Aortic Dissection: Role of Echocardiography

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Introduction

Dissection of the aorta is caused by a tear in the intima of the aortic wall. The blood entering the wall strips the media from the adventitia (Figure 1). This may happen in various levels. DeBakey distinguished three types of dissection, type I, II and II, but usually a division is made according to Daily into type A and type B (Figure 2). Of all dissections, about 2/3 is type A.

Dissection of the aorta is a serious condition with a high mortality in the first few hours after the beginning of complaints. The diagnosis should be made as soon as possible. The diagnosis can only be made if dissection is part of the differential diagnosis; one should think of it. This is not always easy, as the classical clinical picture of pain between the scapulae is not always present. Many patients present with chest pain, resembling angina or myocardial infarction. Ischemia on the electrocardiogram does not rule out the diagnosis because ST depression may be caused by partial obstruction of a coronary ostium by an intimal flap interfering with coronary perfusion. Such ST abnormalities can be found in about 25% of type A dissections.

Usually, in type A dissection surgery is needed as soon as possible. As a consequence, the correct diagnosis should be made as soon as possible. In practice, a short time delay may be more important than the technique with which the diagnosis is made. Various techniques are available, such as echocardiography, MRI and (fast) CT. Even cardiac catheterization is sometimes used.

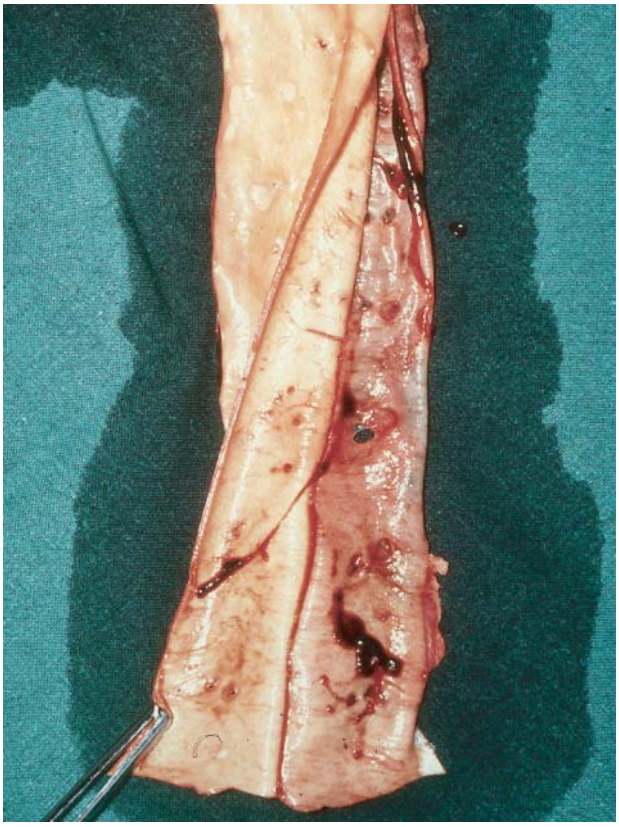

Fig. 1. Specimen of a descending aorta with dissection.

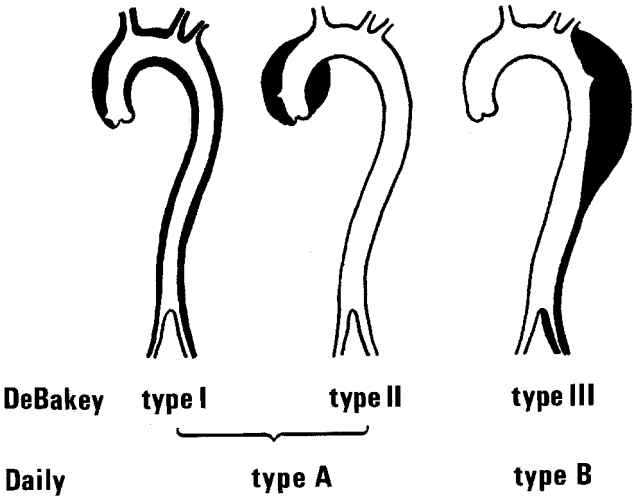

Fig. 2. Types of dissection according to deBakey and Daily.

