Case 01/2015 - 66 Year Old Woman with Hypertensive Cardiopathy and Acute Decompensated Heart Failure

Raphael Marion Pesinat, Alice Tatsuko Yamada, Luiz Alberto Benvenuti

Instituto do Coração, Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo (USP), São Paulo, SP – Brazil

A 66-year-old woman, native of Venturosa (Pernambuco, Brazil) and resident of São Paulo (São Paulo, Brazil), was hospitalized for intense dyspnea on June 8, 2013.

At 61years of age (on February 26, 2007), the patient was initially examined at the Heart Institute (InCor) with the complaint of dyspnea during daily life activities and paroxysmal nocturnal dyspnea since 1 year. The dyspnea was observed 3 years prior, initially upon greater efforts along with palpitations, nausea, and pain in the lower limbs. She complained of chest pain after emotional upset.

She presented a history of arterial hypertension and diabetes mellitus since the age of 56 as well as mixed dyslipidemia and hyperuricemia.

Physical examination showed a heart rate of 72 bpm, blood pressure of 140/90 mmHg, and jugular stasis. Crackle was heard at the lung bases. Cardiac auscultation revealed a split first heart sound. Abdominal examination showed no abnormalities. Further, no edema was observed in the lower limbs, and the pulses were symmetrical.

An ECG performed in February 2007 revealed sinus rhythm, heart rate of 67 bpm, left bundle branch block, and left ventricular hypertrophy (Figure 1).

In April 2007, laboratory tests revealed the following values: red blood cell 4.7 million /mm^3, hemoglobin 13.4 g/dL, mean corpuscular volume 83 fL, leukocytes 7,700/mm^3 (51% neutrophils, 2% eosinophils, 39% lymphocytes, and 8% monocytes), platelets 236,000/mm^3, cholesterol 196 mg/dL, high density lipoprotein-cholesterol (HDLC) 39 mg/dL, low density lipoprotein-cholesterol (LDLC) 102 mg/dL, triglycerides 350 mg/dL, glucose 100 mg/dL, creatinine 0.97 mg/dL, urea 41 mg/dL, sodium 143 mEq/L, potassium 4.5 mEq/L, glycosylated hemoglobin 6.3%, thyroid stimulating hormone (TSH) 5.49 μUI/mL, free T4 1.0 ng/dL, AST 22 U/L, ALT 30 U/L, brain natriuretic peptide (BNP) 115 pg/mL, and uric acid 7.3 mg/dL. Serological testing for Chagas disease was negative.

Medications included spironolactone 25 mg, carvedilol 6.25 mg, furosemide 40 mg, losartan 100 mg (cough was reported with use of captopril), allopurinol 100 mg, simvastatin 20 mg, acetylsalicylic acid 100 mg, metformin 2,550 mg, glibenclamide 10 mg, and NPH insulin 30 U per day.

An echocardiogram on April 26, 2007 showed aortic diameter of 32 mm and left atrial diameter of 44 mm, interventricular septum thickness of 9 mm, posterior wall thickness of 10 mm, left ventricular diameter (systolic/diastolic) of 81/74 mm, ejection fraction of 18%, diffuse hypokinesia of the left ventricle, and normal valves.

Myocardial scintigraphy conducted in November 2008 revealed discrete fixed hypercaptation in medial and apical portions of the anteroseptal wall, and there was no redistribution of thallium-201 reinjection. There was diffuse hypokinesia and anteroapical dyskinesia, and the ejection fraction was 11% (Figures 2 and 3).

The patient was asymptomatic with controlled blood pressure and no edema until an outpatient consultation in December 2012.

In February 2012, another echocardiograph was conducted which showed aortic diameter of 33 mm, left atrial diameter of 54 mm, right ventricular diameter of 27 mm, interventricular septum thickness of 10 mm and rear wall thickness of 11 mm with a left ventricular diameter (systolic/diastolic) of 83/75 mm, left ventricular ejection fraction of 20%, diffuse hypokinesia of the left ventricle, and moderate failure of the mitral valve.

Laboratory tests conducted in November 23, 2012 revealed the following values: hemoglobin 13 g/dL, hematocrit 41%, mean corpuscular volume 89 fL, leukocytes 6.040/mm^3 (63% neutrophils, 5% eosinophils, 27% lymphocytes, and 5% monocytes), platelet 209,000/mm^3, cholesterol 164 mg/dL, triglycerides 275 mg/dL, glucose 125 mg/dL, urea 43 mg/dL, creatinine 0.96 mg/dL, sodium 142 mEq/L, potassium 4.4 mEq/L, AST 17 UI/L, ALT 29 U/L, glycosylated hemoglobin 6.1%, TSH 4.14 μUI/mL, free T4 1.06 ng/dL, prothrombin activation time (PAT) according to the *International Normalized Ratio* (INR) of 1.1, and activated partial thromboplastin time (aPTT) times of 0.98.

An X-ray on June 3, 2012 revealed accentuated cardiomegaly and cephalization of the pulmonary vasculature (Figures 4 and 5).

The patient sought emergency medical attention for worsening of dyspnea, which had begun 3 days prior, accompanied by a dry cough and no fever. Patient was taking carvedilol 25 mg, furosemide 40 mg, spironolactone 25 mg, atorvastatin 20 mg, ciprofibrate 100 mg, metformin 2550 mg, acetylsalicylic acid 100 mg, and 30 IU of NPH insulin.

Keywords

Hypertension; Heart Diseases / physiopathology; Bronchopneumonia; Heart Arrest.

