

Interventricular septum mass presenting as a late acute coronary syndrome with ST-segment elevation: a case report

Lucas Coroyer^{1*}, Philippe Garcon¹, Veronique Duchatelle², and Arshid Azarine³

¹Cardiology Department, Hopital Saint-Joseph, 185 Rue Raymond Losserand, 75014 Paris, France; ²Pathology Department, Hopital Saint-Joseph, 185 Rue Raymond Losserand, 75014 Paris, France; and ³Radiology Department, Hopital Saint-Joseph, 185 Rue Raymond Losserand, 75014 Paris, France

Received 2 July 2020; first decision 5 August 2020; accepted 7 April 2021

Background

Intracardiac masses are relatively rare but the diagnosis can be challenging for the cardiologist and the clinical presentation can be misleading. While most of the cardiac masses are benign, malignant masses are mostly metastatic tumours.

Case summary

An 81-year-old man was admitted to the cardiology department for congestive heart failure with the complaint of recent dyspnoea. The initial electrocardiogram was suggestive of a late presentation of an anterior myocardial infarction. Blood test showed mild and stable elevation of troponin and brain natriuretic peptide. Doppler-echocardiography revealed an interventricular septal thickening. Contrast echocardiography revealed a mass with a possibly necrotic centre and peripheral hypervascularization. Cardiac computed tomography (CT) confirmed the existence of a cardiac tumour with a hypodense centre and also revealed the presence of a large tumour of the lung's left lower lobe with multiple enlarged lymph nodes associated with possible left adrenal gland metastasis. Computed tomography-guided percutaneous biopsy of the pulmonary mass demonstrated a squamous cell lung cancer which was likely the primary cancer. The patient was discharged home waiting for chemotherapy to start but died a few days later at home of an unknown cause.

Discussion

Diagnosis of intracardiac mass is difficult, often requiring multiple imaging modalities. Contrast-enhanced echocardiography may help early diagnosis and can be easily implemented with other imaging modalities such as cardiac magnetic resonance imaging or CT.

Keywords

Case report • Contrast-enhanced echocardiography • Intracardiac mass • Cardiac computed tomography • Squamous cell lung cancer

Learning points

- Intracardiac masses are a challenging diagnosis, often multimodal, with wide therapeutic implications (from abstention to cardiac surgery).
- Diagnostic accuracy of standard echocardiography can be easily enhanced at the bedside with a contrast agent, and an even greater amount of information can be obtained by a myocardial perfusion study which can be processed at the same time by lowering the mechanical index.
- Not all ST-segment elevation is an indication of ischaemia and differential diagnosis should be evocated when the presentation is atypical.

* Corresponding author. Tel: +336 72 11 34 72, Email: lucas.coroyer@gmail.com

Handling Editor: Richard Alexander Brown

Peer-reviewers: Piotr Nikodem Rudzinski and Sameh Shaheen

Compliance Editor: Linh Ngo

Supplementary Material Editor: Fanbienne Vervaat

© The Author(s) 2021. Published by Oxford University Press on behalf of the European Society of Cardiology.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited. For commercial re-use, please contact journals.permissions@oup.com

Introduction

Intracardiac tumours are relatively rare and more often benign. Among malignant tumours, metastatic tumours are the most common neoplasm of the heart.^{1,2}

The clinical presentation ranges from asymptomatic to dyspnoea, chest pain, or arrhythmia.

Transthoracic echocardiography (TTE) is the first-line examination tool and can assess intracardiac masses with a diagnostic sensitivity of 93.3%.³ Its performance can be enhanced by the addition of a contrast agent, helping to better discriminate endothelial borders, myocardium and may help to better characterize the myocardial tumour.⁴

However, initial diagnosis may be difficult and is often multimodal thanks to other cardiac imaging techniques such as cardiac magnetic resonance imaging (CMR) and computed tomography (CT)-scan.

Authors report here an atypical case of lung cancer with cardiac metastasis presenting initially as a late acute coronary syndrome.

