

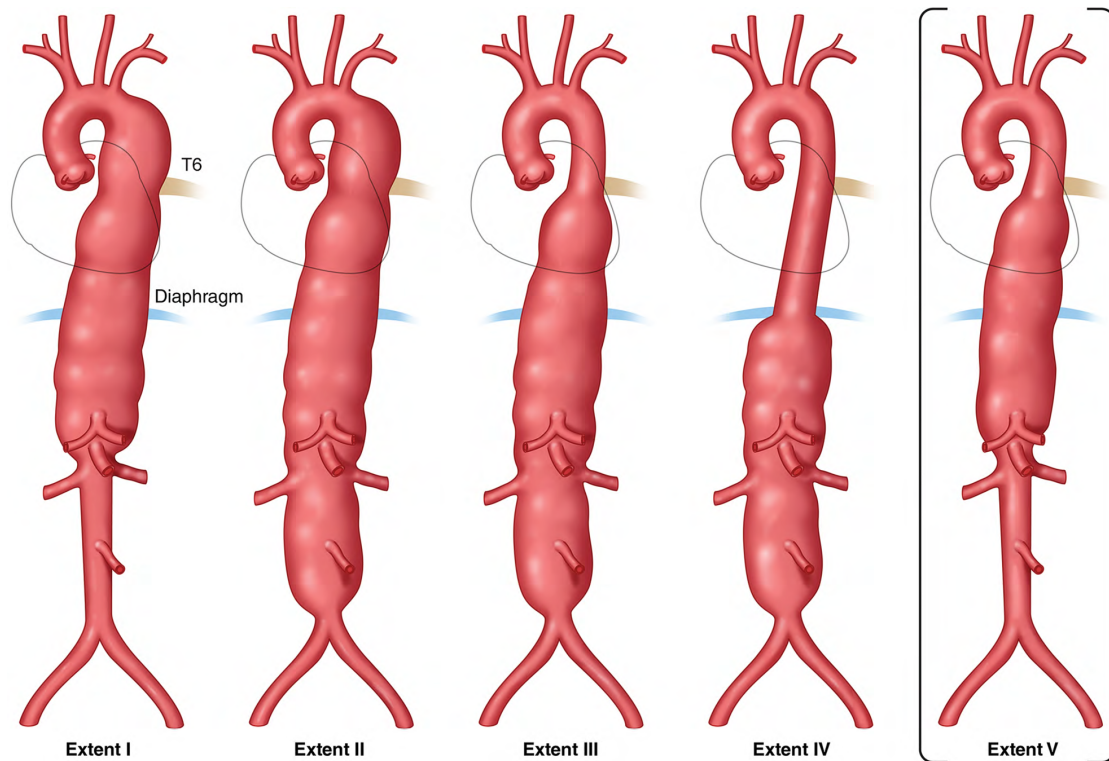


Figure 1. ACC/AHA 2022 GL on Aortic Disease. Classification of Thoracoabdominal Aortic Aneurysms (also adopted by the ESC 2024 GL).

Extent I, below the left subclavian to above the celiac axis or opposite the superior mesenteric and above the renal arteries; Extent II, below the left subclavian and including the infrarenal abdominal aorta to the level of the aortic bifurcation; Extent III, below T6 intercostal space, tapering to just above the infrarenal abdominal aorta to the iliac bifurcation; and Extent IV, below T12, tapering to above the iliac bifurcation. Extent V, below T6, tapering to just above the renal arteries.

Table 1. ACC/AHA 2022 GL on Aortic Disease. Cause of TAA.

HTAD (see Table 7): syndromic
■ Marfan syndrome
■ Loeys-Dietz syndrome
■ Vascular Ehlers-Danlos syndrome
■ Smooth muscle dysfunction syndrome
■ Others: attributable to pathogenic variants in <i>FLNA</i> , <i>BGN</i> , <i>LOX</i>
HTAD (see Table 7): nonsyndromic
■ <i>ACTA2</i> , <i>MYH11</i> , <i>PRKG1</i> , <i>MYLK</i> , and others
■ Familial thoracic aortic aneurysm without identified pathogenic variants in a known gene for HTAD
Congenital conditions
■ Bicuspid aortic valve
■ Turner syndrome
■ Coarctation of the aorta
■ Complex congenital heart defects (tetralogy of Fallot, transposition of the great vessels, truncus arteriosus)
Hypertension
Atherosclerosis
Degenerative
Previous aortic dissection
Inflammatory aortitis
■ Giant cell arteritis
■ Takayasu arteritis
■ Behçet disease
■ Immunoglobulin G4-related disease, antineutrophil cytoplasmic antibody-related, sarcoidosis
Infectious aortitis
■ Bacterial, fungal, syphilitic
Previous traumatic aortic injury
HTAD indicates heritable thoracic aortic diseases; and TAA, thoracic aortic aneurysms.

Table 2. ESC 2024 GL on Aortic and Peripheral Diseases. Recommendations for initial evaluation of thoracic aortic aneurysm and abdominal aortic aneurysm

When an aortic aneurysm is identified at any location, assessment of the entire aorta is recommended at baseline and during follow-up. ^{874,875}	I	C
When a TAA is identified, assessment of the aortic valve (especially for BAV) is recommended. ^{879,880}	I	C
When an AAA is identified, evaluation of the presence of aneurysm in the femoro-popliteal arterial segment should be considered. ^{876–878,881}	IIa	C
Patients with aortic aneurysm are at increased risk of CVD, thus general CV prevention should be considered. ^{26,882,883}	IIa	C

AAA, abdominal aortic aneurysm; BAV, bicuspid aortic valve; CV, cardiovascular; CVD, cardiovascular disease; TAA, thoracic aortic aneurysm.

Table 3. ACC/AHA 2022 GL on Aortic Disease. Risk Factors for Familial TAD.

TAD and syndromic features of Marfan syndrome, Loeys-Dietz syndrome, or vascular Ehlers-Danlos syndrome
TAD presenting at age <60 y
A family history of either TAD or peripheral/intracranial aneurysms in a first- or second-degree relative
A history of unexplained sudden death at a relatively young age in a first- or second-degree relative
TAD indicates thoracic aortic disease.

Table 4. Genetic Testing

ACC/AHA 2022 GL on Aortic Disease. Recommendations for HTAD: Genetic Testing and Screening of Family Members for TAD

In patients with aortic root/ascending aortic aneurysms or aortic dissection, obtain a multigenerational family history of TAD, unexplained sudden deaths, and peripheral and intracranial aneurysms.	I B-NR
In patients with aortic root/ascending aortic aneurysms or aortic dissection and risk factors for HTAD, genetic testing to identify pathogenic/likely pathogenic variants (ie, mutations).	I B-NR
In patients with an established pathogenic or likely pathogenic variant in a gene predisposing to HTAD, genetic counseling to be provided and the patient's clinical management to be informed by the specific gene and variant in the gene.	I B-NR
In patients with TAD who have a pathogenic/likely pathogenic variant, genetic testing of at-risk biological relatives (ie, cascade testing). In family members who are found by genetic screening to have inherited the pathogenic/likely pathogenic variant, aortic imaging with TTE (if aortic root and ascending aorta are adequately visualized, otherwise with CT or MRI).	I B-NR
In a family with aortic root/ascending aortic aneurysms or aortic dissection, if the disease-causing variant is not identified with genetic testing, screen aortic imaging of at-risk biological relatives (ie, cascade testing).	I B-NR
In patients with aortic root/ascending aortic aneurysms or aortic dissection, in the absence of either a known family history of TAD or pathogenic/likely pathogenic variant, screen aortic imaging (as per recommendation 4) of first-degree relatives.	I C-LD
In patients with acute type A aortic dissection, record the diameter of the aortic root	I C-EO