Mailing Address: Vera Demarchi Aiello •
Avenida Dr. Enéas de Carvalho Aguiar, 44, subsolo, bloco I, Cerqueira César.
Postal Code 05403-000, São Paulo, SP – Brazil
E-mail: demarchi@cardiol.br, vera.aiello@incor.usp.br

DOI: 10.5935/abc.20150046

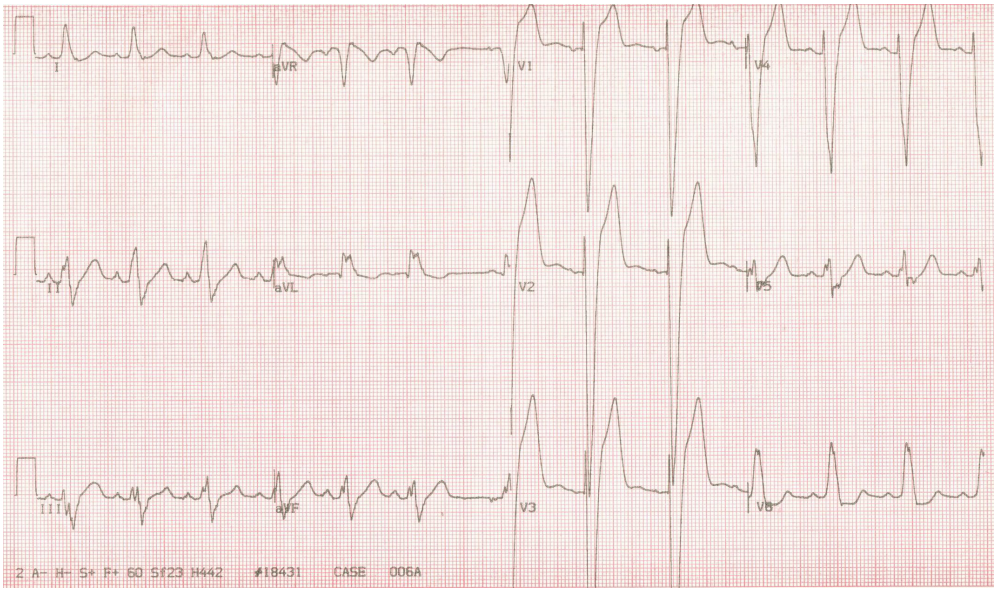

Figure 1 – *Electrocardiogram. Sinus rhythm, left bundle branch block, and left ventricular hypertrophy.*

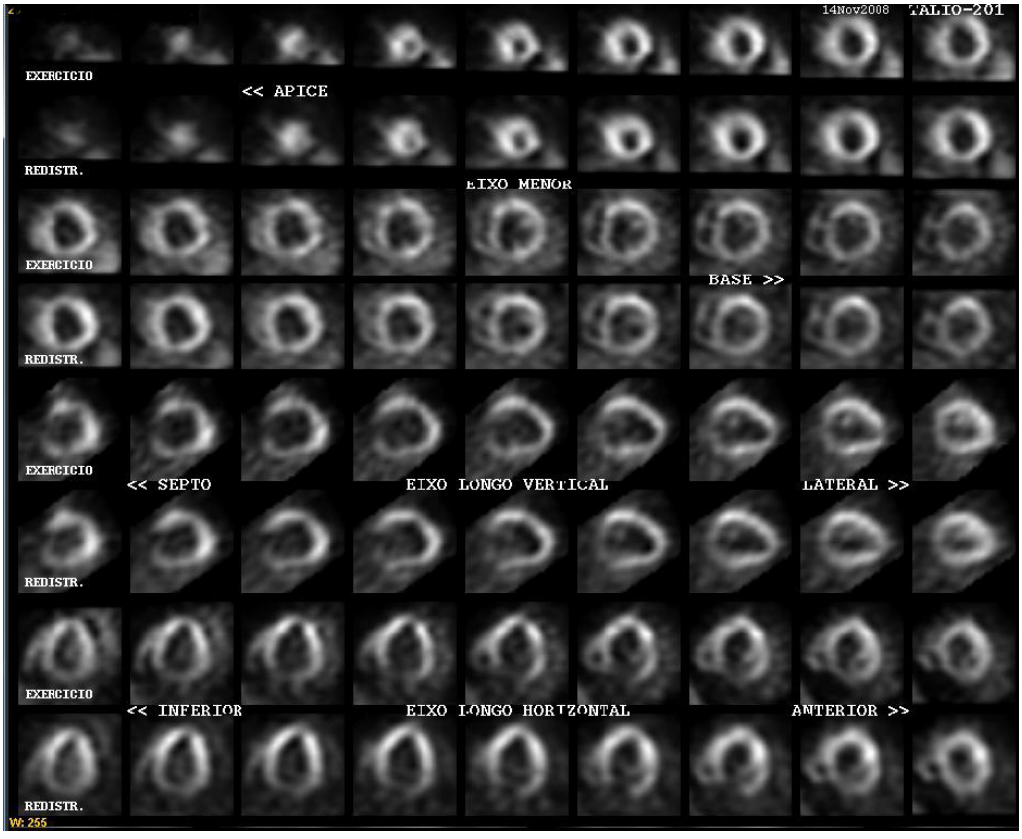

Figure 2 – *Myocardial perfusion scintigraphy with thallium-201. Homogeneous captation and dilatation of the left ventricle.*