Timeline

Date	Events
Few years ago	Stress test is performed, showing anterior ischaemia. Coronary angiography demonstrated stenosis of the mid-left anterior descending artery and a calcified stenosis of the proximal circumflex artery. One drug-eluting stent was placed in the mid-left anterior descending artery.
Early October 2019	Sustained ventricular tachycardia. No new lesion on the coronary angiography. Implantable cardioverter-defibrillator implantation.
Mid-November 2019	One-month post-implantation consultation. No symptoms.
Late November 2019	Onset of moderate exertional dyspnoea
24 December 2019	Physician consultation for worsening of the dyspnoea. Electrocardiography shows anterior ST-segment elevation.
26 December 2019	Contrast-enhanced echocardiography reveals a mass of the septum wall. Computed tomography of the heart confirms the mass and shows voluminous pulmonary tumour.
30 December 2019	Computed tomography-guided percutaneous biopsy of the pulmonary tumour is performed. Pathology shows squamous cell lung cancer
03 January 2020	Patient is proposed with chemotherapy and discharged from hospital.
05 January 2020	Death from unknown cause.

Case presentation

An 81-year-old man, former smoker, was admitted to our cardiology department for congestive heart failure with the complaint of recent onset of dyspnoea. He had a history of ischaemic heart disease with stenting of the mid-left anterior descending artery. Two months before his admission, the patient received an implantable cardioverter-defibrillator (ICD) for sustained ventricular tachycardia.

Upon arrival, blood pressure was 130/70 mmHg, heart rate 72 b.p.m., and oxygen saturation 95% with 3 L/min of oxygen. Physical examination demonstrated signs of decompensated heart failure with no evidence of any heart murmur.

The initial electrocardiogram (ECG) (Figure 1) showed a sinus rhythm with abnormal R-wave progression and ST-segment elevation in leads V2–V5 and II, III, aVF, suggesting a late presentation of an acute myocardial infarction. The previous ECG, performed 2 months before, showed only negative T-waves in V2–V3 with normal R-wave progression (Figure 1).

Blood tests demonstrated mild elevation of cardiac enzymes with ultrasensitive troponin I at 83 ng/L (normal <26 ng/L) and brain natriuretic peptide at 1400 pg/L (normal <100 pg/L). A moderate systemic inflammatory response syndrome was noted with an elevated C-reactive protein at 93 mg/L (normal <4 mg/L) and white blood cell counts at 14 G/L (normal <10 G/L).

As coronary angiography 2 months before, prior to his ICD implantation, had shown no new significant stenosis, it has been decided not to perform an emergency coronary angiography.

Transthoracic echocardiography (TTE) was performed and showed a known impaired left ventricular ejection fraction of 40% due to inferior and posterior wall akinesia. Transthoracic echocardiography also demonstrated a thickening or a mass of the apical and median portion of the interventricular septum (IVS) (Video 1, Figure 2A) measured 5 cm × 3 cm, associated with moderate pericardial effusion. Contrast-enhanced TTE using low mechanical index (MI) imaging settings (MI at 0.23) revealed a myocardial mass involving the apex of both left and right ventricles (Video 2, Figure 2B). Mechanical index was then decreased to 0.07 with an intermittent flash of a high mechanical index to assess the vascularization of the tumour (Video 3), demonstrating a peripheral contrast enhancement suggestive of a necrotic centre with peripheral hypervascularization, consistent with a myocardial malignant tumour (Figure 2C).

To better characterize the cardiac mass, cardiac CT was preferred as a second line exam to CMR, considering the recent ICD implantation. An ECG-gated cardiothoracic contrast-enhanced CT-scanner was performed (Figure 3A) demonstrating an important thickening of the apical part of the IVS at the arterial phase (Figure 3B) and moderate pericardial effusion. Delayed acquisition at 2 min confirmed an intra-septal apical mass of 6 cm × 4 cm × 8 cm with a hypodense centre and peripheral enhancement consistent with the diagnosis of a malignant tumour with a necrotic central area (Figure 3C).

