula originating from the LAD artery that drains into an IVS forming a dissecting aneurysm.

Coronary computed tomography angiography showed no proximal left coronary artery dilation but mild distal dilation. The aneurysm showed significant enhancement and slight calcification, with no enhancement observed in the surrounding myocardium (Fig 1f). Cardiac magnetic resonance confirmed the findings, showing the mass with slightly high T1-weighted and predominantly high T2-weighted signal intensities, encircled by a low-signal intensity ring, with no significant myocardial enhancement post-contrast (Fig 1).

The patient underwent surgical correction of the coronary artery fistula and reduction of the dissecting aneurysm of the interventricular septum (DAIS). Intraoperatively, the LAD was observed penetrating the myocardium, forming a sac-like cavity due to the convergence of the coronary fistula into the myocardial layer of the IVS. Histopathology from a myocardial biopsy showed fibrosis (Fig 2a-d). At 3-month postoperative follow-up, TTE showed a reduced IVS cystic cavity (Fig 2e), and cTTE confirmed fistula closure with no contrast entering the cavity (Fig 2f).

Discussion

Cardiac space-occupying lesions include tumours and non-neoplastic conditions, occurring anywhere in the heart.[1] Dissecting aneurysm of the interventricular septum often results from a ruptured Valsalva aneurysm, myocardial infarction, or trauma.[2] Aneurysms within the IVS caused by congenital coronary artery fistulas are rare, with only a few reported cases.[3-5] These cases often present with marked dilation of the involved coronary artery trunk and dynamic fluctuations in the cystic cavity dimensions throughout the cardiac cycle. The cavity typically expands during diastole and contracts during systole.

In this case, the absence of dilation in the main trunk of the coronary artery could be attributed to the fistula's origin from a small branch of the LAD artery, with a narrow internal diameter and minimal shunting volume. As the patient was young, the coronary arteries exhibited greater elasticity, leading to a reduced propensity for dilation in the main trunk.

In this case, the cystic cavity in the IVS showed minimal size change throughout the cardiac cycle due to a blind-ending coronary artery fistula that prevented left ventricular communication. Chronic shunting from the coronary artery fistula led to the gradual enlargement of a dissecting aneurysm within the interventricular septum, compressing adjacent myocardium and branches of the coronary

