The management is always urgent but depends on the localization and patterns of AAS.

- In case of Type A AD, urgent surgery is indicated (Class I, Level B).
- In case of uncomplicated type B AD, medical therapy (pain relief, blood pressure control…) is always recommended (Class I, Level C), and endovascular therapy (TEVAR) should be considered (Class IIa, Level B). In case of complicated type B AD, TEVAR is indicated (Class I, Level C). The management of IMH is mostly similar to AD.

3. Aortic Aneurysm

This is the second most frequent lesion after atherosclerosis. While the guidelines focus on the management of these lesions, it should be kept in mind that patients with (non-syndromic) aortic aneurysm are at high risk of cardiovascular events and general preventive strategies should be considered (class IIa). In any case with any localization of aneurysm, the assessment of the full aorta is indicated (Class I), as combined presentations may exist, simultaneously or over time. Also, patients with abdominal aorta aneurysm (AAA) are at increased risk of peripheral aneurysms or PAD: ultrasound screening should be considered (Class IIa).

A. Thoracic Aorta Aneurysms (TAA)

Overall TAAs are related either to genetic elastopathies (peak at 38 yrs), or associated with bicuspid aortic valve (BAV, peak at 64 yrs) or degenerative (peak at 67 years), although they may present common histological features. Indications for surgery are based mainly on aortic diameter and derived from findings on natural history regarding the risk of complications weighed against the risk of elective surgery. Familial TAAs grow faster, up to 2.1 mm/yr, with higher risk of rupture. Syndromic TAA growth rates also vary. In patients with Marfan syndrome (MS), the TAA grows 0.5–1 mm/yr in case of Marfan syndrome, whereas TAAs in patients with Loeys-Dietz syndrome can grow even faster than 10 mm/year, resulting in death in the youth. TAAs of the descending aorta grow faster (3 mm/yr) than those in ascending aorta (1 mm/yr).

In case of aortic root aneurysm, surgery should be considered when

- the diameter ≥55 mm (Class IIa) for any patient,
- in case of MS surgery is indicated when ≥50 mm (Class I), and should be even considered earlier ≥45 mm in the presence of family history of AD, diameter growth >3 mm/yr, severe aortic/mitral regurgitation or desire for pregnancy (Class IIa).
- in patients with BAV with other risk factors (including hypertension, aortic regurgitation), when diameter ≥50 mm (Class IIa).

In case of aneurysm located at the aortic arch, surgery should be considered for diameters ≥55 mm (Class IIa) but smaller diameters may be operated if there is already an indication for surgery of an adjacent segment.

3. Aortic Aneurysm (cont.)

For aneurysms located at the level of the descending aorta, TEVAR should be considered, rather than surgery, when anatomy is suitable (Class IIa), except for MS and other elastopathies, where surgery is preferred (Class IIa). In the absence of elastopathies, when TEVAR is feasible, it should be considered for aneurysms ≥55 mm (Class IIa), while surgery should be indicated when TEVAR is not feasible and the aneurysmal diameter ≥60 mm (Class IIa).

Abdominal aorta aneurysm (AAA), defined by a diameter >30 mm, is the most frequent case of aortic aneurysms. Main risk factors are male gender, age, smoking and family history of aneurysms. The epidemiology is evolving, with decreasing prevalence, mostly related to the decreasing rates of smoking. While AAA rupture is associated with grim prognosis, intervention for uncomplicated AAA presents low risk of mortality. Screening can be easily done by ultrasound. Screening for AAA with ultrasound:

- is indicated in all men >65 years (Class I),
- may be indicated for women with a history of past/current smoking (Class IIb),
- should be considered in first-degree siblings of a patient with AAA (Class IIa).

Also, opportunistic screening after TTE should be considered in men >65 years (Class IIa) and may be considered in women >65 years with a history of current/past smoking (Class IIb).

Once detected, surveillance is indicated and safe in patients with AAA with a maximum diameter of <55 mm and slow (<10 mm/year) growth (Class I). Smoking cessation should be strongly advised (Class I). Statins and ACE-inhibitors may be indicated (Class IIb), mostly because of their interest in cardiovascular prevention. Repeated ultrasound is indicated to follow-up the AAA until decision for intervention (every 3 years for AAA of 30–39 mm, every 2 years for AAA of 40–45 mm, and every 6–12 months for larger aneurysms). Repair is indicated for AAA ≥55 mm, this threshold could be lower (50 mm) for women. When anatomically suitable for EVAR, either open or endovascular aortic repair is recommended in patients with acceptable surgical risk (Class I). For those anatomically unsuitable for EVAR, surgery is indicated (Class I). For those unfit to open surgery, EVAR may be considered (Class IIb). In case of symptomatic AAA anatomically suitable for EVAR, either open surgery or EVAR is recommended (Class I).