Interestingly, cardiac-CT also revealed a voluminous mass of the lung's left lower lobe (LLL) measured at 9 cm × 6 cm with multiple mediastinal lymph nodes and a possible left adrenal gland involvement. Computed tomography-guided percutaneous biopsy of the LLL mass demonstrated a squamous cell lung cancer (Figure 4).

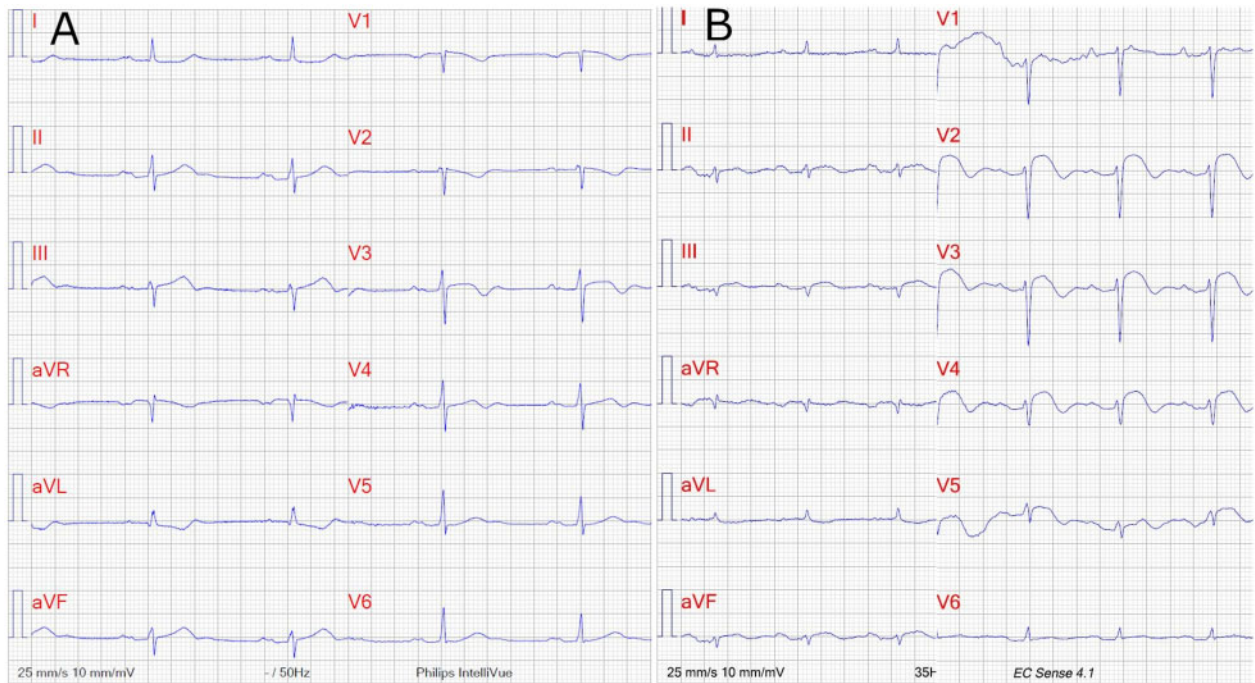


Figure 1 Twelve-leads electrocardiogram performed 2 months before the event (A) showing negative T-waves in V2–V3 and at the time of presentation (B) showing abnormal R-waves progression in precordial leads, ST-segment elevation and negatives T-waves in anteroseptal, and inferior territories.

The final diagnosis was a Stage IVB (according to the Union for International Cancer Control) large squamous cell lung cancer possibly spreading to the heart and the left adrenal gland.