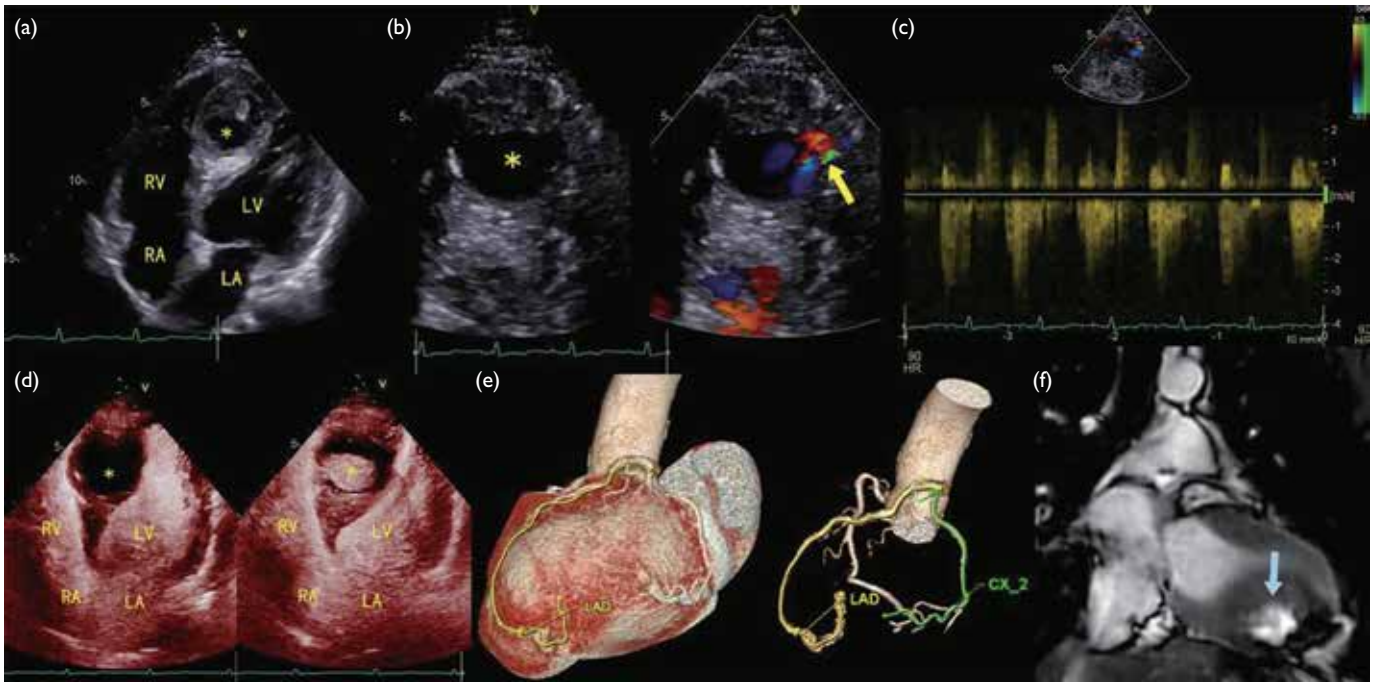

FIG 1. Preoperative imaging examination. (a) Transthoracic echocardiography (TTE) shows a cystic-solid echo area in the interventricular septum (IVS) at the apical four-chamber view (asterisk). (b) Colour Doppler demonstrates blood flow entering the cystic cavity (asterisk) through the fistula (yellow arrow). (c) Spectral Doppler shows bidirectional, high-velocity blood flow at the fistula site during systole and diastole. (d) Contrast TTE shows that the cystic cavity enhances later than the left ventricle, with no infiltration of the solid component. (e) Coronary computed tomography angiography confirms distal left anterior descending dilation into the IVS. (f) Cardiac magnetic resonance suggests a high signal in the cyst cavity, with surrounding myocardium showing low-signal intensity (blue arrow)

Abbreviations: CX_2 = distal segment of the left circumflex coronary artery; LA = left atrium; LAD = left anterior descending artery; LV = left ventricle; RA = right atrium; RV = right ventricle

arteries. This compression resulted in localised myocardial ischaemia and subsequent myocardial fibrosis, as demonstrated by both the patient's electrocardiogram and pathological findings. The fibrosis and high-velocity flow at the fistula site contributed to myocardial thickening and reduced elasticity, impairing the cavity's expansion and contraction, and resulting in minimal size variation.

Transthoracic echocardiography is often the initial imaging choice for coronary artery fistulas into the IVS, providing critical haemodynamic and anatomical data, but its limitations may result in misdiagnosis. Coronary computed tomography angiography and cardiac magnetic resonance provide detailed assessments of coronary anatomy and myocardial fibrosis, complementing TTE. Coronary computed tomography angiography provides diagnostic clarity with the caveat of radiation exposure, especially for repeated scans. Cardiac magnetic resonance, while valuable for its soft tissue characterisation, presents cost considerations for patients. Contrast TTE, valued for its safety, cost-effectiveness, and timeliness, excels in visualising myocardial perfusion and detecting congenital cardiac defects, enhancing diagnostic precision when TTE results are indeterminate. In our case, cTTE, with its high sensitivity to blood flow signals, rapidly delineated the shunt and accurately mapped the fistula. The contrast agent, perfusing the myocardium via the coronary arteries, resulted in delayed opacification of the interventricular septum compared with the left ventricle, thereby disclosing DAIS. This comprehensive diagnostic profiling was pivotal for tailored treatment strategies and prognostic enhancement. This marks the first instance, to our knowledge, where cTTE has been utilised to diagnose DAIS.

Author contributions

Concept or design: D Xie, G Yang, C Li.
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Analysis or interpretation of data: D Xie, H Li, X Hao, Y Zhang, M Xie, Y Xu.
Drafting of the manuscript: D Xie, G Yang, Y Xu.
Critical revision of the manuscript for important intellectual content: D Xie, G Yang, C Li, Y Xu.

All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

The authors declared no conflicts of interest.