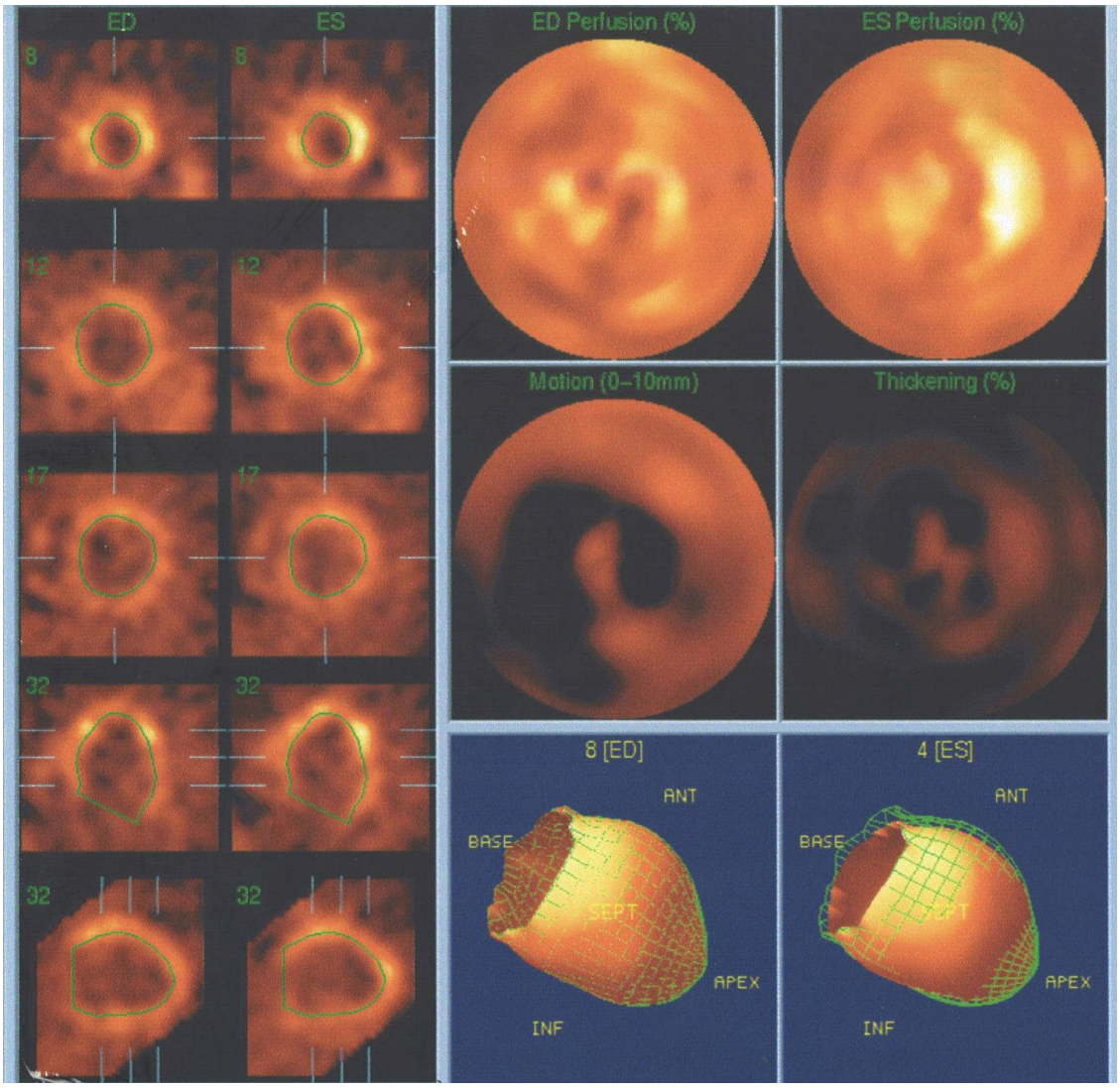

Figure 3 – *Ventriculography via myocardial scintigraphy. Diffuse hypokinesia and anteroapical dyskinesia, ejection fraction 11%.*

She reported taking antibiotics to treat pneumonia and a urinary tract infection 30 days prior to seeking emergency care.

Upon physical examination on June 8, 2013, the patient was in her regular general state, cyanotic, with tachydyspnea, respiratory rate of 40 rpm, heart rate of 110 bpm, and blood pressure of 140/100 mmHg. There was crackling stridor up to the apex of both the lungs, hypophonic heart sounds, abdomen without alterations, and edema of the lower limbs ++/4+; the patient's wrists were symmetrical. The patient was diagnosed with acute edema of the lungs and was administered furosemide 20 mg and morphine bolus 3 mg along with initiation of continuous intravenous nitroglycerin 5 μg/min and non-invasive ventilation (Figure 6).

An electrocardiogram on June 8, 2013 (9:24 a.m.) revealed a probable sinus rhythm with broad complexes and left ventricular overload. (Figure 7). The chest x-ray on June 8, 2014 revealed bilateral paracardiac alveolar pulmonary infiltrate and a marked increase in cardiac area (Figure 4).

Laboratory tests conducted on the same day revealed the following values: hemoglobin 13.1 g/dL, hematocrit 41%, leukocytes 14,530/mm^3 (neutrophils 79%, eosinophils 0%, basophils 1%, lymphocytes 16%, and monocytes 4%), platelets 303,000/mm^3, cholesterol 149 mg/dL, HDL-c 36 mg/dL, LDL-c 90 mg/dL, triglycerides 117 mg/dL, glucose 374 mg/dL, urea 75 mg/dL, creatinine 1.69 mg/dL (glomerular filtration 32 ml/min/1.73 m^2), C-reactive protein 28.42 mg/dL, TSH 1.40 μUI/mL, CK-MB 6.42 ng/mL, and troponin I 0.236 ng/mL.

The patient continued to have significant dyspnea and exhibited a reduced level of consciousness requiring

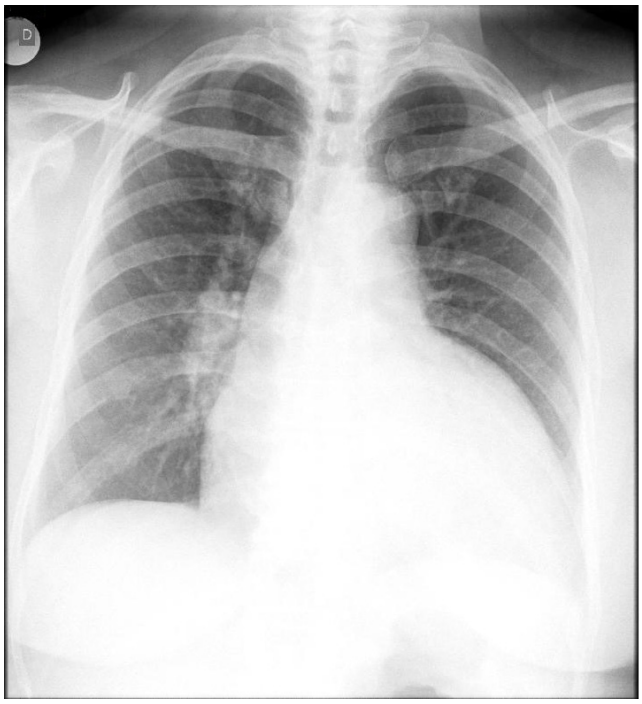

Figure 4 – *Chest X-ray in posteroanterior projection. Cephalization of the pulmonary vasculature and accentuated cardiomegaly.*