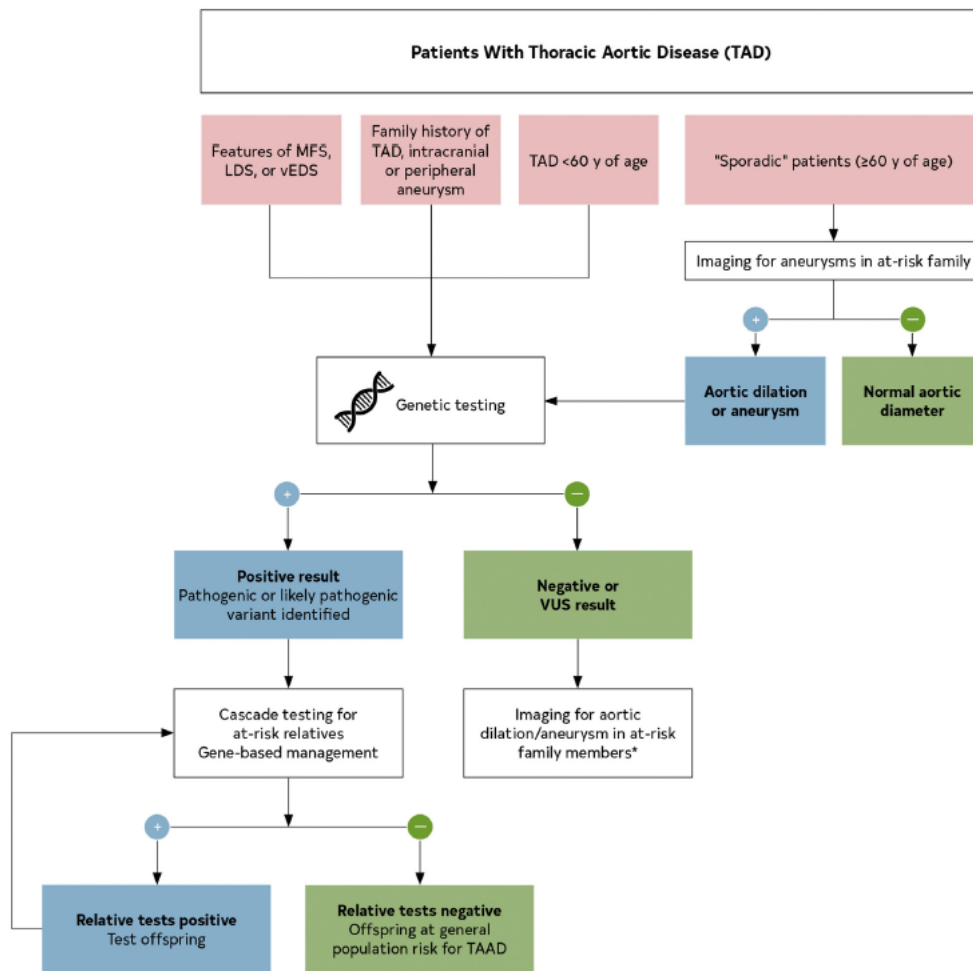


Figure 2. ACC/AHA 2022 GL on Aortic Disease. Evaluation and Genetic Testing Protocol for Patients With TAD

Genetic testing is recommended for individuals with syndromic features, family history of TAD, and/or early age of disease onset. Thoracic aortic imaging is recommended for first-degree relatives of all individuals with TAD, regardless of age of onset, to detect asymptomatic aneurysms. Positive genetic testing should trigger gene-based management and cascade testing of at-risk relatives. When testing is negative or reveals variants of unknown significance, first-degree relatives should undergo screening aortic imaging.

Blue (+) indicates positive; green (-), negative; LDS, Loeys-Dietz syndrome; MFS, Marfan syndrome; TAAD, thoracic aortic aneurysm and dissection; TAD, thoracic aortic disease; and VUS, variants of unknown significance.

*Aneurysms are typically asymptomatic.

Table 5. Medical Therapy**ACC/AHA 2022 GL on Aortic Disease. Thoracic Aortic Aneurysms (TAA)*****BP Management***

In patients with TAA and an average systolic BP (SBP) of ≥ 130 mm Hg or an average diastolic BP (DBP) of ≥ 80 mm Hg, use of antihypertensive medications to reduce risk of cardiovascular events. I B-NR

In patients with TAA, regardless of cause and in the absence of contraindications, use of beta blockers to achieve target BP goals. IIa C-LD

In patients with TAA, regardless of etiology and in the absence of contraindications, ARB therapy as an adjunct to beta-blocker therapy to achieve target BP goals. IIa C-EO

Statins

In patients with TAA and imaging or clinical evidence of atherosclerosis, statin therapy at moderate or high intensity. IIa C-LD

In patients with TAA who have no evidence of atherosclerosis, statin therapy. IIb C-LD

Smoking Cessation

In patients with TAA who smoke cigarettes, smoking cessation efforts. I C-LD

Antiplatelet Therapy

In patients with atherosclerotic TAA and concomitant aortic atheroma or PAU, low-dose aspirin, unless contraindicated IIa C-EO

ESC 2024 GL on Aortic and Peripheral Diseases Recommendations for medical treatment in patients with thoracic aorta or abdominal aortic aneurysms

In patients with aortic aneurysm (TAA and/or AAA), optimal implementation of CV risk management and medical are recommended to reduce MACE I C

Fluoroquinolones, while generally discouraged for patients with aortic aneurysms, may be considered if there is a compelling clinical indication and no other reasonable alternative IIb B

AAA, abdominal aortic aneurysm; CV, cardiovascular; MACE, major adverse cardiovascular events; TAA, thoracic aortic aneurysm.

Table 6. ACC/AHA 2022 GL on Aortic Disease. Intervention**Surgery for Sporadic Aneurysms of the Aortic Root and Ascending Aorta**

Surgery in patients with aneurysms of the aortic root and ascending aorta who have symptoms attributable to the aneurysm.	I C-LD
Surgery in asymptomatic patients with aneurysms of the aortic root or ascending aorta who have a maximum diameter of ≥ 5.5 cm.	I B-NR
Surgery in patients with an aneurysm of the aortic root or ascending aorta of < 5.5 cm, whose growth rate confirmed by tomographic imaging is ≥ 0.3 cm/y in 2 consecutive years, or ≥ 0.5 cm in 1 year.	I C-LD
In asymptomatic patients with aneurysms of the aortic root or ascending aorta who have a maximum diameter of ≥ 5.0 cm, surgery when performed by experienced surgeons in a Multidisciplinary Aortic Team.	IIa B-NR
In patients undergoing repair or replacement of a tricuspid aortic valve who have a concomitant aneurysm of the ascending aorta with a maximum diameter of ≥ 4.5 cm, ascending aortic replacement when performed by experienced surgeons in a Multidisciplinary Aortic Team.	IIa B-NR
In patients undergoing repair or replacement of a tricuspid aortic valve who have a concomitant aneurysm of the ascending aorta with a maximum diameter of ≥ 5.0 cm, ascending aortic replacement.	IIa B-NR
In patients undergoing cardiac surgery for indications other than aortic valve repair or replacement who have a concomitant aneurysm of ascending aorta with a maximum diameter of ≥ 5.0 cm, ascending aortic replacement.	IIb C-LD
In patients with a height > 1 standard deviation above or below the mean who have an asymptomatic aneurysm of the aortic root or ascending aorta and a maximal cross-sectional aortic area/height ratio of ≥ 10 cm ² /m, surgery when performed by experienced surgeons in a Multidisciplinary Aortic Team.	IIa C-LD
In asymptomatic patients with aneurysms of the aortic root or ascending aorta who have either an ASI of ≥ 3.08 cm/m ² or AHI of ≥ 3.21 cm/m, surgery when performed by experienced surgeons in a Multidisciplinary Aortic Team.	IIb C-LD

