

Dissection of the ascending aorta mimicking an acute coronary syndrome: usefulness of transthoracic echocardiography for the differential diagnosis

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We describe the case of 2 patients presenting with chest pain and electrocardiographic signs of myocardial ischemia, in whom a transthoracic echocardiogram, performed urgently at the bedside, allowed a diagnosis of dissection of the ascending aorta. Prompt recognition of this condition avoided inappropriate aggressive medical treatments and permitted emergency surgical intervention.

Aortic dissection can mimic other conditions including an acute coronary syndrome. When the diagnosis is unclear it may be useful to perform a transthoracic echocardiogram before starting any aggressive medical treatment because in such cases thrombolytic or anticoagulant therapy and antithrombotic treatment with platelet glycoprotein IIb/IIIa receptor antagonists can result in serious side effects. On the other hand, transthoracic echocardiography can confirm the suspicion of an acute coronary syndrome or suggest other diagnoses such as aortic dissection.

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Introduction

Acute dissection is an uncommon catastrophic condition with an incidence of 5-30 cases per million inhabitants per year and with a high risk of mortality¹. It is characterized by separation of the layers within the aortic wall leading to the creation of a space in which blood penetrates thus permitting further propagation of the dissection.

A new classification distinguishes between five classes of aortic dissection²:

- class 1: classic aortic dissection with an intimal flap between the true and false lumens;
- class 2: medial disruption leading to intramural hemorrhage or hematoma;
- class 3: subtle or discrete aortic dissection with bulging of the aortic wall;
- class 4: aortic plaque ulceration following plaque rupture;
- class 5: iatrogenic or traumatic aortic dissection.

Classes 1-5 constitute a further subdivision of the Stanford classification that distinguishes between type A dissection, involving the ascending aorta, and type B dissection, involving the descending aorta³.

While uncomplicated type B aortic dissections are usually treated conservatively, acute dissection of the ascending aorta is a life-threatening condition requiring immediate surgical intervention: among untreated patients, the early mortality is as high as 1% per hour⁴. For this reason, it is mandatory to make an accurate and prompt diagnosis.

The classic symptoms of aortic dissection are sudden tearing chest or interscapular pain migrating along the route of the aorta and great vessels. The symptoms and clinical features of aortic dissection are similar to those of other conditions such as acute congestive heart failure and myocardial ischemia; for this reason, the diagnosis of aortic dissection is frequently not only delayed but even missed and sometimes it is made only at *postmortem* examination⁵.

In fact, up to 30% of patients later found to have aortic dissection are initially suspected of having other conditions such as acute coronary syndromes, non-dissecting aneurysms, pulmonary embolism or aortic stenosis⁵.

Moreover, many authors reported cases of acute aortic dissection associated with ECG signs of myocardial ischemia^{1,5-7}. Therefore, aortic dissection may often be

mistaken for other causes of chest pain, especially acute coronary syndromes. As reported by many authors^{8,9}, in these cases inappropriate administration of thrombolytic or anticoagulant agents or platelet glycoprotein IIb/IIIa receptor antagonists can result in catastrophic outcomes.

So it is necessary to have a high clinical index of suspicion and therefore to perform, as soon as possible, a diagnostic imaging procedure in order to rule out or confirm the presence of dissection.

We here report 2 cases of acute ascending aorta dissection in patients presenting with symptoms and ECG signs suggesting myocardial ischemia; in such cases a primary transthoracic echocardiography followed by further more accurate evaluation by means of transesophageal echocardiography or computed tomographic scan allowed a diagnosis of acute aortic dissection and hence emergency surgery.

Description of cases

Case 1. A 48-year-old male patient complaining of sudden-onset substernal chest pain lasting 2 hours and associated with diaphoresis was admitted to the emergency department.