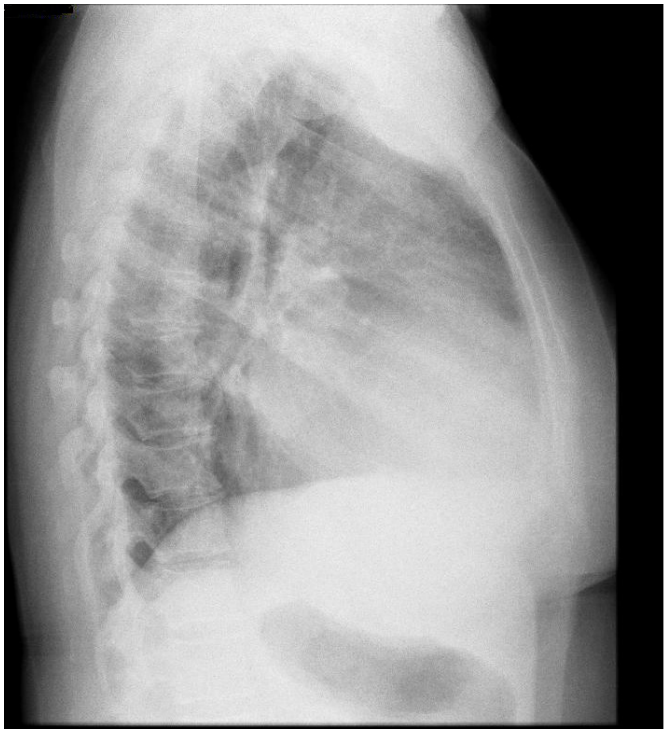

Figure 5 – *Chest X-ray profile. Accentuated cardiomegaly observed.*

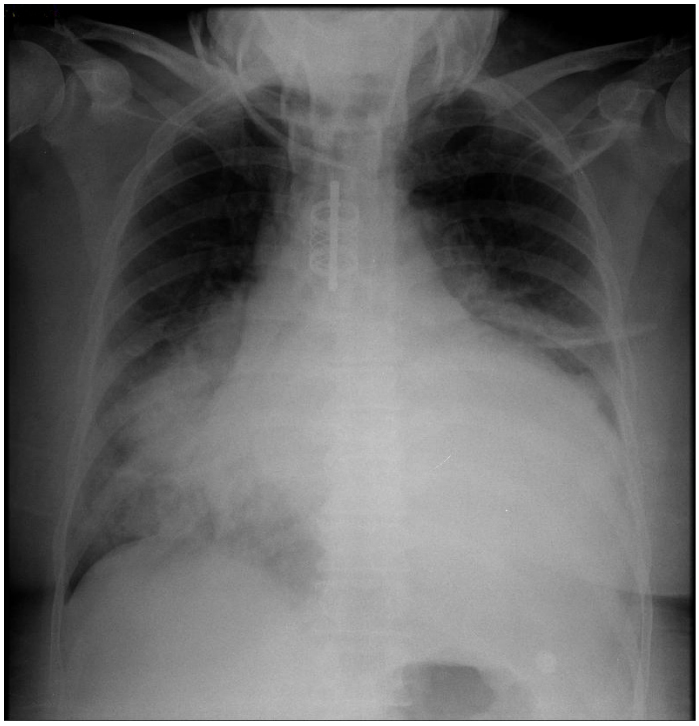

Figure 6 – *Chest X-ray in posteroanterior projection. Bilateral paracardiac alveolar infiltrate and accentuated increase in cardiac area were observed.*

orotracheal intubation for respiratory support. During this procedure, she experienced a pulseless cardiac arrest with cessation of electrical activity; however, she was resuscitated. The presence of pneumothorax was noted by marked decrease in vesicular breath sounds on the right side, which was immediately drained.

An electrocardiogram after approximately 40 min revealed irregular rhythm (Figure 8).

The patient experienced another cardiac arrest; however, this time she did not respond to resuscitation. The patient died on June 8, 2013 at 10:35 a.m.

Clinical aspects

This is the case of a patient who began outpatient follow-up with symptoms of heart failure and effort dyspnea, orthopnea, and paroxistic nocturnal dyspnea with increasing intensity as well as with jugular stasis and bi-basal crackles (revealed by physical examination)[1].

Heart failure is the final outcome of most cardiovascular diseases, and is very prevalent in Brazil. With 1,156,136 admissions in 2007, cardiovascular diseases is known to be the third most common cause of hospitalization in the Brazilian Unified Health System (SUS), with heart failure being the most frequent. Like other developed countries, the principal etiologies of heart failure in Brazil are hypertension and chronic ischemic heart disease, but other etiologies are also present, such as Chagas cardiomyopathy, endomyocardial fibrosis, and degenerative as well as rheumatic valvular disease[2].

The patient's echocardiogram showed enlarged left cardiac chambers and a sharply reduced left ventricular ejection fraction from diffuse hypokinesia, allowing a diagnosis of dilated cardiomyopathy, which is the most common of the cardiomyopathies essentially characterized by dilatation and compromised contraction of the left ventricle or both ventricles[3,4].