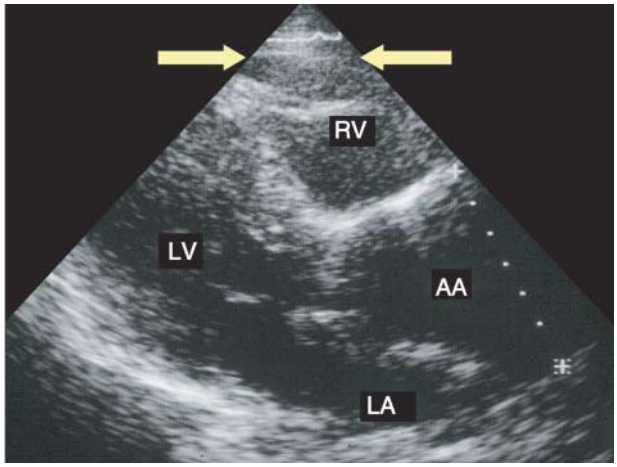

Fig. 3. In this left parasternal view a dilated ascending aorta (62 mm) is visualized. This predisposes for dissection. Also, pericardial effusion is detected (arrows), in this patient caused by leakage of blood through the aortic wall in the presence of aortic dissection. RV=right ventricle; LV=left ventricle; LA=left atrium; AA=ascending aorta.

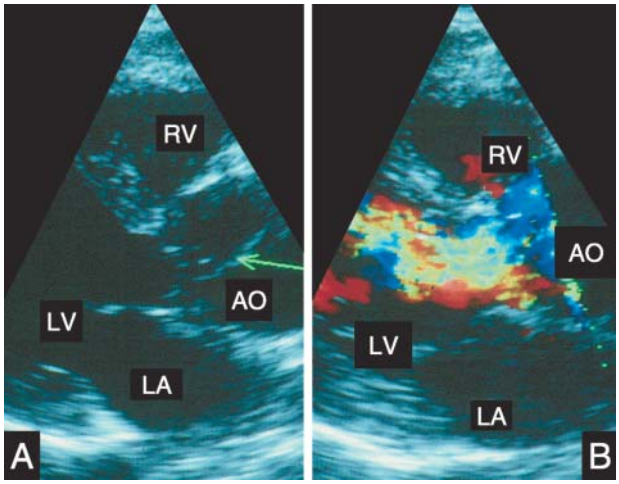

Fig. 5. Type A dissection in a parasternal long axis view. **A**: the intimal flap is visible near to the aortic valve (arrow). With color Doppler aortic insufficiency is detected, in this patient caused by the dissection **(B)**. RV=right ventricle; LV=left ventricle; LA=left atrium; AO=ascending aorta.