He had no history of cardiac diseases or arterial hypertension. Physical examination revealed clear lung fields and soft heart sounds with a grade 2/6 holodiastolic regurgitant murmur. The carotid and peripheral pulses were valid and symmetric. His blood pressure was 180/80 mmHg. An ECG showed sinus rhythm at a rate of 63 b/min with isodiphasic T-waves in the V₁-V₄ precordial leads and negative T-waves in leads V₅-V₆, and DI, aVL (Fig. 1). Laboratory tests revealed normal values of cardiac enzymes (total creatine kinase, creatine kinase MB-fraction, troponin T and myoglobin) and

a serum level of creatinine of 2.1 mg/dl. The patient was initially treated with intravenous beta-blockers and nitrates. Soon after a transthoracic echocardiogram was performed and revealed moderate aortic regurgitation and a suspected intimal flap extending from the proximal ascending to the descending aorta; there were no regional wall motion abnormalities or pericardial effusion.

Subsequently, the patient underwent abdominal and thoracic helical computed tomographic scan with intravenous contrast medium that confirmed aortic dissection beginning from the root, extending through the entire aorta and involving both common iliac arteries. The patient was immediately transferred to the operating theatre and underwent emergency surgery with implantation of a tubular allograft replacing the ascending aorta; intraoperative assessment revealed no coronary involvement in the dissection.

The patient's postoperative course was characterized by elevated blood pressure values requiring endovenous infusion of high doses of antihypertensive drugs. A transthoracic echocardiogram revealed moderate pericardial effusion, mainly localized around the postero-lateral portion of the left ventricle, and mild aortic regurgitation.

At 3 months of follow-up a transesophageal echocardiography was performed and showed a vascular graft in the ascending aorta and chronic dissection of the aortic arch and thoraco-abdominal tract. At 1 year of follow-up the patient is well, with just residual mild renal insufficiency (creatinine value of 2.0 mg/dl) and adequately controlled blood pressure. The ECG revealed sinus rhythm at a rate of 66 b/min without ST-segment abnormalities (Fig. 2).

A transthoracic echocardiogram was repeated and confirmed the absence of pericardial effusion, mild aortic regurgitation and chronic dissection of the descending aorta as far as the carrefour.

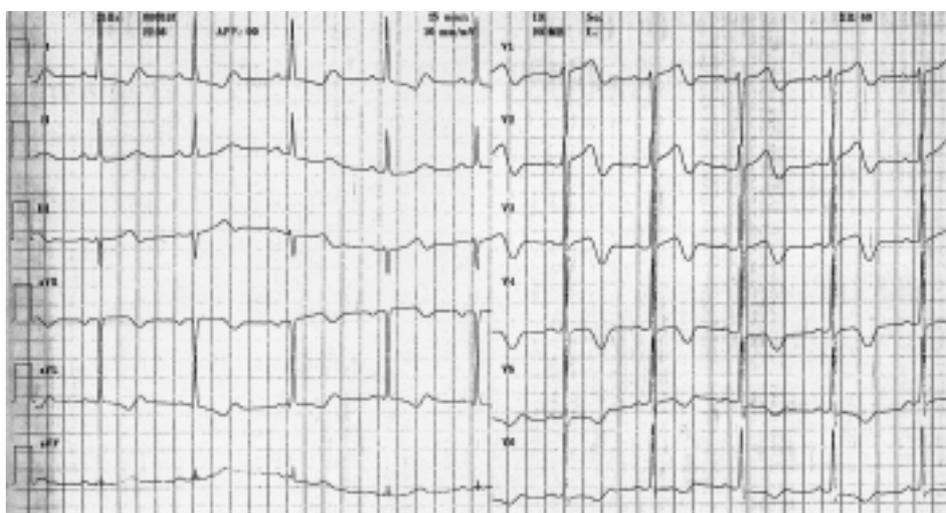


Figure 1. Case 1: 12-lead ECG at admission showing isodiphasic T waves in the V₁-V₄ precordial leads and negative T waves in leads V₅-V₆ and DI and aVL.



Figure 2. Case 1: 12-lead ECG at 1 year of follow-up showing regression of the ventricular repolarization abnormalities.