The hospitalization rate is high in patients with heart failure, mainly precipitated by decompensation, poor adherence to treatment (dietary as well as medication), cardiac ischemia, uncontrolled hypertension, arrhythmias, and infectious causes[5]. Mortality in patients with heart failure is also high with a 5-year survival rate of 50%[4]. There are some morphological parameters that may indicate a poorer prognosis with increased risk for sudden death, arrhythmias, and embolism. These parameters include the degree of impairment of ejection fraction (mainly in ejection fractions below 25%), increase in left ventricular and/or right ventricular volume, ventricular dyssynchrony, and decrease in mass/volume ratio[6]. Among the clinical and laboratorial parameters, the New York Heart Association functional class IV has a poorer prognosis, as do younger patients, women, patients with syncope, S3 gallop, right heart failure upon examination, left bundle branch block, first or second degree atrioventricular blockage, and hyponatremia[6]. Among these factors, in this case, the patient presented a sharply reduced ejection fraction, ventricular enlargement, was female, and had left bundle branch block.

The main causes of death in patients with heart failure are complications, such as sudden death/arrhythmias and

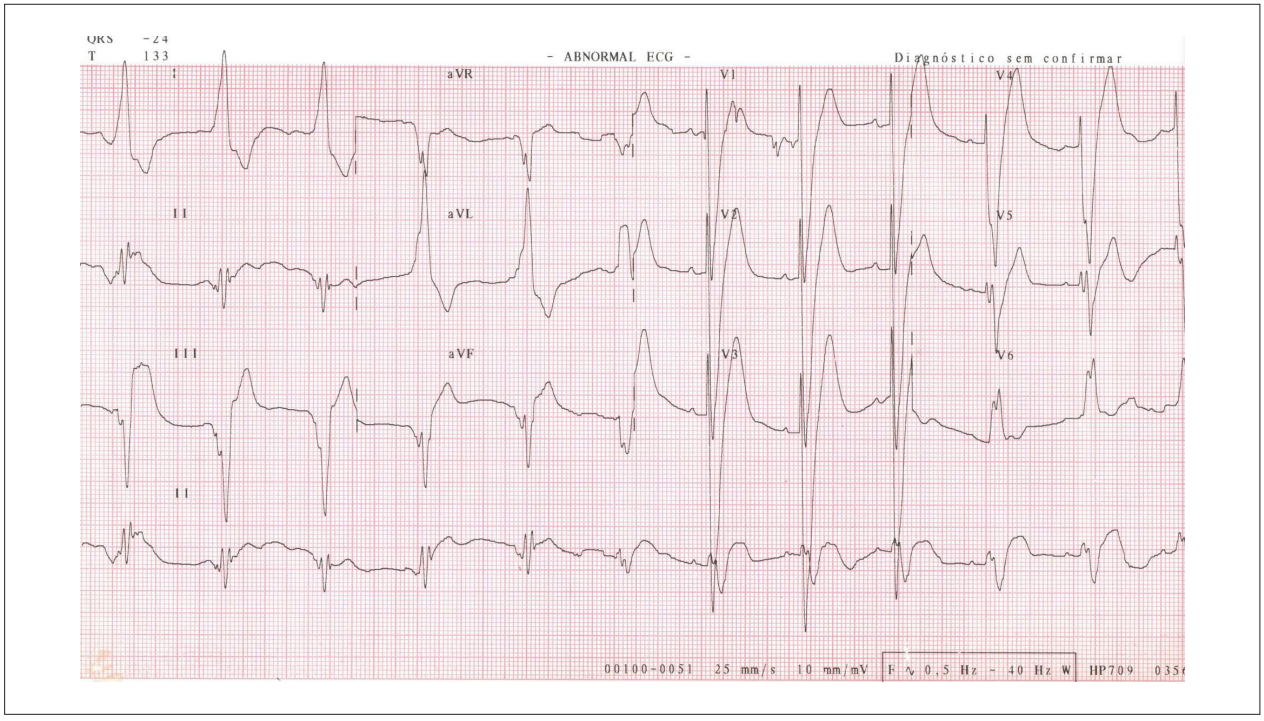

Figure 7 – *Electrocardiogram. Sinus rhythm, left bundle branch block, with probable electrical inactivity in the lower and anteroseptal wall.*