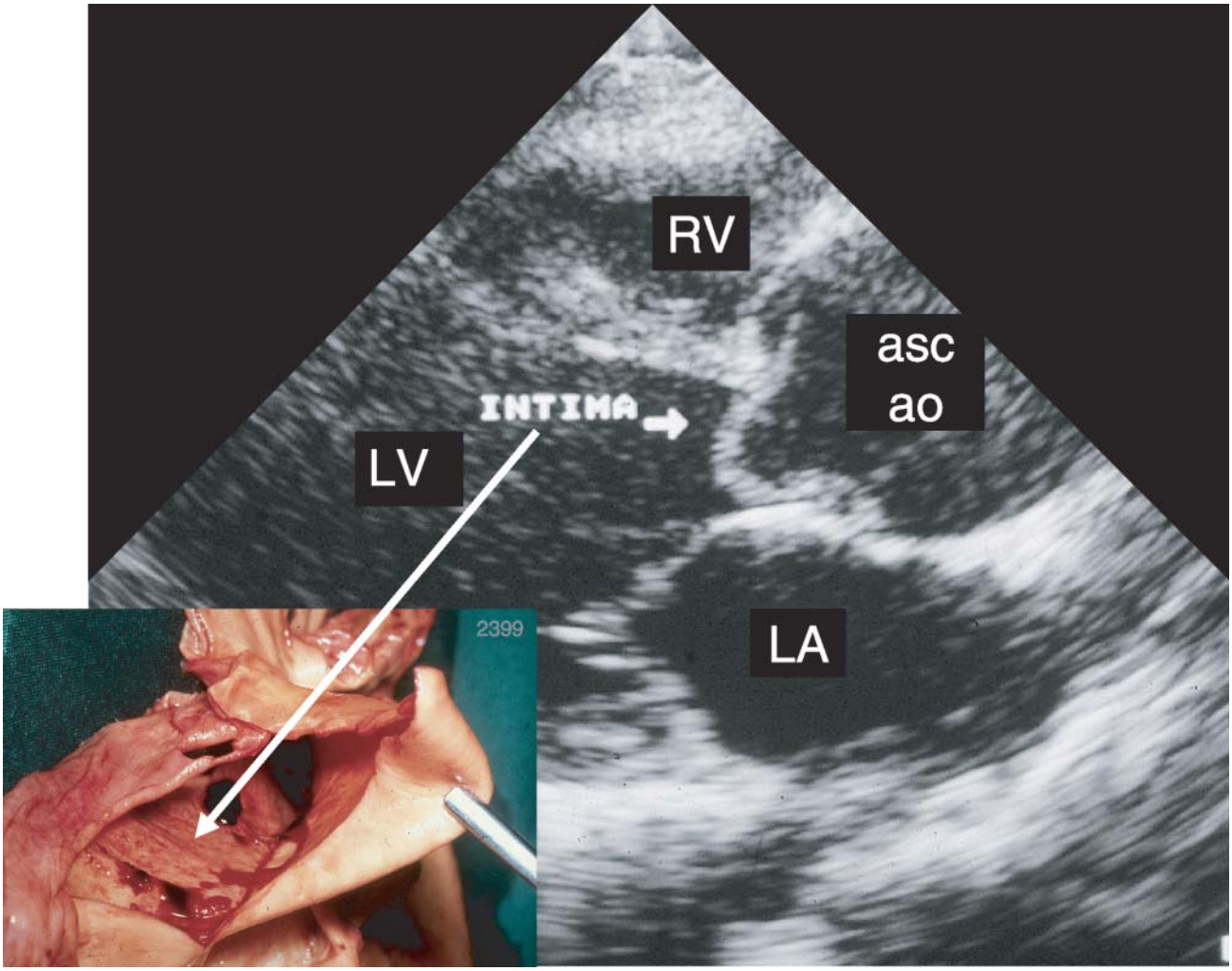

Fig. 4. Left parasternal view from a patient with aortic dissection. The intima protrudes during diastole through the aortic ostium into the outflow tract of the left ventricle. The diagnosis was confirmed at surgery. RV=right ventricle; LV=left ventricle; ASC AO=ascending aorta.

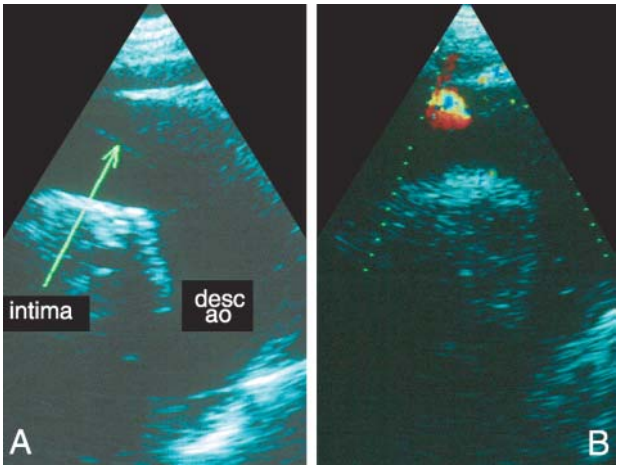

Fig. 6. In this suprasternal view an intimal flap is detected in the aortic arch (**A**, arrow). With color Doppler a flow is detected from the true lumen toward the false lumen **(B)**. DESC AO= descending aorta.

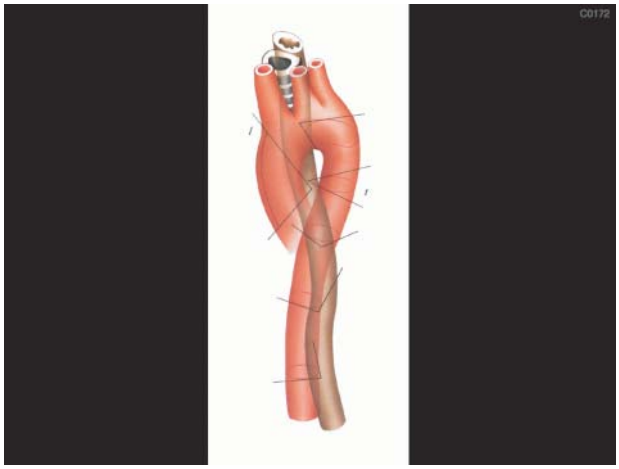

Fig. 8. Schematic representation of the thoracic aorta with possible cross-sections as can be made with TTE and TEE. A few centimeters of the cranial part of the ascending aorta usually can not be visualized with echocardiography.