4. Aortic atherosclerosis

This is the most frequent aortic lesion, most often silent, usually detected either incidentally when imaging (e.g. chest radiograph), and in this case general preventive measures to control risk factors are indicated (Class I). It can also be detected during the diagnostic work up for cerebral/distal embolism. In this case anticoagulation or antiplatelet therapy should be considered (Class II). The choice between the two strategies depends on comorbidities and other indications for these treatments.

EUROPEAN SOCIETY OF CARDIOLOGY®

ESC
Les Templiers
2035 route des Colles
CS 80179 BIOT
06903 SOPHIA ANTIPOLIS CEDEX - FRANCE
PHONE: +33 (0)4 92 94 76 00
E-mail: guidelines@escardio.org

For more information
www.escardio.org/guidelines

SUMMARY CARD FOR GENERAL PRACTICE

Committee for Practice Guidelines
To improve the quality of clinical practice and patient care in Europe

AORTIC DISEASES

ESC GUIDELINES ON THE DIAGNOSIS AND TREATMENT OF AORTIC DISEASES

For more information
www.escardio.org/guidelines

EUROPEAN SOCIETY OF CARDIOLOGY®

1. introduction

Aortic diseases contribute to the wide spectrum of arterial diseases: aortic aneurysms (AA), acute aortic syndromes (AAS) including aortic dissection (AD), intramural haematoma (IMH), penetrating atherosclerotic ulcer (PAU), traumatic aortic injury (TAI), pseudoaneurysm, aortic rupture, atherosclerotic and inflammatory affections, as well as genetic diseases and congenital abnormalities (e.g. coarctation of the aorta, CoA). This summary card will focus on the most frequent and/or life-threatening conditions. These guidelines highlight the holistic approach, viewing the aorta as a 'whole organ', from the aortic valve to the aortic bifurcation. Indeed, in many cases tandem lesions of the aorta may exist. Treatment should at best be concentrated in 'aorta clinics', with a multidisciplinary team, especially during the chronic phases of disease. In emergency cases (e.g. ruptured abdominal AA or type-A AD), patient's transfer should be avoided, if sufficient medical and surgical facilities and expertise are available locally.

The aorta is a complex geometric structure. Assessment of the aorta is mainly based on imaging techniques (Table 1): ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI). Diameter measurements should be at best estimated perpendicular to the flow's axis (Fig. 1).

Table 1 Comparison of methods for imaging the aorta

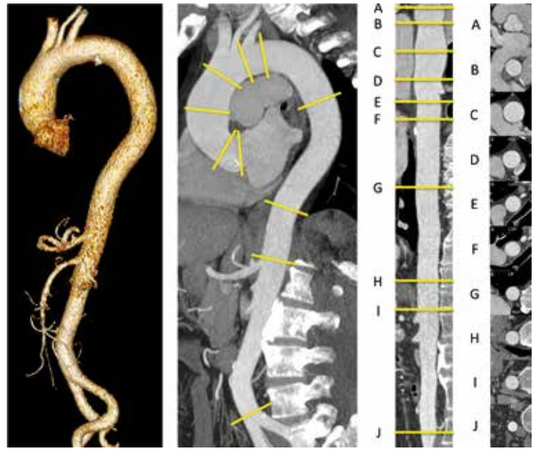
Advantages/disadvantages	TTE	TOE	CT[c]	MRI[c]	Aortography
Ease of use	+++	++	+++	++	+
Diagnostic reliability	+	+++	+++	+++	++
Bedside/interventional use[a]	++	++	–	–	++
Serial examinations	++	+	++(+)[b]	+++	–
Aortic wall visualization[c]	+	+++	+++	+++	–
Cost	–	–	– –	– – –	– – –
Radiation	0	0	– – –	0	– –
Nephrotoxicity	0	0	– – –	– –	– – –

CT = computed tomography; MRI = magnetic resonance imaging; TOE = transoesophageal echocardiography; TTE = transthoracic echocardiography.
+ means a positive aspect and – means a negative point. The number of signs indicates the estimated potential value.
[a]IVUS can be used to guide interventions (see web addenda art www.escardio.org/guidelines).
[b]+++ only for follow-up after aortic stenting (metallic struts), otherwise limit radiation.
[c]PET can be used to visualize suspected aortic inflammatory disease.

Corresponding authors:
Raimund Erbel
Department of Cardiology, West-German Heart Centre Essen, University Duisburg-Essen, Hufelandstrasse 55, DE-45122 Essen, Germany.
Tel: +49 201 723 4801 - Fax: +49 201 723 5401 - Email: erbel@uk-essen.de
Victor Aboyans
Department of Cardiology, CHRU Dupuytren Limoges, 2 Avenue Martin Luther King, 87042 Limoges, France.
Tel: +33 5 55 05 63 10 - Fax: +33 5 55 05 63 84 - Email: vaboyans@live.fr