Surgical Approach for Patients With Sporadic Aneurysms of the Aortic Root and Ascending Aorta Meeting Criteria for Surgery

In patients with an aneurysm isolated to the ascending aorta who meet criteria for surgery, aneurysm resection and replacement with an interposition graft.	I B-NR
In patients undergoing aortic valve repair or replacement with a concomitant ascending aortic aneurysm, a separate aortic valve intervention and ascending aortic graft	I B-NR
In patients undergoing aortic root replacement with an aortic valve	I B-NR

that is unsuitable for sparing or repair, a mechanical or biological valved conduit aortic root replacement.

In patients undergoing aortic root replacement, valve-sparing aortic root replacement if the aortic valve is suitable for sparing or repair and when performed by experienced surgeons in a Multidisciplinary Aortic Team. IIa B-NR

Aortic Arch Aneurysms

In patients with an aortic arch aneurysm who have symptoms attributable to the aneurysm and are at low or intermediate operative risk, open surgical replacement. I C-EO

In patients with an isolated aortic arch aneurysm who are asymptomatic and have a low operative risk, open surgical replacement at an arch diameter of ≥ 5.5 cm. IIa B-NR

In patients undergoing open surgical repair of an ascending aortic aneurysm, if the aneurysmal disease extends into the proximal aortic arch, extend the repair with a hemiarch replacement. IIa C-LD

In patients undergoing open surgical repair of an aortic arch aneurysm, if the aneurysmal disease extends into the proximal descending thoracic aorta, an elephant trunk procedure. IIb C-LD

In patients with an aortic arch aneurysm who are asymptomatic but meet criteria C-EO IIb
for intervention, but have a high risk from open surgical repair, a hybrid or endovascular approach.

Size Thresholds for Repair of Descending Thoracic Aortic Aneurysms (TAA)

In patients with intact descending TAA, repair when the diameter is ≥ 5.5 cm. I B-NR

In patients with intact descending TAA and risk factors for rupture, repair at a diameter of < 5.5 cm. IIb B-NR

In patients at increased risk for perioperative morbidity and mortality, increase the size threshold for surgery accordingly. IIb B-NR

Adverse Aortic Events at 1 Year, Based on Baseline Aortic Diameter, Among Patients With Descending Thoracic Aortic Aneurysms (TAA)

<i>Aortic Diameter</i>	<i>Definite Aortic Event*</i>	<i>Probable Aortic Event†</i>
<i>(cm)</i>	<i>(%)</i>	<i>(%)</i>
5.0	5.5	8.0
5.5	7.2	11.2
6.0	9.3	15.6
7.0	15.4	28.1

*Definite aortic event includes aortic dissection or rupture confirmed with imaging or intraoperative findings.

†Probable aortic event includes definite aortic events as well as sudden unexplained death.

Risk Factors for Aortic Rupture Among Patients With Descending Thoracic Aortic Aneurysms

High-Risk Features for Rupture

Aneurysm growth of ≥ 0.5 cm/y

Symptomatic aneurysm

Marfan, Loeys-Dietz, or vascular Ehlers-Danlos syndrome, or HTAD

Saccular aneurysm

Female sex

Infectious aneurysm

HTAD indicates heritable thoracic aortic disease

Patient Characteristics Associated With Increased Perioperative Morbidity and Mortality After Open and Endovascular Repair of Descending Thoracic Aortic Aneurysms

Open Surgical Repair

Advanced age

65-74 y (OR, 1.8; 95% CI, 1.4-2.4; $P < 0.001$)

≥ 75 y (OR, 2.6; 95% CI, 2.0-3.5; $P < 0.001$)

Preoperative renal insufficiency (stage 3 or greater CKD) or hemodialysis

COPD and FEV1 $\neq 50\%$ predicted

Previous stroke

Endovascular Repair

Functional dependence

Thoracoabdominal aortic aneurysm extent

Pulmonary disease

Need for iliac access

Zone 1/2 landing for thoracic stent graft

CKD indicates chronic kidney disease; COPD, chronic obstructive pulmonary disease; FEV1, forced expiratory volume in 1 second.

Recommendations for Endovascular Versus Open Repair of Descending Thoracic Aortic Aneurysms (TAA)

TEVAR over open surgery in patients without Marfan syndrome, Loeys-Dietz syndrome, I B-NR

or vascular Ehlers-Danlos syndrome, who have a descending TAA that meets criteria for intervention and anatomy suitable for endovascular repair.

In patients with a descending TAA that meets criteria for repair with TEVAR, I B-NR
who have smaller or diseased access vessels, consider alternative vascular access.

Open surgical repair in patients with a descending TAA that meets criteria I Ia B-NR
for intervention, who have anatomy unsuitable for endovascular repair, and who are without significant comorbidities and have a life expectancy of at least 10 years.

Left Subclavian Artery Management

In patients with descending TAA who undergo TEVAR with planned left subclavian artery coverage, revascularization of the left subclavian artery before TEVAR I B-NR

to prevent spinal cord injury, and potentially to reduce stroke risk, and prevent other ischemic complications.

In patients with descending TAA who have undergone TEVAR with left subclavian coverage and develop SCI that is unresponsive to an increase in BP or a cerebrospinal fluid drain, consider left subclavian artery revascularization. I Ib C-LD

Celiac Artery Management

In patients with descending TAA undergoing TEVAR in whom celiac artery coverage is being considered, first confirm adequate collateralization I Ia B-NR

Ruptured Descending Thoracic Aortic Aneurysms (TAA)

In patients with ruptured descending TAA who are anatomic candidates for endovascular repair, TEVAR over open repair because of decreased perioperative death and morbidity. I B-NR

In patients with ruptured descending TAA undergoing TEVAR, intentional coverage of the left subclavian artery, celiac artery, or both may be considered to increase the landing zone for endovascular repair I Ib B-NR

Access Issues for TEVAR in Descending Thoracic Aortic Aneurysms (TAA)

In patients with descending TAA undergoing TEVAR, review of preoperative CTA of the iliofemoral vessels to evaluate access. I B-NR

In patients with descending TAA undergoing TEVAR, if iliac access is marginal NR or inadequate to prevent access-related complications, use alternative conduits. I B-

In patients with descending TAA undergoing TEVAR who have suitable anatomy, total percutaneous femoral access as an alternative to open surgical cutdown to avoid access-related complications I Ia B-NR

Size Thresholds for Open Surgical Repair of Thoracoabdominal Aortic Aneurysms (TAAA)

In patients with intact degenerative TAAA, repair when the diameter is ≥ 6.0 cm. I B-NR

In patients with intact degenerative TAAA, repair when the diameter is ≥ 5.5 cm and the repair is performed by experienced surgeons in a Multidisciplinary Aortic Team. I Ia B-NR

In patients with intact degenerative TAAA who have features associated with an increased risk of rupture, repair when the diameter is < 5.5 cm I Ia B-NR