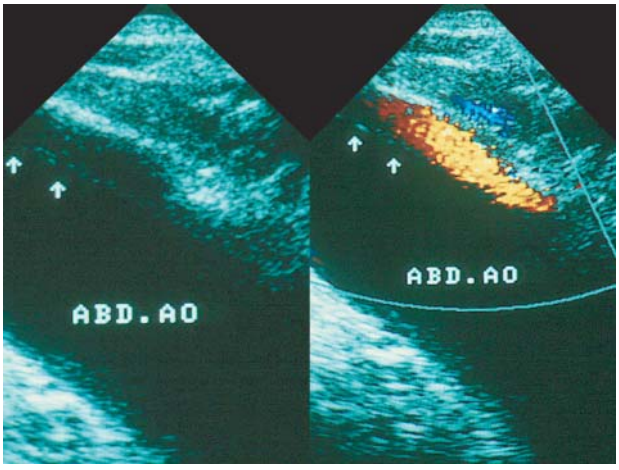

Fig. 7. An intimal flap is visualized in this abdominal aorta (arrow). With color Doppler the true lumen is clearly defined. ABD AO=abdominal aorta.

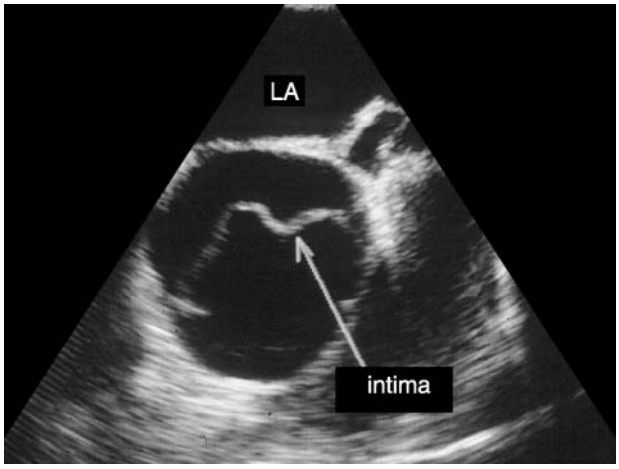

Fig. 9. Typical image of a dissection type A, obtained with TEE. This image was made under general anesthesia from a patient with a high suspicion of having a type A dissection. LA= linker atrium.

Each of these modalities has its advantages and disadvantages. The choice of technique or techniques depends on its availability and safety and may differ between doctors and between hospitals because of differences in experience and quality of equipments.

Transthoracic echocardiography

Of all techniques that can be used to diagnose aortic dissection transthoracic echocardiography (TTE) does not have the best sensitivity and specificity. However, in most hospitals TTE is readily available and can be performed quickly which makes it the first choice of technique. The echocardiographic diagnosis is definite when a true lumen is found, separated from a false lumen by an intimal flap.

TTE is the technique that must be used first. Most often, the diagnosis is readily made with this technique. In the left parasternal view a dilated ascending aorta may be visualized (Figure 3). This is important as a dilation predisposes for dissection. Visualization of a slowly moving structure in the aorta makes the diagnosis very likely. Also, in case of a large intima flap, the intima may protrude during diastole through the aortic ostium into the outflow tract of the left ventricle (Figure

4). Aortic insufficiency caused by the dissection can be detected (Figure 5). Also, TTE is an easy technique to detect pericardial effusion (Figure 3). This is a most serious complication of aortic dissection. It is caused by leakage of blood through the wall of the intrapericardial part of the ascending aorta; this wall is thinner as a consequence of the dissection itself. If a type A dissection with pericardial effusion is detected, immediate surgery is indicated.

Sometimes the quality of the parasternal images is good enough to also visualize and examine the descending aorta.

Not only the parasternal region should be examined with TTE. With the transducer in the suprasternal position information can be obtained from the aortic arch such as dilation or also the detection of an intimal flap (Figure 6).

Examination of the abdominal aorta is also part of TTE in order to confirm or exclude aortic dissection (Figure 7).