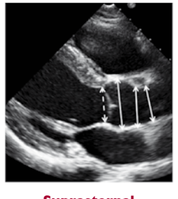
Figure 1

Landmarks for measurement of aortic diameters on CT

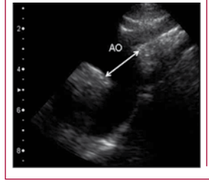


Transthoracic echocardiography

Parasternal long-axis view



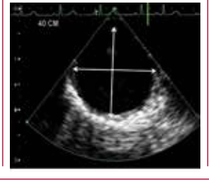
Suprasternal long-axis view



Transoesophageal Echocardiography

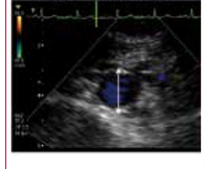
Ascending aorta

Descending aorta

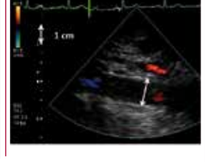


Abdominal aortic ultrasound

Abdominal short-axis view



Abdominal long-axis view



2. Acute Aortic Syndromes

Acute aortic syndromes (AAS) encompass emergency conditions with similar clinical characteristics, occurring when a tear or an ulcer allows blood to penetrate from the aortic lumen into the media or bleeding within the media. The Stanford classification delineates 2 subgroups according to whether the ascending aorta is involved (Type A) or not (Type B).

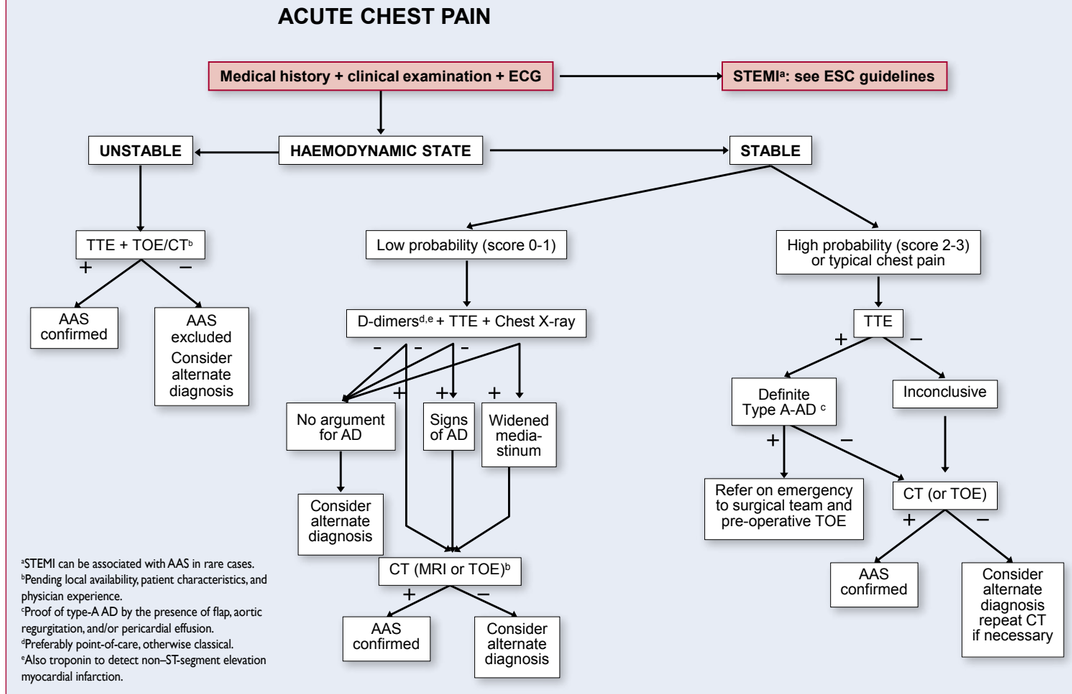
Acute AD (≤14 days) is followed by subacute (15–90 days), and chronic (>90 days) AD. The diagnostic algorithm (Table 2 and Fig. 2) aims to limit as far as possible any misdiagnosis differs according to the haemodynamic stability and the clinical probability.

Table 2 Risk score according to positive categories (1 per column)

High-risk conditions	High-risk pain features	High-risk examination features
• Marfan syndrome (or other connective tissue diseases) • Family history of aortic disease • Known aortic valve disease • Known thoracic aortic aneurysm • Previous aortic manipulation (including cardiac surgery)	• Chest, back, or abdominal pain described as any of the following: - abrupt onset - severe intensity - ripping or tearing	• Evidence of perfusion deficit: - pulse deficit - systolic blood pressure difference - focal neurological deficit (in conjunction with pain) • Aortic diastolic murmur (new and with pain) • Hypotension or shock

Table modified from Rogers AM et al Circulation 2011;123:2213-8.
Risk score varies from 0–3 according the number of positive categories (1 point per column).

Figure 2 The diagnostic algorithm for AAS



[a]STEMI can be associated with AAS in rare cases.
[b]Pending local availability, patient characteristics, and physician experience.
[c]Proof of type-A AD by the presence of flap, aortic regurgitation, and/or pericardial effusion.
[d]Preferably point-of-care, otherwise classical.
[e]Also troponin to detect non–ST-segment elevation myocardial infarction.