Features Associated With an Increased Risk of Thoracoabdominal Aortic Aneurysms Rupture

Rapid growth (confirmed increase in diameter of ≥ 0.5 cm/y)

Symptomatic aneurysm

Significant change in aneurysm appearance

Saccular aneurysm or presence of penetrating atherosclerotic ulcers

Open Versus Endovascular Repair of Thoracoabdominal Aortic Aneurysms (TAAA)

Ruptured TAAA

Open repair in patients with ruptured TAAA requiring intervention.	I B-NR
In patients with ruptured TAAA requiring intervention, provided that the patient is hemodynamically stable, endovascular repair in centers with endovascular expertise and access to appropriate endovascular stent grafts.	IIb C-LD

Intact TAAA

In patients with Marfan syndrome, Loeys-Dietz syndrome, or vascular Ehlers-Danlos syndrome and intact TAAA requiring intervention, open repair is recommended over endovascular repair.	I C-LD
In patients with intact degenerative TAAA and suitable anatomy, endovascular repair with fenestrated stent grafts, branched stent grafts, or both in centers with endovascular expertise and access to appropriate endovascular stent grafts.	IIb B-NR

Thoracoabdominal Aortic Aneurysms (TAAA) Spinal Cord Protection

In patients undergoing open TAAA repair who are at high risk for SCI, cerebrospinal fluid drainage to reduce the incidence of temporary SCI, permanent SCI, or both.	I A
In patients who experience delayed spinal cord dysfunction after either open or endovascular TAAA repair, timely measures to optimize spinal cord perfusion and decrease intrathecal pressure.	I B-NR

Measures to Optimize Spinal Cord and End-Organ Perfusion

Cardioversion for tachyarrhythmias
 Insertion of cerebrospinal fluid drain
 Increase mean arterial pressure to >100 mm Hg
 Transfuse to a hemoglobin >10 g/dL
 Volume resuscitation

Thoracoabdominal Aortic Aneurysms (TAAA) Renal and Visceral Organ Protection

In patients undergoing open repair of TAAA involving the renal arteries, cold blood or crystalloid renal perfusion to provide effective protection against renal injury.	I A
Additional revascularization procedures in patients undergoing open or endovascular TAAA repair who have end-organ ischemia or significant stenoses from atherosclerotic visceral or renal artery disease.	I B-NR

Table 7. ESC 2024 GL on Aortic and Peripheral Diseases. Intervention.**Recommendations for surgery in aortic root and ascending aorta dilatation associated with tricuspid aortic valve**

Surgery is recommended in patients with dilatation of the aortic root or ascending aorta with a tricuspid aortic valve and a maximum diameter of ≥ 55 mm. ^{172,894,899,904}	I	B
Valve-sparing aortic root replacement is recommended in patients with aortic root dilatation if performed in experienced centres and durable results are expected. ^{961–965}	I	B
VKAs are recommended lifelong for all patients with a Bentall procedure with an MHV prosthesis. ^{970,971}	I	B
In patients with dilatation of the tubular ascending aorta who can be offered surgery with low predicted risk, ^c ascending aortic replacement should be considered at a maximum diameter > 52 mm. ^{153,981,983}	IIa	B
In patients undergoing surgery for tricuspid aortic valve disease who have concomitant dilatation of the aortic root or ascending tubular aorta, and low predicted surgical risk, ascending aorta or root replacement should be considered at a maximum diameter ≥ 45 mm, otherwise ≥ 50 mm. ^{70,987–989}	IIa	B

SAPT with low-dose aspirin (75–100 mg per day) should be considered for the first 3 months after valve-sparing aortic surgery when there are no other baseline indications for OAC.	IIa	C
In patients undergoing non-aortic-valve cardiac surgery who have concomitant dilatation of the ascending aorta or aortic root with a maximum diameter ≥ 50 mm, concomitant aortic surgery should be considered. ^{70,990,991}	IIa	C
Ascending aortic or root replacement may be considered at a maximum diameter of ≥ 50 mm in patients with proximal aorta dilatation who can be offered surgery with low predicted risk ^c and present with any of the following: ^{153–155,891,892} • Growth of the aortic diameter ≥ 3 mm per year • Resistant hypertension^d • Short stature < 1.69 m • Root phenotype • Aortic length^e > 11 cm • Age < 50 years • Desire for pregnancy • Aortic coarctation	IIb	B

MHV, mechanical heart valve; OAC, oral anticoagulation; SAPT, single antiplatelet therapy; VKA, vitamin K antagonist.

c Individual patient's risk $< 3\%$.

d Hypertension that cannot be adequately controlled despite use of three or more agents recommended by a physician with expertise in the management of hypertension.

e Curvilinear distance at aortic centreline between the ventriculo-aortic junction and the origin of the innominate artery.

Recommendations for surgery in aortic arch aneurysms

In patients with low or intermediate operative risk with an aortic arch aneurysm and recurrent episodes of chest pain not attributable to non-aortic causes, open surgical replacement of the arch is recommended. ^{70,172}	I	C
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In patients with an isolated aortic arch aneurysm who are asymptomatic and have low operative risk, open surgical replacement should be considered at an arch diameter of ≥ 55 mm. ^{70,172,899}	IIa	B
In patients undergoing open surgical repair of an ascending aortic aneurysm, concomitant hemi-arch replacement should be considered if the dilatation extends into the proximal aortic arch (>50 mm). ^{70,172,1000}	IIa	C
In patients undergoing open surgical repair of an aortic arch aneurysm, an elephant trunk or frozen elephant trunk procedure should be considered if the aneurysmal disease extends into the proximal descending thoracic aorta. ^{70,172,997,1001}	IIa	C
In patients undergoing open surgical repair of an ascending aortic aneurysm, concomitant hemi-arch or arch replacement may be considered in experienced centres if the dilatation extends into the aortic arch (>45 mm). ^{70,172,1001}	IIb	C
In patients with an aortic arch aneurysm who meet criteria for intervention but have high surgical risk, a hybrid or endovascular approach may be considered. ^{70,172}	IIb	C

Recommendations for the management of patients presenting with descending thoracic aortic and thoracoabdominal aortic aneurysms

In patients with unruptured DTA aneurysm (without HTAD), elective repair is recommended if diameter ≥ 55 mm. ^{902,1002}	I	B
In patients without HTAD with unruptured DTA aneurysm, when elective repair is indicated and anatomy is suitable, TEVAR is recommended over open repair. ^{1006,1019,1020}	I	B
In patients with DTA aneurysm who undergo TEVAR with planned LSA coverage, it is recommended to revascularize the LSA before TEVAR to reduce the risk of SCI and stroke. ^{1026,1028,1029}	I	B
In patients with unruptured degenerative TAAA, elective repair is recommended when the diameter is ≥ 60 mm. ^{902,1002,1033}	I	B
In patients without significant comorbidities and with unruptured DTA aneurysm, when elective repair is indicated and anatomy is unsuitable for TEVAR, open repair should be considered if life expectancy exceeds 2 years. ¹⁰¹³	IIa	B
In TAAA, surgical repair should be considered at diameters ≥ 55 mm if patients present with high-risk features, are at very low risk, and are under the care of experienced surgeons in a multidisciplinary aorta team. ^{1004,1033,1034}	IIa	B
In patients with unruptured degenerative TAAA and suitable anatomy, when elective repair is indicated, endovascular repair using fenestrated and/or branched endografts should be considered in experienced centres. ^{1051,1052,1055–1059}	IIa	B
In patients with unruptured DTA aneurysm (without HTAD) and high-risk features, ^c elective repair may be considered if the diameter is < 55 mm. ^{904,1003,1004,1033,1034}	IIb	B

DTA, descending thoracic aorta; HTAD, heritable thoracic aortic disease; LSA, left subclavian artery; SCI, spinal cord ischaemia; TAAA, thoracoabdominal aortic aneurysm; TEVAR, thoracic endovascular aortic aneurysm repair.