Limitations of TTE cross sections

From the parasternal region image quality may be too poor to confirm or exclude the diagnosis. Also, usually only the first few centimeters of the ascending aorta can be examined. The remaining part of the ascending aorta is not visible, caused by tissue interference.

Transesophageal echocardiography

Another method to diagnose aortic dissection is transesophageal echocardiography (TEE). With this technique the ultrasound hits the walls of the descending aorta and the first part of the ascending aorta perpendicularly (Figure 8), resulting in magnificant echocardiographic images (Figures 9 and 10). With color Doppler a distinction can be made between the false and the true lumen (Figure 11). TEE raises sensitivity to 99% and specificity to 98%.

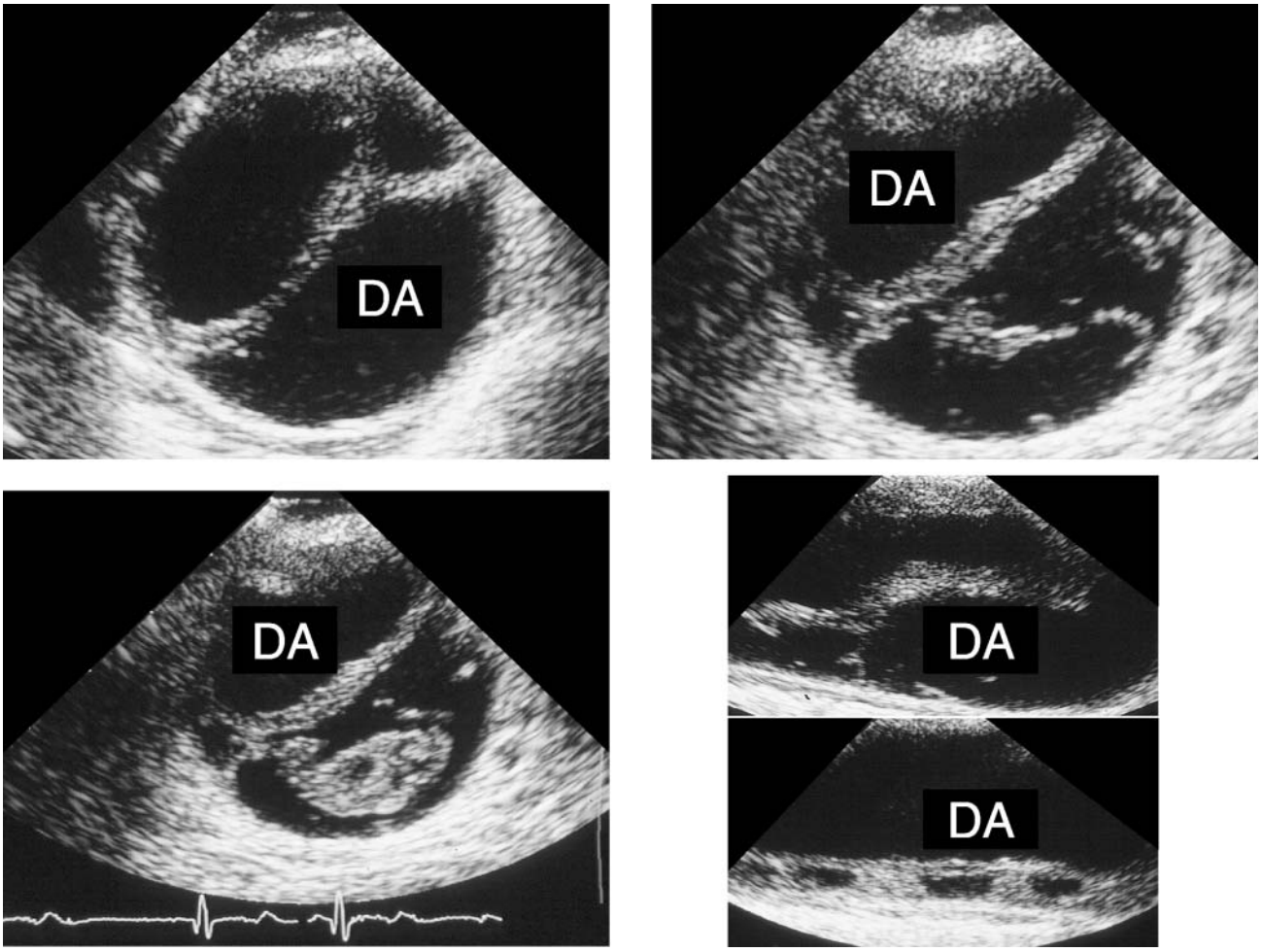

Fig. 10. Dissection of the descending aorta (DA) as obtained with TEE. Thrombus masses are clearly visible in the false lumen.