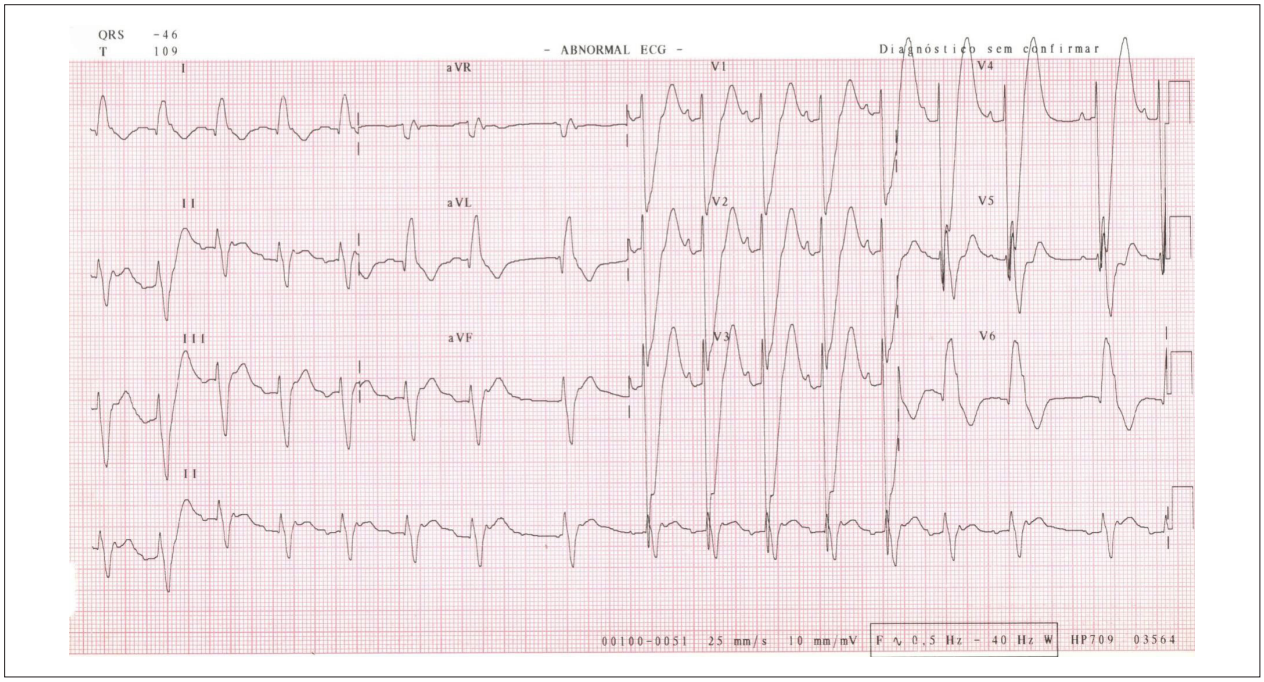

Figure 8 – *Electrocardiogram. Irregular rhythm, likely atrial arrhythmia, left bundle branch block, and left ventricular overload.*

pulmonary embolism as well as progressive deterioration of the ventricular function with subsequent hemodynamic collapse[4,7].

In this case, the patient had dilated cardiomyopathy with no prior history of myocarditis, no report of alcohol or substance abuse, and no significant personal or family background; however, she did have cardiovascular risk factors that made idiopathic etiology less likely. For this patient, the most likely etiologies for cardiomyopathy were hypertensive or ischemic.

Myocardial scintigraphy showed areas of hypercaptation, suggesting an ischemic origin for the cardiomyopathy, but

these findings may be attributed to the presence of left bundle branch block or artifacts resulting from mammary attenuation; additionally, the patient had no prior history of heart attack and her echocardiogram showed no areas of akinesia.

The patient's electrocardiogram showed left ventricular overload, which supports hypertensive etiology, as well as the echocardiogram, which exhibited increased ventricular mass and diffuse hypokinesia.

After the initial assessment, therapy was optimized with medications known to modify the rates of hospitalization and mortality for patients with heart failure resulting from reduced ejection fraction (carvedilol, enalapril, and spironolactone)[8] and agents to relieve symptoms (furosemide). The patient remained asymptomatic until she was hospitalized for acute decompensated heart failure.

In this case, the patient exhibited leukocytosis with neutrophil predominance and elevated C-reactive protein indicating a possible infectious cause for decompensation. These factors, along with the findings of tachycardia and tachypnea, and the severity criteria such as renal dysfunction and neurological changes (reduced consciousness level), allow a diagnosis of severe sepsis, a disease with a mortality rate of 48% in Brazil, with worse prognosis in patients with previous comorbidities such as cardiomyopathy[9-11].

Although it is sometimes difficult to differentiate between sepsis and decompensated heart failure, treatment of sepsis should not be delayed and must be started within the first hour of diagnosis, because for every hour of delay there is a 4% increase in mortality.

The rapid evolution of our patient, requiring orotracheal intubation and subsequent pulseless cardiac arrest, led us to discuss the main causes of this type of cardiac arrest such as hypoxia, hypovolemia, acidosis, hyper/hypokalemia, pneumothorax, pulmonary embolism, and acute myocardial infarction[12].

Although pulmonary embolism is one of the leading causes of death in patients with heart failure and the patient did present the most frequent symptoms (tachypnea and tachycardia), she was considered to be hypotensive and without pulmonary congestion.

In a patient with multiple cardiovascular risk factors, such as hypertension, dyslipidemia, and diabetes, an important differential diagnosis is myocardial ischemia, which is a leading cause of mortality in diabetic patients because of more extensive disease and atypical symptoms[13]. Although the patient was experiencing hemodynamic stress, was hypertensive, and showed signs of infection, which increases myocardial oxygen demand, acute coronary syndrome was not the main diagnostic hypothesis because she did not exhibit any objective evidence of ischemia, remembering that we did not have electrocardiographic parameters because of left bundle branch block, or clinical parameters because she was diabetic. The markers for myocardial necrosis were slightly elevated, but in patients with decompensated heart failure or with altered renal function, these values can present alterations as a result of the cardiac injury itself. We cannot rule out the possibility that the patient suffered a heart attack, because there was no time to conduct serial testing of markers.

In the case presented, the most likely cause of death was sepsis. The patient presented in a state of infection, likely with a pulmonary focus, and progressed to severe sepsis, a disease with high mortality, particularly in individuals with severe comorbidities. During its evolution, the case exhibited complications such as respiratory failure and pneumothorax, which further exacerbated the hypoxia, cell suffering, metabolic acidosis, and electrolytic disorders, culminating in pulseless cardiac arrest and death.

Diagnostic hypotheses:

- Heart failure resulting from dilated cardiomyopathy of likely hypertensive etiology.
- Decompensated heart failure resulting from infection.
- Cause of death: septic shock with pulseless cardiac arrest with cessation of electric activity.