Overview of factors favouring open vs. endovascular repair in thoracoabdominal aortic aneurysm

Characteristic	Favours open repair	Favours endovascular repair
Biological age and life expectancy	- Younger age - Considerable life expectancy with acceptable quality of life	- Older age - Limited life expectancy
Anatomical considerations	- If aortic and branch anatomy preclude endovascular approach - Poor vascular access	- Suitable proximal and distal landing zones - Favourable visceral and renal configuration - Vascular access obtainable
Pathological	Chronic dissection	Acute dissection
Background/causal factor	Hereditary aortic disease	Degenerative aortic disease
Cardiopulmonary condition	Good cardiopulmonary reserve	Poor cardiopulmonary reserve
Fitness	- No significant comorbidities - Successful rehabilitation likely	- Severe organ impairment (renal, kidney, pulmonary) - Obesity - Limited mobility, unlikely to rehabilitate successfully
Urgency	- Elective repair - Emergency repair without a viable endovascular solution	- Elective repair - Emergency repair with time for custom-made graft or suitable for standard grafts

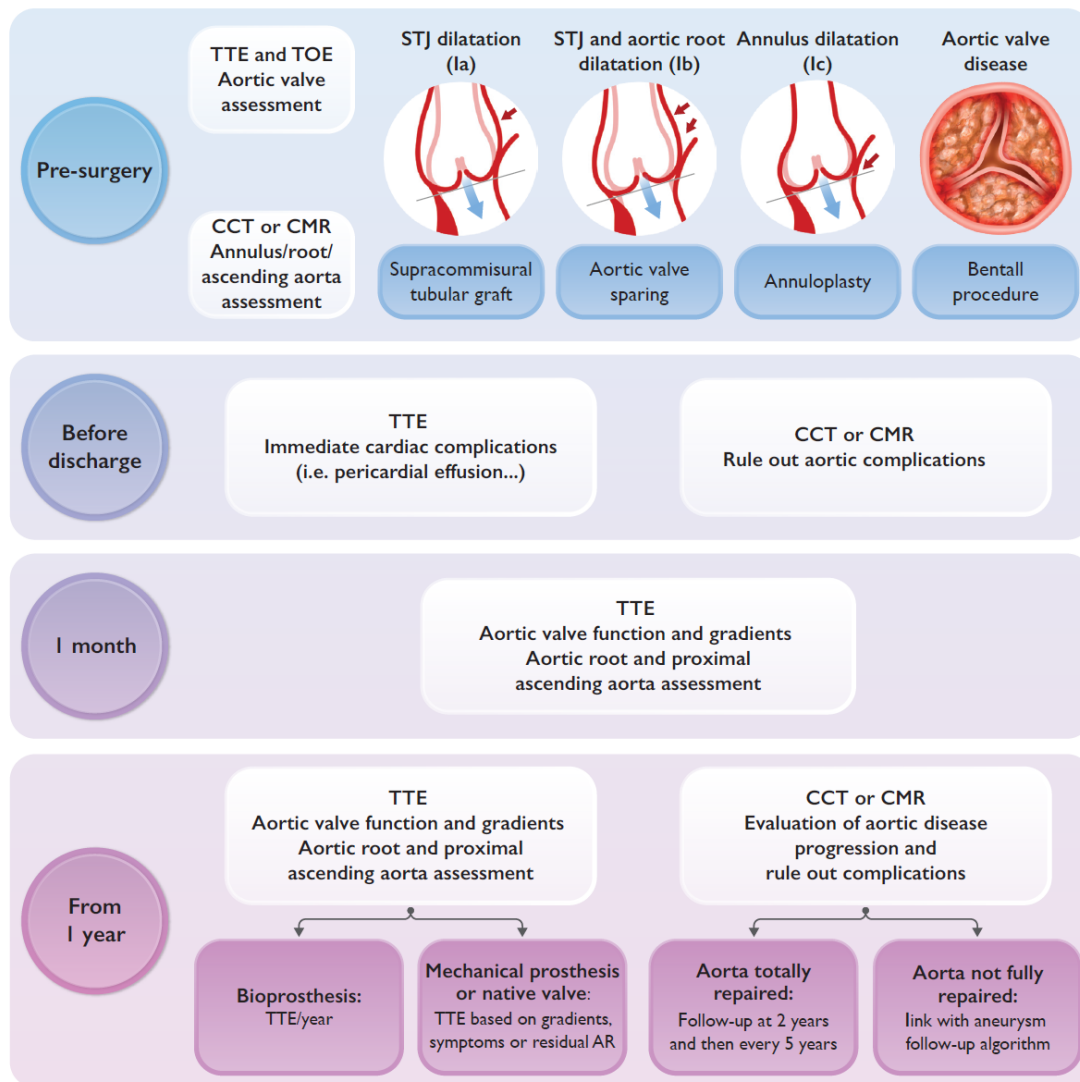


Figure 3. ESC 2024 GL on Aortic and Peripheral Diseases. Peri-operative algorithm for the management of patients with surgically treated aortic root and ascending aortic aneurysm.

AR, aortic regurgitation; CCT, cardiovascular computed tomography; CMR, cardiovascular magnetic resonance; STJ, sinotubular junction; TOE, transoesophageal echocardiography; TTE, transthoracic echocardiography.

Table 8. Follow-up**ACC/AHA 2022 GL on Aortic Disease. Surveillance of Thoracic Aortic Dilation and Aneurysm**

In patients with a dilated thoracic aorta, TTE at the time of diagnosis to assess aortic valve anatomy, aortic valve function, and thoracic aortic diameters.	I C-LD
In patients with a dilated thoracic aorta, a CT or MRI at the time of diagnosis to assess thoracic aortic anatomy and diameters.	IIa C-LD
In patients with a dilated thoracic aorta, follow-up imaging (with TTE, CT, or MRI, as appropriate based on individual anatomy) in 6 to 12 months is reasonable to determine the rate of aortic enlargement; if stable, surveillance imaging every 6 to 24 months (depending on aortic diameter).	IIa C-LD

ESC 2024 GL on Aortic and Peripheral Diseases. Recommendation for the surveillance of patients with thoracic aortic aneurysms (non-heritable thoracic aortic disease)

In thoracic aortic dilatation, TTE is recommended at diagnosis to assess aortic valve anatomy and function, aortic root, and ascending aorta diameters. Additionally, a global aortic evaluation using all echocardiographic views is recommended. ¹⁵⁹	I	C
CMR or CCT is recommended for surveillance of patients with aneurysm at the distal ascending aorta, aortic arch, DTA, or TAAA. ^{70,159,172,912–915}	I	C
In thoracic aortic dilatation, CCT or CMR is recommended to confirm TTE measurements, rule out aortic asymmetry, and determine baseline diameters for follow-up. ^{137,143,144}	I	C
Follow-up imaging with TTE, CCT, or CMR (based on aneurysm location) should be considered annually if there is no expansion/extension or customized according to baseline aortic diameter and the underlying condition. ^{70,159,172}	IIa	C
TTE is not recommended for the surveillance of aneurysms in the distal ascending aorta, aortic arch, or DTA. ^{159,171}	III	C

CCT, Cardiovascular computed tomography; CMR, cardiovascular magnetic resonance; DTA, descending thoracic aorta; TAAA, thoracoabdominal aortic aneurysm; TTE, transthoracic echocardiography.