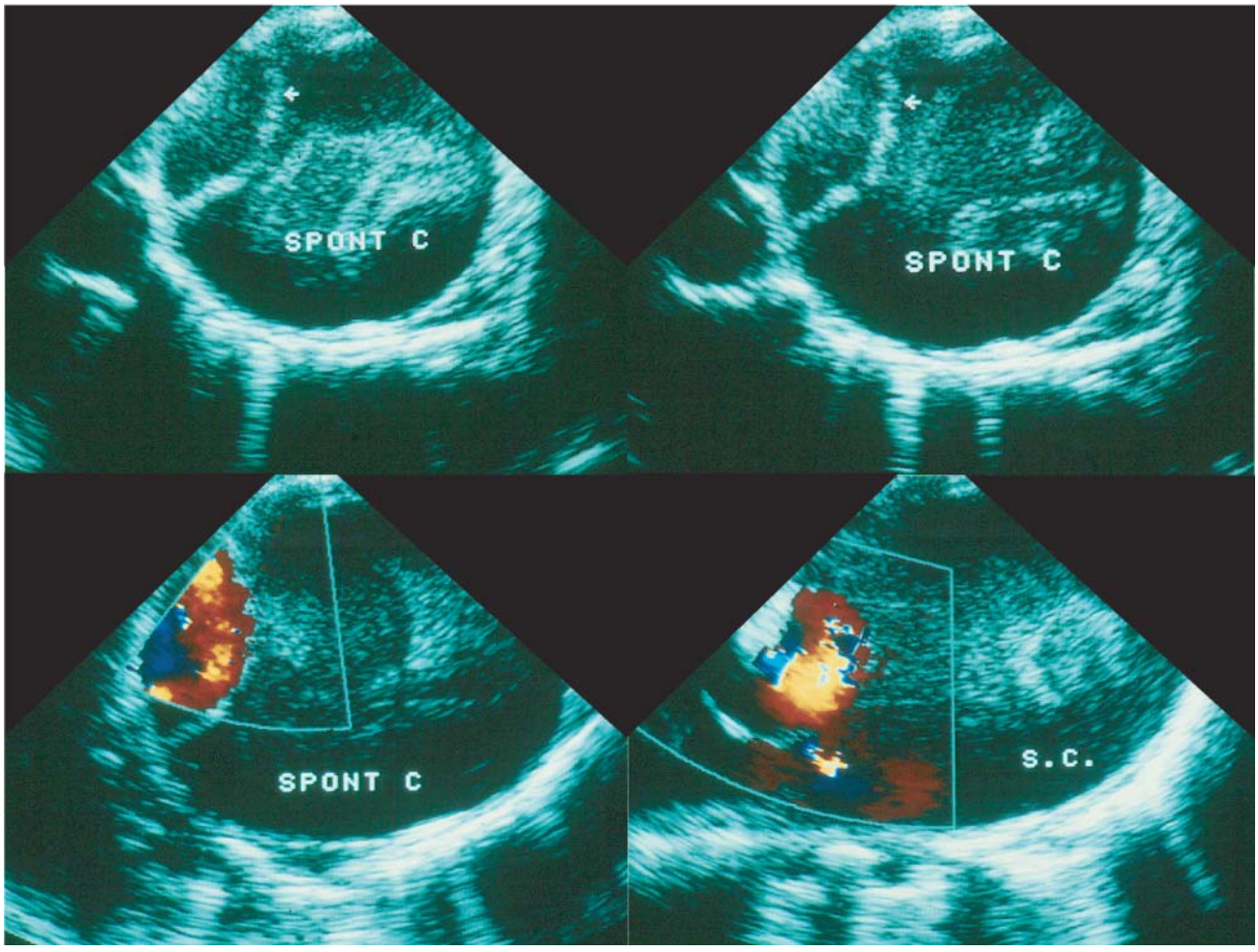

Fig. 11. With color Doppler false and the true lumens are clearly defined. Spontaneous contrast (SPONT C, S.C.) is visible in the false lumen.