Case 2. A 78-year-old male patient was referred to the emergency department of our hospital because of severe retrosternal pain irradiating to the epigastrium.

Physical examination revealed only a 1/6 systolic aortic murmur. The peripheral and carotid pulses were normal. His blood pressure was 100/70 mmHg. Laboratory tests and serum cardiac enzymes were normal.

An ECG showed sinus rhythm (60 b/min) with a left anterior hemiblock, isodiphasic T waves in the V₄-V₅-V₆ precordial leads and in D2 and aVF and negative T waves in D3 (Fig. 3).

Thereafter, transthoracic echocardiography, performed in order to clarify the diagnosis, showed no regional wall motion abnormalities, no pericardial effusion and an image suggestive of an intimal flap in the ascending aorta; so the patient was submitted to transesophageal echocardiography that revealed dissection of the ascending aorta (Fig. 4) beginning immediately above the level of the aortic valve and extending through the entire thoracic and abdominal tracts. The

ostia and proximal coronary arteries were also identified and did not appear to be involved in the dissection or obstructed by the intimal flap.



Figure 4. Case 2: transesophageal echocardiographic view showing dissection of the ascending aorta with an intimal flap beginning from the aortic root (arrow).

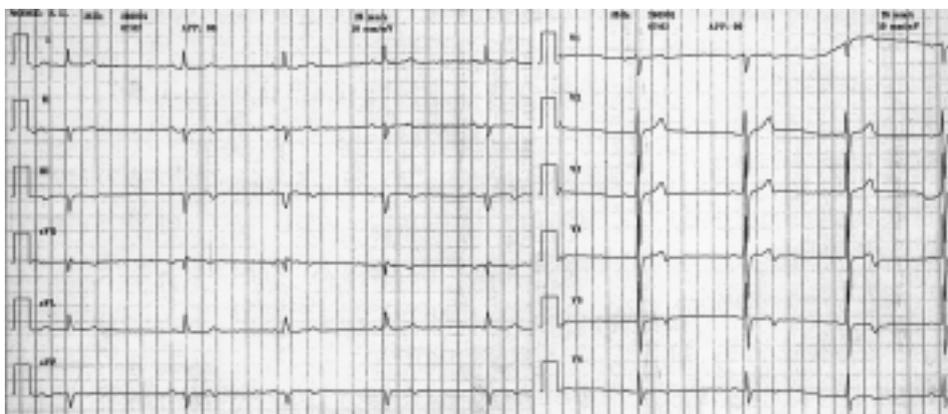


Figure 3. Case 2: 12-lead ECG at admission revealing left anterior hemiblock, isodiphasic T waves in the V₄-V₅-V₆ precordial leads and in D2 and aVF and negative T waves in D3.

The patient was transferred to the operating theatre and underwent immediate surgical intervention with the placement of an ascending aortic graft. As preoperatively suggested by echocardiographic evaluation, intraoperative assessment confirmed that the coronary arteries were not involved.

The postoperative course was without complications; a transthoracic echocardiogram revealed mild aortic regurgitation and mild left pleural effusion. The patient was discharged on antihypertensive and antiplatelet treatment.

At 5 months of follow-up, the patient is well, with adequately controlled blood pressure. ECG showed sinus rhythm at a rate of 66 b/min and a left anterior hemiblock with unspecific repolarization abnormalities (Fig. 5).

Discussion

Acute ascending aortic dissection is an uncommon disease with a high mortality rate during the first hours of presentation⁴; it therefore requires immediate surgical intervention. It is critical to suspect and then diagnose the disease as early as possible.

Classic signs and symptoms are tearing chest or interscapular pain of abrupt onset and shifting in location, absent or reduced pulses and a different blood pressure between the two arms. Nevertheless typical findings are often absent; so a high index of clinical suspicion is necessary.