ESC 2024 GL on Aortic and Peripheral Diseases. Recommendations for follow-up after treatment of aortic aneurysms

Thoracic aortic aneurysm		
After open repair of TAA, an early CCT is recommended within 1 month, and then yearly CCT follow-up for the first 2 post-operative years and every 5 years thereafter is recommended if findings are stable. ^{c,70,1153,1159}	I	B
After TEVAR, follow-up imaging is recommended at 1 and 12 months post-operatively, then yearly until the fifth post-operative year if no abnormalities ^d are documented. ^{70,1153,1158}	I	B
After 5 post-operative years without complications, continuing long-term follow-up of TEVAR by CCT every 5 years should be considered. ^{70,1153,1158}	IIa	B
If growth of the excluded aneurysm is observed, without evidence of type I or III endoleak, repeating CCT every 6–12 months, depending on the growth rate observed, should be considered. ¹¹⁵⁰	IIa	C
When frequent controls are required in TAA patients treated either by open or endovascular repair, CMR should be considered instead of CCT after the first year of follow-up. However, the choice between these imaging modalities should be based on individual patient factors, the potential for artefacts, and the local availability and expertise in specific imaging techniques. ¹¹⁵⁵	IIa	C

CCT, cardiovascular computed tomography; CEUS, contrast-enhanced ultrasound; CMR, cardiovascular magnetic resonance; DUS, Duplex ultrasound; EVAR, endovascular aortic repair; OMT, optimal medical treatment; TAA, thoracic aortic aneurysm; TEVAR, thoracic endovascular aortic repair.

c Both at the level of the treated segment and in the residual native aorta.

d Including: endoleak (any type), enlargement of the excluded aneurysm, and stent graft migration/separation/fracture.

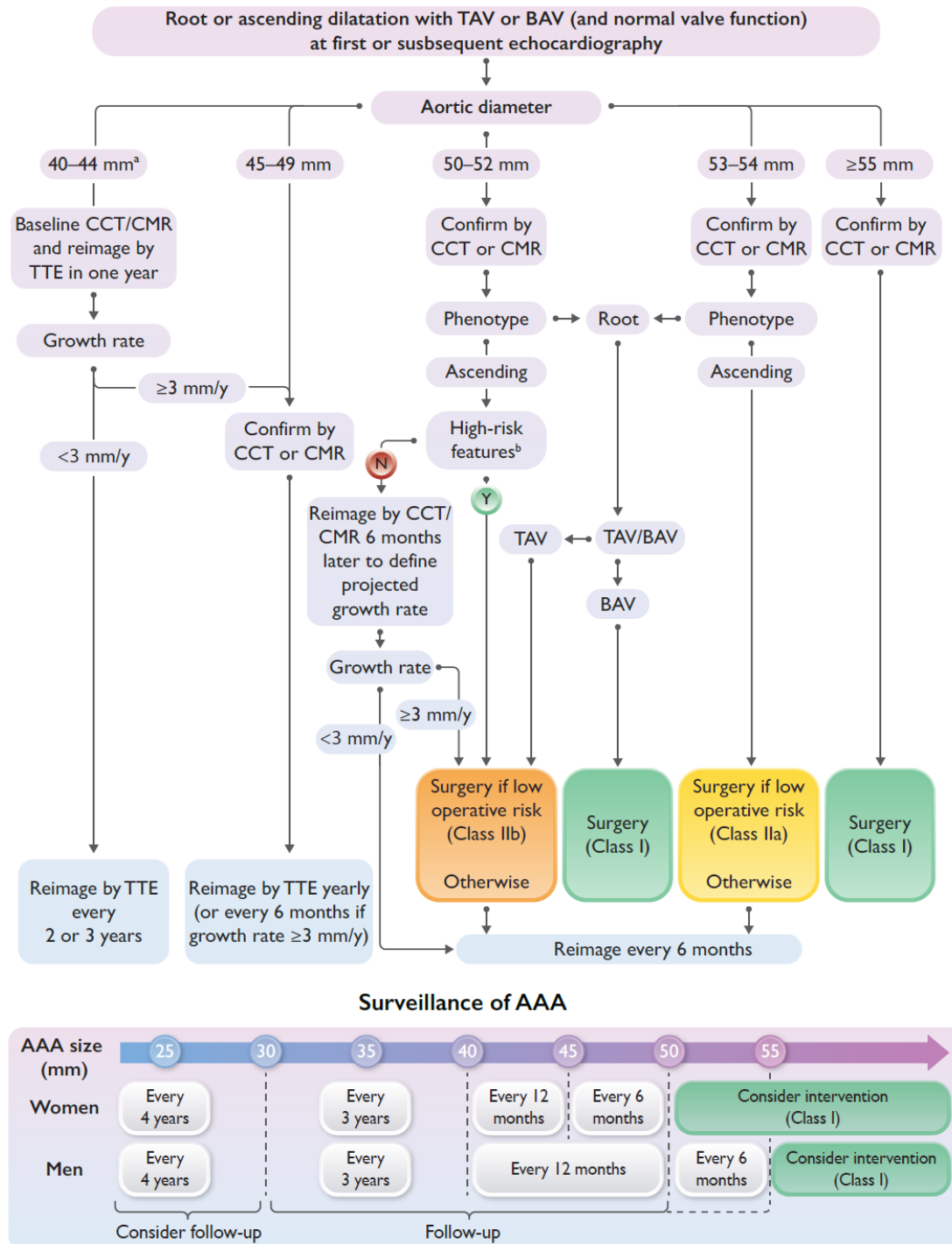


Figure 4. ESC 2024 GL on Aortic and Peripheral Diseases. Surveillance of patients with **non-heritable** thoracic aortic disease and abdominal aortic aneurysms.

^a 36–44 mm in women.

^b For TAV and BAV: age <50 years; height <1.69 m; ascending length >11 cm; uncontrolled hypertension; and, for BAV: coarctation; family history of acute aortic events.

AAA, abdominal aortic aneurysm, BAV, bicuspid aortic valve; CCT, cardiovascular computed tomography; HTAD, heritable thoracic aortic disease; CMR, cardiovascular magnetic resonance; TAV, tricuspid aortic valve; TTE, transthoracic echocardiography.