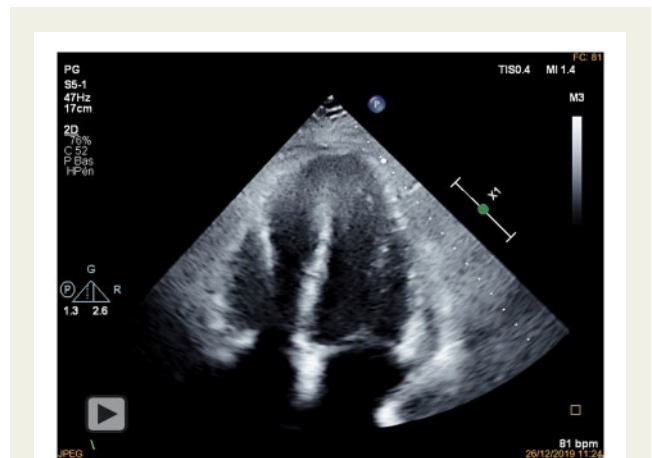
The signs of decompensated heart failure resolved after low-dose intravenous furosemide therapy and the patient was discharged home before chemotherapy with Carboplatin and Paclitaxel. He unfortunately died 2 days later at home from an unknown cause. We could not perform autopsy nor device interrogation because of the family's opposition to further investigate the cause of death.

Discussion

Incidental finding of a cardiac mass is challenging for cardiologists. Initial transthoracic echocardiography plays a central role and therapeutic consequences may range from conservative management to more invasive management, i.e. cardiac surgery.

The prevalence of cardiac tumours in the general population is very low, estimated between 0.001 and 0.3% in autopsy studies.¹ About three out of four are benign tumours including myxoma, fibroelastoma, and lipoma.³ Malignant tumours are most frequently metastases, mostly from lung and blood cancer but remain often clinically silent and are often diagnosed post-mortem.^{2,5}

In our report, the acute coronary syndrome (ACS) presentation of our patient was very atypical, even though, already described in the literature.^{6,7} Indeed, most cardiac masses are asymptomatic and are discovered during a routine examination or baseline echocardiography prior to chemotherapy, but our patient had no medical history



Video 1 Standard apical four-chambers view with poor echogenicity showing septal wall akinesia and thickening, and moderate pericardial effusion.

of cancer. Nevertheless, some patients may present with dyspnoea, chest pain,⁸ ventricular arrhythmia,⁹ conduction disturbance¹⁰ or, similar to our patient, mimic an acute myocardial ischaemic event.^{6,7} Previous explanations have been proposed to better understand ACS presentation, including inflammation and potassium abnormalities inside and around the tumour and mechanical stress on fibres adjacent to the tumour mimicking ischaemic ECG patterns.^{6,7} In our

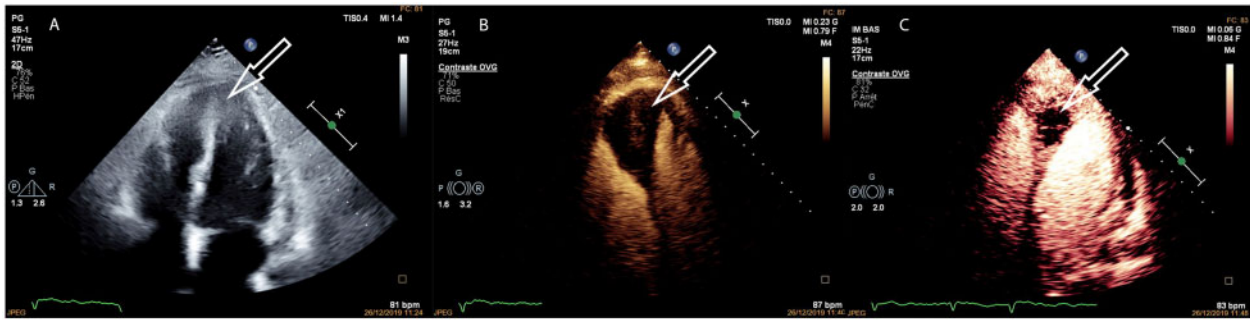
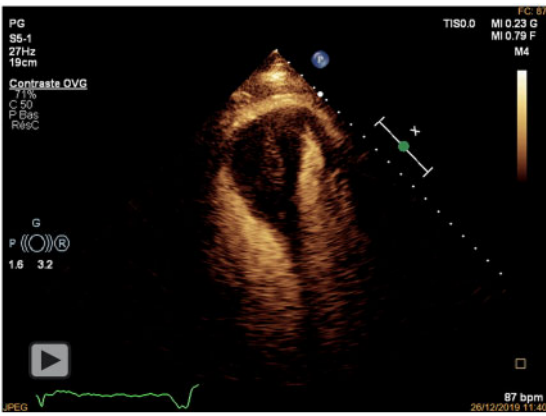
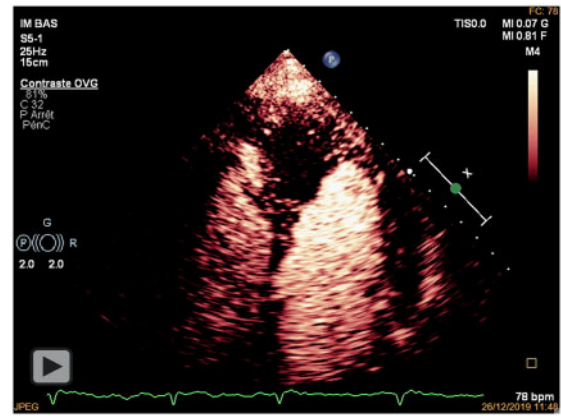