Dr. Raphael Marion Pesinato

Autopsy

The heart weighed 824 g. There was intense hypertrophy of the left ventricle with moderate dilation of the cavity and an area of irregular fibrous replacement of the posterior myocardium, corresponding to a small scarred infarction (Figure 9). A histological examination of the myocardium showed diffuse hypertrophy of the cardiomyocytes with small and rare foci of necrosis, formation of microabscesses and myocardial sclerosis in the subendocardial region of the left ventricle, and confirmed the area of fibrous replacement in the posterior wall. The coronary arteries were dissected and subjected to histological study, identifying discrete atherosclerosis with plaque in focal areas of calcification in the proximal segments without significant obstructive lesions. The aortic valve was trivalvular and did not exhibit any abnormalities. Atherosclerosis of the aorta was moderate with the presence of focal calcified plaque. Examination of the lungs showed slight chronic passive congestion and extensive bilateral bronchopneumonia affecting all lobes of both the lungs, but was more intense in the right lung (Figure 10). The kidneys had a fine granular surface, and on histological examination, atherosclerosis of the arterial branches and hyaline arteriosclerosis were observed. The glomeruli were preserved. Other findings of the autopsy were multiple intramural and subserous uterine leiomyomas (the largest measuring 4.0 cm), an endometrial polyp (filling the uterine cavity) measuring 5.0 cm, and an ovarian fibroma measuring 0.7 cm. **Dr. Luiz Alberto Benvenuti**

Pathological Diagnosis

Hypertensive decompensated heart disease; healed myocardial infarction on the posterior left ventricular wall; benign nephrosclerosis; atherosclerosis of the aorta (moderate) and coronary arteries (discrete); uterine leiomyomas; endometrial polyp; ovarian fibroma; bilateral confluent bronchopneumonia (terminal cause of death). **Dr. Luiz Alberto Benvenuti**

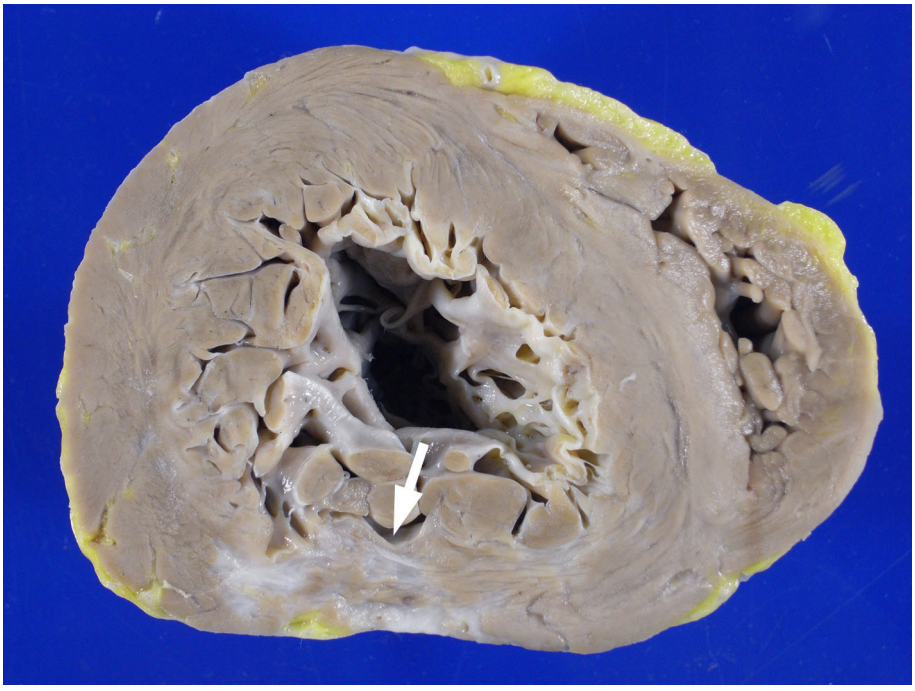

Figure 9 – *Cross-section of the heart (at the level of the ventricle). There is eccentric hypertrophy with moderate dilatation of the left ventricular cavity and irregular fibrous replacement of the posterior wall (arrow), which appears discretely tapered (healed infarction).*

Comments

A case of a 66-year-old woman with hypertension, diabetes mellitus, and congestive heart failure. In her last hospitalization, she exhibited respiratory failure with a diagnosis of acute pulmonary edema. She received drug treatment, but progressed to worsened respiratory status requiring orotracheal intubation, and died in less than 24 h after admission.

An autopsy revealed decompensated hypertensive heart disease[14]. The heart exhibited a large increase in mass due to severe left ventricular hypertrophy, weighing 824 g. Although there was no significant coronary atherosclerosis, a small scarred infarction was found on the posterior wall of the left ventricle. This previous ischemic event was likely related to the exaggerated consumption of the hypertrophic myocardium, coupled with microvascular disease, and endothelial dysfunction in hypertensive heart disease[15].

The terminal cause of death was extensive confluent bilateral bronchopneumonia. Further, evidence of septicemia was found along with the presence of small microabscesses in the myocardium. Bronchopneumonia was not diagnosed while the patient was alive, because the respiratory failure that caused the patient's last hospitalization was interpreted and treated as acute pulmonary edema of cardiogenic origin. However, it should be noted that the patient only survived a short time after seeking medical attention, preventing further enlightening supportive examinations. Dr. Luiz Alberto Benvenuti