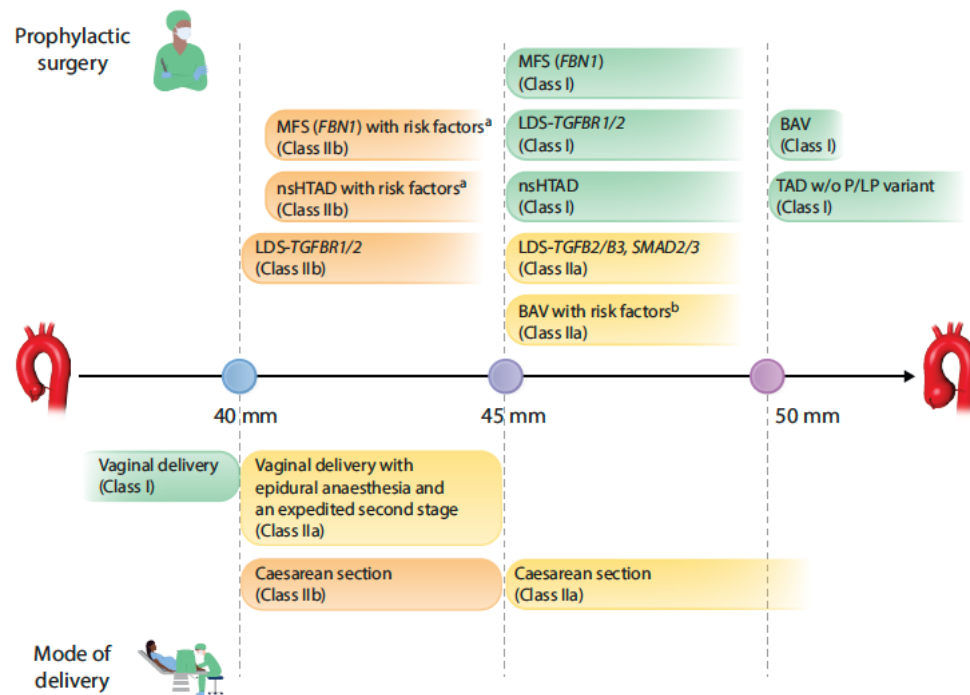


Figure 5. ESC 2025 GL on pregnancy.

Thresholds for prophylactic surgical treatment prior to pregnancy of aortic root/ascending aneurysm (above the line) and recommended mode of delivery according to aortic diameter (below the line). BAV, bicuspid aortic valve; LDS, Loeys–Dietz syndrome; MFS, Marfan syndrome; nsHTAD, nonsyndromic heritable thoracic aortic disease; P/LP, pathogenic/likely pathogenic; TAD, thoracic aortic disease; w/o, without.

^a Risk factors: family history of dissection, rapid aortic growth (≥ 3 mm/year), uncontrolled hypertension.

^b Root phenotype to be added to the other risk factors.

Table 9. ESC 2020 GL on Sports. Aortopathy**Classification of risk to perform sports in patients with aortic pathology**

	Low risk	Low-intermediate risk	Intermediate risk	High risk
Diagnosis	- Aorta <40 mm in BAV or tricuspid valve - Turner syndrome without aortic dilatation	- MFS or other HTAD syndrome without aortic dilatation - Aorta 40–45 mm in BAV or tricuspid valve - After successful thoracic aorta surgery for BAV or other low risk situation	- Moderate aortic dilatation (40–45 mm in MFS or other HTAD; 45–50 mm in BAV or tricuspid valve, Turner syndrome ASI 20–25 mm/m², tetralogy of Fallot <50 mm) - After successful thoracic aorta surgery for MFS or HTAD	- Severe aortic dilatation (>45 mm in MFS or other HTAD, >50 mm in BAV or tricuspid valve, Turner syndrome ASI >25 mm/m², tetralogy of Fallot >50 mm) - After surgery with sequelae
Advice	All sports permitted with preference for endurance over power sports	- Avoid high and very high intensity exercise, contact, and power-sports. - Preference for endurance over power sports	Only skill sports or mixed or endurance sports at low intensity	Sports are (temporarily) contra-indicated
Follow-up	Every 2–3 years	Every 1–2 years	Every 6 months to 1 year	Re-evaluation after treatment

ASI = aortic size index; BAV = bicuspid aortic valve; HTAD = hereditary thoracic aortic disease; MFS = Marfan syndrome.

Recommendations for exercise and participation in sports in individuals with aortic pathology

Prior to engaging in exercise, risk stratification, with careful assessment including advanced imaging of the aorta (CT/CMR) and exercise testing with blood pressure assessment	I C
Regular follow-up including risk assessment	I C
Dynamic exercise is more suitable than static exercise.	IIa C
Participation of low-risk individuals in competitive or leisure-time sports activities (except power sports)	IIa C
Participation of high-risk individuals in individualized leisure exercise programmes	IIb C
Competitive sports are not recommended in individuals who are at high risk	III C

CMR = cardiac magnetic resonance; CT = computed tomography.

Table 10. Aortic Atheromatous Disease**ACC/AHA 2022 GL on Aortic Disease. Atherosclerotic Disease**

In patients with aortic atherosclerotic disease and concomitant coronary artery disease, PAD or both, prescribe antiplatelet therapy, anticoagulant therapy or both, guided by the clinical setting. I C-LD

In patients with aortic atherosclerotic disease and risk factors for confirmed coronary artery disease, prescribe a moderate- or high-intensity statin. IIa C-LD

In patients with aortic atheromas of a thickness ≥ 4 mm, statin therapy. IIb C-LD

ESC 2024 GL on Aortic and Peripheral Diseases. Recommendations for primary and secondary prevention in aortic atheromatous plaques

Primary prevention		
In patients with severe/complex aortic atheromatous plaques, statins should be considered to decrease progression and risk of CV events. ⁸⁶²	IIa	C
SAPT with clopidogrel or low-dose aspirin should be considered in severe/complex plaques. ^{493,666,861,863}	IIa	C
Anticoagulation ⁸⁶¹ or DAPT ⁸⁶³ are not recommended in aortic plaques since they present no benefit and increase bleeding risk. ⁶⁶⁶	III	C
Secondary prevention after an embolic event related to aortic atherosclerosis		
In patients with an embolic event and evidence of an aortic arch atheroma, intensive lipid management to an LDL-C target <1.4 mmol/L (<55 mg/dL) is recommended to prevent recurrences. ^{242,862,865,868}	I	A
In patients with an embolic event and evidence of an aortic arch atheroma, SAPT is recommended to prevent recurrences. ^{666,865,866}	I	C

CV, cardiovascular; DAPT, dual antiplatelet therapy; LDL-C, low-density lipoprotein cholesterol; SAPT, single antiplatelet therapy.

ESC 2024 GL on Aortic and Peripheral Diseases. Grading of atherosclerotic aortic plaques

Grade	Severity (atheroma thickness)	Description
1	Normal	Intimal thickness <2 mm
2	Mild	Intimal thickening of 2 to <3 mm
3	Moderate	Atheroma ≥ 3 to <4 mm (no mobile/ulcerated components)
4	Severe	Atheroma ≥ 4 mm (no mobile/ulcerated components)
5	Complex	Grade 2, 3, or 4 atheroma plus mobile/ulcerated components

ESC 2024 GL on Aortic and Peripheral Diseases. Recommendations for screening and management of polyvascular disease and peripheral arterial disease with cardiac diseases

In patients with PVD, an LDL-C reduction by $\geq 50\%$ from baseline and an LDL-C goal of <1.4 mmol/L (<55 mg/dL) are recommended. ^{242,1571}	I	A
In patients with PAD and newly diagnosed AF with a CHA ₂ DS ₂ -VASc score ≥ 2 , full oral anticoagulation is recommended. ¹⁵⁹⁷	I	C
Screening for ilio-femoral PAD is recommended in patients undergoing TAVI. ^{198,1598}	I	B
Carotid DUS should be considered for stable patients scheduled for CABG with TIA/stroke within the past 6 months without carotid revascularization. ^{1556,1569}	IIa	B
In patients with stable PVD who are symptomatic in at least one territory and without high bleeding risk, ^c treatment with a combination of rivaroxaban (2.5 mg b.i.d.) and aspirin (100 mg o.d.) should be considered. ^{429,1559}	IIa	A
Carotid DUS may be considered for stable patients scheduled for CABG without TIA/stroke within the past 6 months. ^{1555,1562}	IIb	C

AF, atrial fibrillation; b.i.d., twice daily; CABG, coronary artery bypass grafting; CHA₂DS₂-VASc, congestive heart failure, hypertension, age ≥ 75 (doubled), diabetes, stroke (doubled), vascular disease, age 65 to 74 and sex category (female); DUS, duplex ultrasound; eGFR, estimated glomerular filtration rate; LDL-C, low-density lipoprotein cholesterol; o.d., once daily; PAD, peripheral arterial disease; PVD, polyvascular disease; TAVI, transcatheter aortic valve implantation; TIA, transient ischaemic attack.

c Prior history of intracerebral haemorrhage or ischaemic stroke, history of other intracranial pathology, recent gastrointestinal bleeding or anaemia due to possible gastrointestinal blood loss, other gastrointestinal pathology associated with increased bleeding risk, liver failure, bleeding diathesis or coagulopathy, extreme old age or frailty, or renal failure requiring dialysis or with eGFR <15 mL/min/1.73 m².