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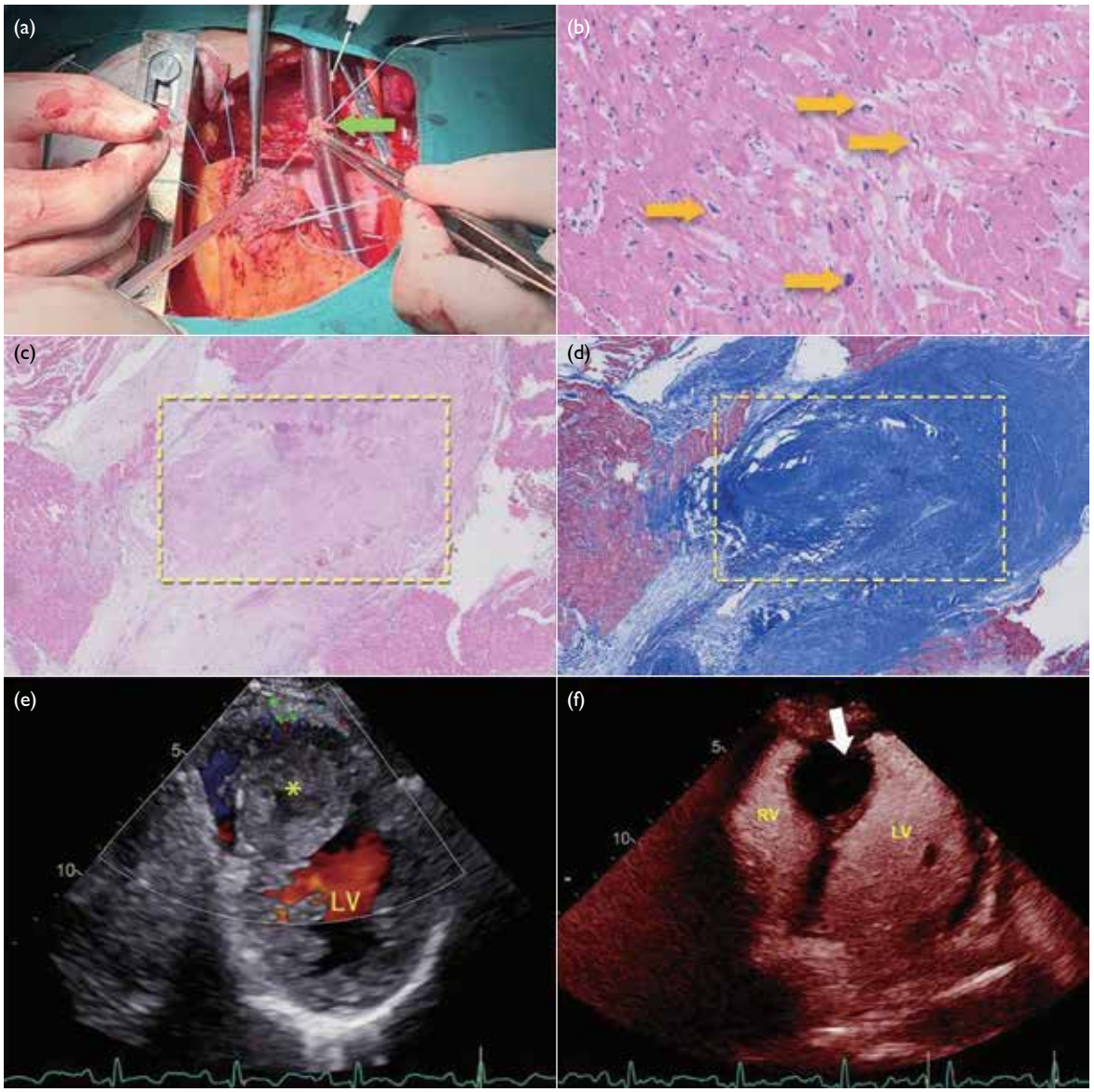

FIG 2. Surgical and postoperative assessment. (a) Intraoperative image shows resection of the solid component within the dissected aneurysm (green arrow). (b, c) Histology reveals myocardial degeneration (yellow arrows, 40×) and interstitial fibrosis (20×, dashed line box). (d) Masson's trichrome staining confirms interstitial fibrosis (20×, dashed line box). (e) Postoperative transthoracic echocardiography (TTE) demonstrates almost no visible interventricular septal cystic cavity, with no discernible colour Doppler flow signal (asterisk). (f) Contrast TTE confirms the absence of contrast in the fibrotic myocardium (white arrow)
Abbreviations: LV = left ventricle; RV = right ventricle

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Ethics approval

The patient was treated in accordance with the Declaration of Helsinki. The patient provided written consent for publication of this case report.

References

1. Maleszewski JJ, Anavekar NS, Moynihan TJ, Klarich KW. Pathology, imaging, and treatment of cardiac tumours. Nat Rev Cardiol 2017;14:536-49.
2. Zhang JP, Meng H, Wang H. Dissecting aneurysm of the interatrial and interventricular septum with concomitant ventricular septal defect-multimodality cardiac imaging and surgical repair. Echocardiography 2016;33:932-5.
3. Zhi Ku L, Xia J, Lv H, Song LC, Ma XJ. Giant interventricular septal dissecting aneurysm resulting from congenital coronary fistula. Circ Cardiovasc Imaging 2022;15:e013861.
4. Wu Q, Jin Y, Zhou L, Liu Y, Wu D. A dissecting aneurysm of interventricular septum resulting from congenital coronary artery fistula. J Clin Ultrasound 2019;47:55-8.
5. Tekinhatun M, Cihan F, Demir M. Interventricular septal dissecting aneurysm resulting from congenital coronary fistula: a case report. Echocardiography 2023;40:1140-3.