Figure 2 Transthoracic echocardiography, apical four-chamber view without contrast agent (A) of the mass (arrows), after contrast injection using low mechanical index (B), and late perfusion using very low mechanical index (C) suggestive of a necrotic central area (arrow).



Video 2 Apical four-chambers view after contrast agent injection with low mechanical index (0.23) demonstrating a large septum's mass invading both left and right ventricles' apices.



Video 3 Perfusion study in apical four-chamber view during contrast agent infusion with very low mechanical index (0.07). The high mechanical index flash reveals the centripetal vascularization of the mass and the necrotic, avascular central area.

case, we hypothesized that the electric abnormalities could be explained by the intra-tumoral necrosis.

Standard TTE is the first-line test enabling mass detection and providing information about its localization (pericardial, intramyocardial, or intracavitary), size, mobility, shape, echogenicity, and its relationship with other structures at the bedside.

The use of additional contrast agents may improve TTE performances enabling a better differentiation between different types of cardiac masses. In a prospective study aimed to assess the discrimination between thrombi, myxoma and malignant tumour, contrast echocardiography showed excellent sensitivity and specificity, improving interobserver variability.¹¹ Both the *European Association of Cardiovascular Imaging* and the *American Society of Echocardiography* recommend the use of contrast echocardiography for the evaluation of intracardiac masses, in particular when MRI is unavailable.^{12,13} The use of contrast agent needs specific imaging settings including a low mechanical index (0.1–0.3) which are now widely available on all echocardiograms.

Using a very low mechanical index (near 0.1) after a high mechanical index flash, enable trained echocardiographers to assess tumoral

vascularization and compare it with the adjacent myocardium. This may help to better discriminate between malignant and benign cardiac tumours, particularly when they are located inside the myocardium. Kirkpatrick *et al.*⁴ and Wang *et al.*⁸ demonstrated that by using semi-quantitative or quantitative measurements, operators could differentiate between malignant tumours (abnormal neovascularization, enhanced or hyper-enhanced tissular mass), benign tumours (poor vascularization, only partially enhanced), and thrombi and fibroelastoma (no vascularization at all).¹²

Cardiac MRI and cardiac-CT are recognized modalities to characterize cardiac tumours.¹⁴ In our case, the presence of ICD limited the assessment by cardiac MRI. Cardiac CT-scanner confirmed contrast-enhanced echocardiography findings and more importantly, revealed a voluminous suspect pulmonary tumour with a high probability of adrenal gland metastasis.

Differential diagnoses have been suggested before contrast-enhanced TTE such as intracardiac thrombus and primitive hypertrophic cardiomyopathy, ruled out by the tumoral enhancement



Figure 3 Axial views of the cardiac electrocardiogram-gated computed tomography scanner of the patient, without contrast (A), at arterial phase (B) and 2 min (C) after iodine contrast media injection. Moderate pericardial effusion (thick arrow) is seen mostly next to the lateral left ventricular wall (A–C). Slightly spontaneously hypodense (A) apical mass (thin arrow) inducing a thickening of the interventricular septum is demonstrated (B) with a central necrotic hypodense component at the delayed phase (C). Interestingly on the same slice a voluminous suspicious lower left lobular pulmonary mass of 9 cm × 6 cm is demonstrated (*).