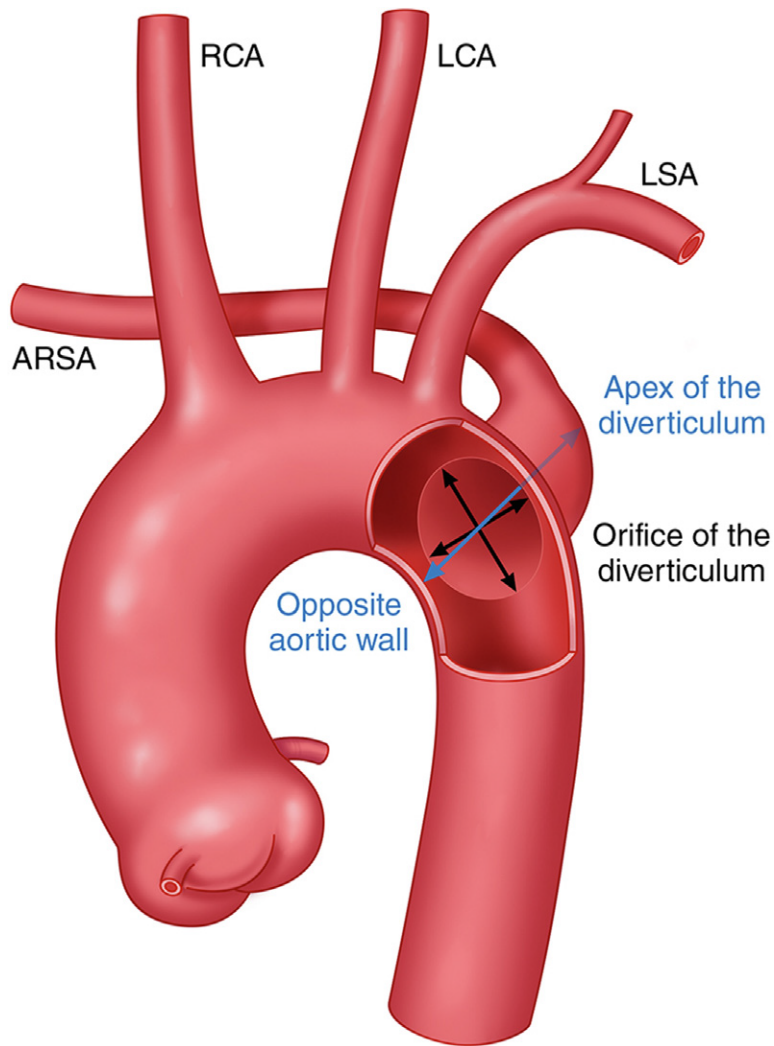


Figure 6. ACC/AHA 2022 GL on Aortic Disease. Measurements of Kommerell's Diverticulum

Two diameter measurements should be obtained using cross-sectional imaging: the diverticulum orifice (radially and longitudinally at the aortic wall) and the combined diameter of the diverticulum and adjacent descending thoracic aorta (measured from the apex of the diverticulum to the opposite aortic wall).

ARSA indicates aberrant right subclavian artery; LCA, left common carotid artery; LSA, left subclavian artery; and RCA, right common carotid artery.

Table 10. ACC/AHA 2022 GL on Aortic Disease. Aberrant Subclavian Artery (ASCA), Kommerell's Diverticulum

In patients discovered to have an ASCA in the absence of thoracic aortic imaging, dedicated imaging to assess for TAA.	Ila C-LD
In patients with Kommerell's diverticulum, depending on patient anatomy and comorbidities, repair when the diverticulum orifice is >3.0 cm, the combined diameter of the diverticulum and adjacent descending aorta is >5.0 cm, or both.	Ilb C-LD

Table 11. ACC/AHA 2022 GL on Aortic Disease. Aberrant Left Vertebral Artery Origin

Revascularization of the vertebral artery in patients with an aberrant left vertebral artery origin arising directly from the thoracic aorta who require aortic repair involving reconstruction or coverage of the vertebral artery origin, is reasonable.	2a C-EO
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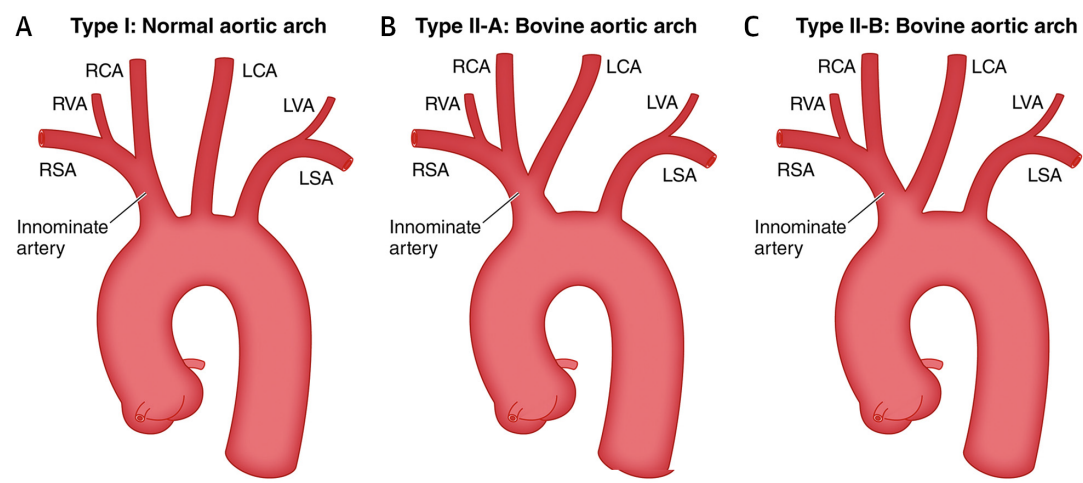


Figure 7. ACC/AHA 2022 GL on Aortic Disease. Normal and Bovine Aortic Arch Configurations

(A) Type I aortic arch: The normal aortic arch configuration. (B) Type II-A aortic arch: The left common carotid artery originates from the innominate artery. (C) Type II-B aortic arch: The innominate and left common carotid arteries share a common origin.

LCA indicates left common carotid artery; LSA, left subclavian artery; LVA, left vertebral artery; RCA, right common carotid artery; RSA, right subclavian artery; and RVA, right vertebral artery.

Table 12. ACC/AHA 2022 GL on Aortic Disease. Recommendation for Bovine Arch (Common Innominate and Left Carotid Artery)

In patients with bovine arch (common innominate and left carotid artery),
imaging to assess for TAA may be reasonable

2c C-LD