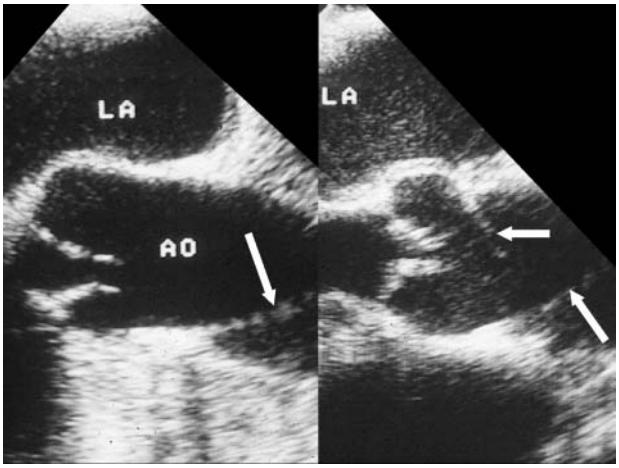

Fig. 12. False positive images of a dissection can be made with echocardiography. Linear artefacts may be visible, sometimes resembling intimal flaps (arrows). LA=left atrium; AO=aorta.

TEE is contra-indicated if a type A dissection is clearly diagnosed with TTE. There is a mortality of type A dissection patients during TEE, probably caused by rupture of the aorta, caused by blood pressure elevation as a consequence of introduction of the probe or stress caused by the examination itself. If there are diagnostic doubts about the existence of a type A dissection, TEE can be performed during general anesthesia with the patient ready for surgery.

If in other cases a TEE should be performed depends on the clinical picture of the patient and of the level of suspicion of dissection but it should not be the first technique of choice.

Limitations of TEE

Also with TEE, as with TTE, the upper part of the ascending aorta (usually a few centimeters) can not be