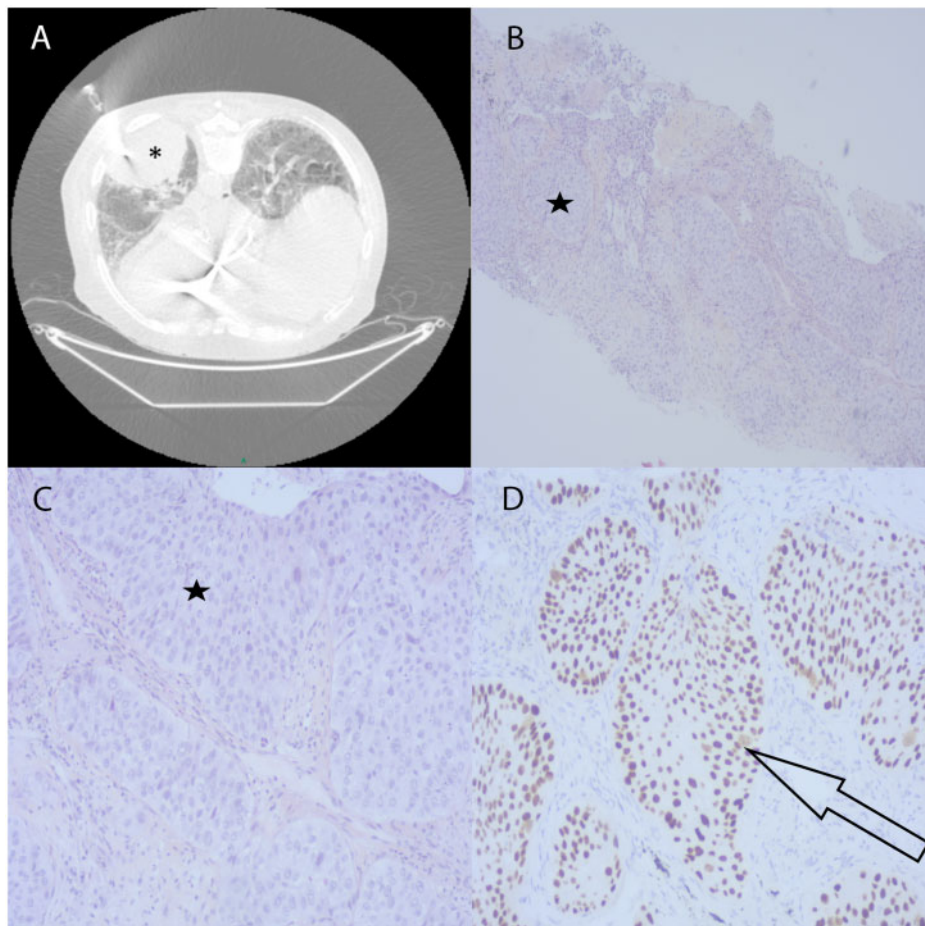


Figure 4 Computed tomography-guided percutaneous biopsy of the left lower lobe mass (A) haematoxylin and eosin stain showing extensive tumoral infiltration (★) with low (B) and high magnification (×200) with cells with large eosinophilic cytoplasm and intercellular bridges (C). Positive immunostaining of P40 antigen confirming the squamous nature of the tumour (D) (arrow, brown coloration).

pattern of the mass after contrast injection. Haematoma from ischaemic or traumatic origin was also unlikely because of the perfusion pattern and the low levels of troponin.

Our case illustrates how a multimodality non-invasive approach using contrast perfusion echocardiography and cardiac-CT scanner enabled a rapid diagnostic shift from an acute coronary syndrome in a patient with no history of cancer to an unexpected cardiac metastasis of lung cancer.