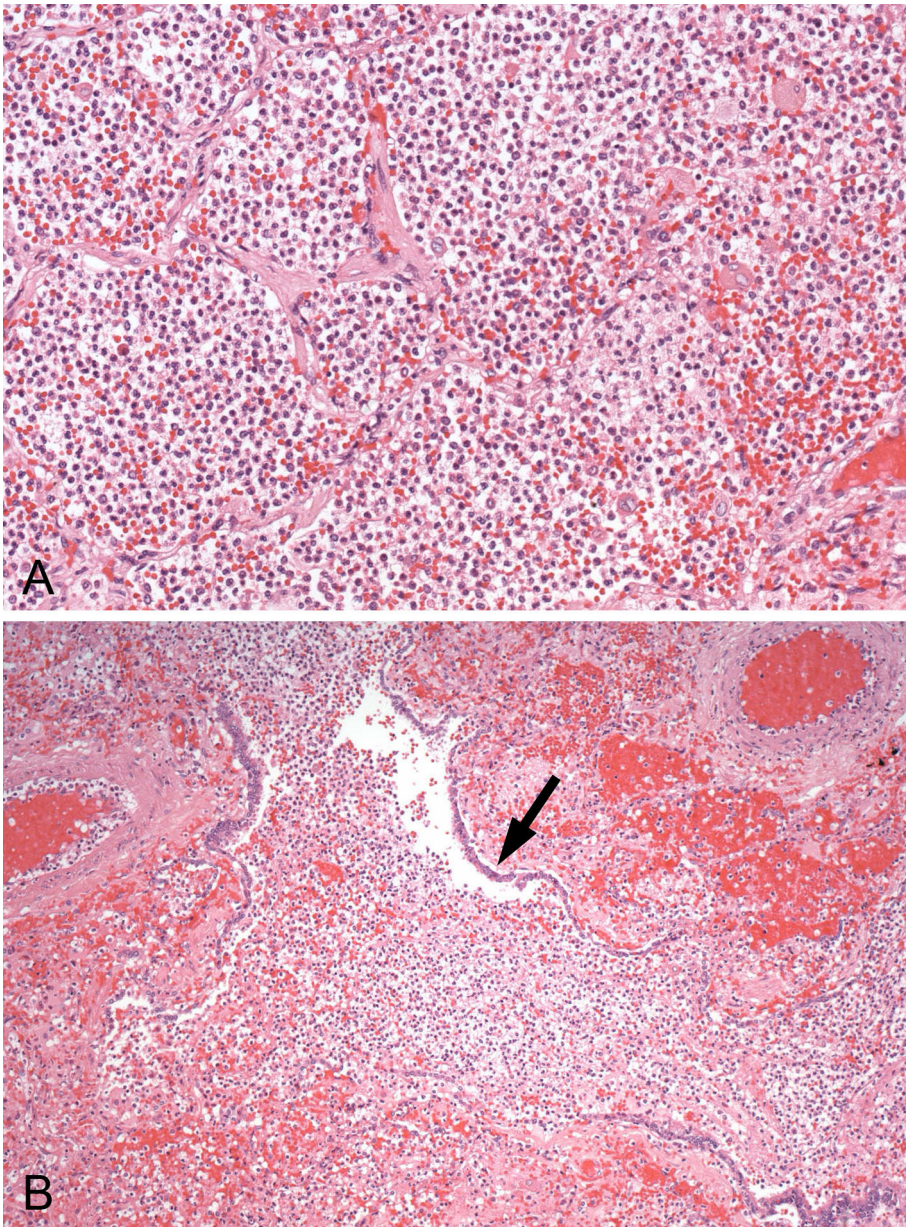

Figure 10 – *Histological sections of the lung showing alveolar spaces completely filled by inflammatory neutrophilic exudate (A), spread via the airway (arrow, B), characteristic of bronchopneumonia. Hematoxylin-eosin, ×200 (A) and ×100 (B).*

References

1. Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE Jr, Drazner MH, et al; American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines. Circulation. 2013;128(16):e240-327.
2. Bocchi EA, Marcondes-Braga FG, Ayub-Ferreira SM, Rohde LE, Oliveira WA, Almeida DR, et al; Sociedade Brasileira de Cardiologia. III Diretriz Brasileira de insuficiência cardíaca crônica. Arq Bras Cardiol. 2009;93(1 supl.1):1-71.
3. Richardson P, McKenna W, Bristow M, Maisch B, Mautner B, O'Connell J, et al. Report of the 1995 World Health Organization/International Society and Federation of Cardiology Task Force on the Definition and Classification of Cardiomyopathies. Circulation. 1996;93(5):841-2.
4. Luk A, Ahn E, Soor GS, Butany J. Dilated cardiomyopathy: a review. J Clin Pathol. 2009;62(3):219-25.
5. Michalsen A, König G, Thimme W. Preventable causative factors leading to hospital admission with decompensated heart failure. Heart. 1998;80(5):437-41.
6. Dec GW, Fuster V. Idiopathic dilated cardiomyopathy. N Engl J Med. 1994;331(23):1364-75.
7. Effects of enalapril on mortality in severe congestive heart failure. Results of the Cooperative North Scandinavian Enalapril Survival Study (CONSENSUS). The CONSENSUS Trial Study Group. N Engl J Med. 1987;316(23):1429-35.
8. Sacks CA, Jarcho JA, Curfman GD. Paradigm shifts in heart-failure therapy: a timeline. N Engl J Med. 2014;371(11):989-91.
9. Dellinger RP, Levy MM, Rhodes A, Annane D, Gerlach H, Opal SM, et al; Surviving Sepsis Campaign Guidelines Committee including The Pediatric Subgroup. Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock, 2012. Intensive Care Med. 2013;39(2):165-228.
10. Levy MM, Fink MP, Marshall JC, Abraham E, Angus D, Cook D, et al; International Sepsis Definitions Conference. 2001 SCCM/ESICM/ACCP/ATS/SIS International Sepsis Definitions Conference. Intensive Care Med. 2003;29(4):530-8.
11. Sales Junior JA, David CM, Hatum R, Souza PC, Japiassú A, Pinheiro CT, et al. Sepse Brasil: estudo epidemiológico da sepse em unidades de terapia intensiva brasileiras. Rev Bras Ter Intens. 2006;18(1):9-17.
12. Neumar RW, Otto CW, Link MS, Kronick SL, Shuster M, Callaway CW, et al. Part 8: adult advanced cardiovascular life support: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2010;122(18 Suppl 3):S729-67. Erratum in: Circulation. 2011;123(6):e236. Circulation. 2013;128(25):e480.
13. Tabibiazar R, Edelman SV. Silent Ischemia in people with diabetes: a condition that must be heard. Clin Diabetes. 2003;21(1):5-9.
14. Díez J. Arterial hypertension in patients with heart failure. Heart Fail Clin. 2014;10(2):233-42.
15. Raman SV. The hypertensive heart: an integrated understanding informed by imaging. J Am Coll Cardiol. 2010;55(2):91-6.