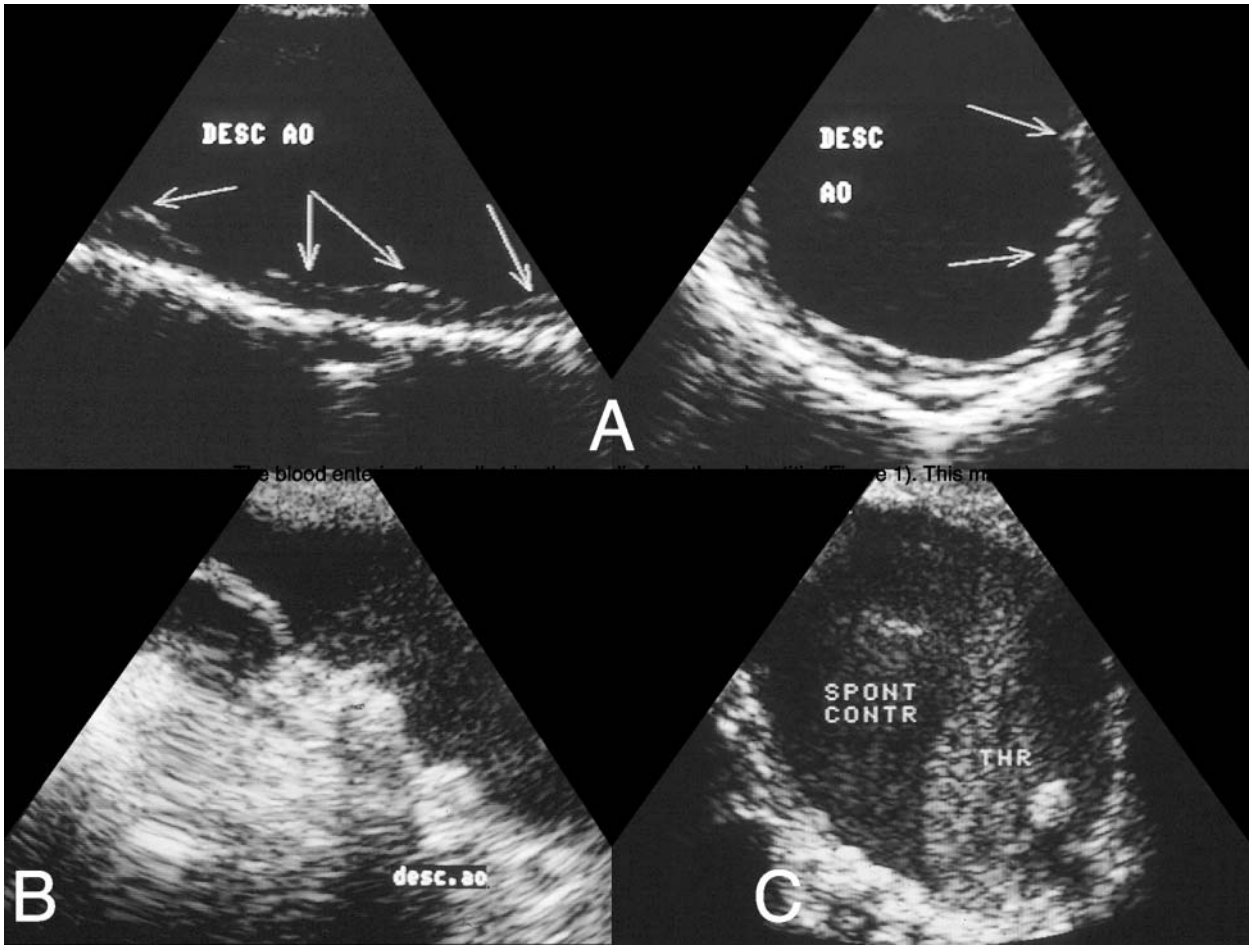

Fig. 13. A: echoes in the descending aorta (DESC AO) caused by atherosclerotic plaques. **B**: ruptured atherosclerotic plaque with a intima-like thrombus. **C**: thrombus mass with spontaneous contrast in case of low output. SPONT CONTR=spontaneous contrast; THR=thrombus mass.

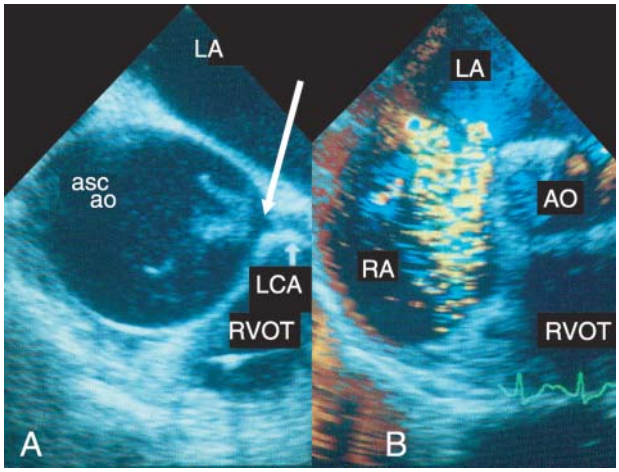

Fig. 14. TEE just before surgery of a type A dissection **(A)**. The intimal flap almost obstructs the left coronary ostium, causing myocardial ischemia. Thus, left ventricular enddiastolic pressure was elevated, with elevation of left atrial pressure. This caused protrusion of the valvula fossa ovalis into the right atrium, with a large left-to-right shunt at atrial level **(B)**. LA=left atrium; RA=right atrium; asc ao=ascending aorta; RVOT=right ventricular outflow tract; LCA=ostium of left coronary artery.

visualized. With longitudinal sections this invisible part is smaller than with transverse sections, but it is still there.

False positive recordings

False positive images of a dissection can be made with echocardiography. Linear artefacts, sometimes resembling an intima flap (Figure 12) can be found in almost half of the patients. However, depending of type of reflection, they are recognized easily by the experienced echocardiographer.

Many structures can be found in the thoracic aorta such as thrombi and atherosclerotic plaques with or without rupture Figures 13). They should be distinguished from an intimal flap which is not always easy.

Every patient with a typical history, but also patients with atypical chest pain or a history of myocardial infarction but only ST depression on the electrocardiogram should be examined carefully for dissection.

The role of echocardiography in patients suspected of having dissection extends further than examination of the aorta alone. This is illustrated with the findings in a patient who presented himself with atypical complaints. Myocardial ischemia was diagnosed on the electrocardiogram. With TTE a dissection type A was suspected. During general anesthesia TEE was performed and a type A dissection was diagnosed. The intimal flap almost obstructed the left coronary ostium, explaining the myocardial ischemia (Figure 14A). Because of myocardial ischemia, left ventricular enddiastolic pressure was elevated, causing elevation of left atrial pressure. This caused protrusion of the valvula fossa ovalis into the right atrium, causing a large left-to-right shunt at atrial level (Figure 14B).

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