Lead author biography



Lucas Coroyer graduated in medicine at Université de Paris in 2016 and is currently completing his internship in general cardiology in Paris.

Supplementary material

[Supplementary material](#) is available at *European Heart Journal - Case Reports* online.

Acknowledgements

The authors would like to thank Prof. Michel Komadja for his kind proofreading.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

Consent: The patient reported in this case is deceased. Despite the best efforts of the authors, they have been unable to contact the patient's next-of-kin to obtain consent for publication. Every effort

has been made to anonymize the case. This situation has been discussed by a local ethics board and with the editors.

Conflict of interest: None declared.

Funding: Hopital Saint-Joseph, 185 Rue Raymond Losserand, 75014 Paris, France.

References

- Lam KY, Dickens P, Chan AC. Tumors of the heart. A 20-year experience with a review of 12,485 consecutive autopsies. *Arch Pathol Lab Med* 1993;**117**:1027–1031.
- Klatt EC, Heitz DR. Cardiac metastases. *Cancer* 1990;**65**:1456–1459.
- Meng Q, Lai H, Lima J, Tong W, Qian Y, Lai S. Echocardiographic and pathologic characteristics of primary cardiac tumors: a study of 149 cases. *Int J Cardiol* 2002;**84**:69–75.
- Kirkpatrick JN, Wong T, Bednarz JE, Spencer KT, Sugeng L, Ward RP et al. Differential diagnosis of cardiac masses using contrast echocardiographic perfusion imaging. *J Am Coll Cardiol* 2004;**43**:1412–1419.
- Silverman NA. Surgical progress: primary cardiac tumors. *Ann Surg* 1980;**191**:127–138.
- Hartman RB, Clark PI, Schulman P. Pronounced and prolonged ST segment elevation: a pathognomonic sign of tumor invasion of the heart. *Arch Intern Med* 1982;**142**:1917–1919.
- Abe S, Watanabe N, Ogura S, Kunikane H, Isobe H, Yamaguchi E et al. Myocardial metastasis from primary lung cancer: myocardial infarction-like ECG changes and pathologic findings. *Jpn J Med* 1991;**30**:213–218.
- Wang X, Li Y, Ren W, Yu X, Tan X. Clinical diagnostic value of contrast-enhanced ultrasonography in the diagnosis of cardiac masses: a pilot study. *Echocardiography* 2020;**37**:231–238.
- Domínguez-Pérez L, Arias MA, Juliá-Calvo J, Bartolomé-Mateos S, Santos-González B, Colchero T et al. Unusual case of an intramyocardial tumor presenting with a ventricular tachycardia. *Circulation* 2012;**125**:3246–3249.
- Wolver SE, Franklin RE, Abbate A. ST segment elevation and new right bundle branch block: broadening the differential diagnosis. *Int J Cardiol* 2007;**114**:247–248.
- Mansencal N, Revault-d'Allonnes L, Pelage J-P, Farcot J-C, Lacombe P, Dubourg O. Usefulness of contrast echocardiography for assessment of intracardiac masses. *Arch Cardiovasc Dis* 2009;**102**:177–183.
- Porter TR, Mulvagh SL, Abdelmoneim SS, Becher H, Belcik JT, Bierig M et al. Clinical applications of ultrasonic enhancing agents in echocardiography: 2018 American Society of Echocardiography Guidelines Update. *J Am Soc Echocardiogr* 2018;**31**:241–274.
- Senior R, Becher H, Monaghan M, Agati L, Zamorano J, Vanoverschelde JL, et al. EACVI Scientific Documents Committee for 2014–16 and 2016–18. Clinical practice of contrast echocardiography: recommendation by the European Association of Cardiovascular Imaging (EACVI) 2017. *Eur Heart J Cardiovasc Imaging* 2017;**18**:1205–1205.
- Pazos-López P, Pozo E, Siqueira ME, García-Lunar I, Cham M, Jacobi A et al. Value of CMR for the differential diagnosis of cardiac masses. *JACC Cardiovasc Imaging* 2014;**7**:896–905.