Many conditions such as pericarditis, myocarditis, pulmonary embolism or acute coronary syndromes might mimic aortic dissection hence increasing the risk of a mistaken diagnosis. For this reason, appropriate surgical treatment may be delayed and/or unnecessary or harmful therapeutic procedures undertaken thus increasing the risk of death^{5,10,11}.

A variable percentage of patients with type A aortic dissection has ECG signs of myocardial ischemia^{1,5,6}. In one study ECG changes were present in more than 50% of patients⁷. Such patients are at high risk of a misdiagnosis and consequently of inappropriate thrombolytic or anticoagulant therapy. Although less frequent, even patients with type B dissection may present ST-T wave changes⁷. When the diagnosis is unclear, emergency echocardiography, performed at the bedside, may be useful to identify regional wall motion abnormalities because it can provide images suggestive of an aortic dissection or findings supporting the different diagnosis.

Our cases showed ECG signs of myocardial ischemia in patients with prolonged chest pain and without risk factors for coronary artery disease: transthoracic echocardiography suggested the presence of an aortic dissection which was subsequently confirmed.

There are several mechanisms which may be responsible for the ST-T wave changes observed in aortic dissection: 1) coronary malperfusion due to coronary ostium involvement in the dissection or to functional obstruction by diastolic prolapse of the intimal flap; 2) state of shock and cardiac tamponade causing hypotension and subsequently subendocardial ischemia; 3) pre-existing coronary artery disease⁷.

In our cases the ECG signs consistent with myocardial ischemia, occurring at the time of admission and subsequently disappearing, suggested extension of the dissection to a coronary ostium. Nevertheless, surgical intervention revealed no coronary involvement. It is possible that in the first case a coronary functional obstruction by a mobile flap of intima occurred and that in the second the presence of hypotension associated with possible, given the patient age, underlying coronary artery disease caused subendocardial ischemia.

These cases revealed the difficulties one may encounter in the differential diagnosis of chest pain: it was



Figure 5. Case 2: 12-lead ECG at 5 months of follow-up revealing left anterior hemiblock with unspecific ST-T segment abnormalities.

critical to perform emergency transthoracic echocardiography at the patients' bedside before initiating any aggressive medical treatment. In fact, having obtained an echocardiographic image suggestive of an aortic dissection, further diagnostic procedures including a computed tomographic scan in a case and a transesophageal echocardiography in the other were performed. Such modalities confirmed the diagnosis of aortic dissection and justified emergency surgical treatment.

Transesophageal echocardiography and helical computed tomography, in conjunction with magnetic resonance, are excellent modalities for the diagnosis of aortic dissection: both imaging techniques are safe, fast, widely available and permit a rapid diagnosis¹²⁻¹⁶; moreover, transesophageal echocardiography can be performed at the bedside or in the emergency department. On the other hand, magnetic resonance is relatively expensive and usually not available on an emergency basis^{16,17}.

Transthoracic echocardiography represents the initial diagnostic modality for the evaluation of patients with suspected aortic dissection. On the strength of its high positive predictive value ($\geq 90\%$)¹⁸ when the diagnosis is certain, findings obtained by transthoracic echocardiography can be sufficient for surgical decision-making: transesophageal echocardiography can be subsequently performed in the operating room and provide useful information to the surgeon.

However, transthoracic echocardiography in the assessment of aortic dissection has some limitations: its sensitivity ranges from 59 to 85%¹⁹⁻²² and its specificity from 63 to 96%¹⁹⁻²³. Its sensitivity is highest for dissections involving the ascending aorta, ranging from 78 to 100%^{19,20,23}; besides transthoracic echocardiography for the detection of dissections of the descending aorta has some limitations¹⁶.

In conclusion, regardless of its non-optimal diagnostic sensitivity, transthoracic echocardiography remains the most important tool for the initial evaluation of patients with suspected aortic dissection: it is widely available, quick and easily performed at the bedside and in the emergency department and it may also permit correct differential diagnoses. The other diagnostic techniques can be performed to confirm the suspicion of dissection or when transthoracic echocardiography alone is not sufficient to make a diagnosis.

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