

Table 1. Aetiology of AR***Diseases that primarily affect the leaflets***

Congenital AV abnormalities (mainly bicuspid aortic valve, jet lesion due to subaortic stenosis)

Rheumatic heart disease

Myxomatous degeneration

Atherosclerotic degeneration

Infective endocarditis

VSD

Connective tissue or inflammatory diseases (ankylosing spondylitis, systemic lupus erythematosus,

giant cell arteritis, Takayasu arteritis, Whipple disease, Crohn disease)

Antiphospholipid syndrome

Trauma

Anorectic drugs

Diseases that primarily affect the annulus or aortic root

Congenital abnormalities (bicuspid aortic valve, Marfan)

Idiopathic aortic root dilation

Ehlers-Danlos syndrome

Osteogenesis imperfecta

Aortic dissection

Syphilitic aortitis

Connective tissue diseases (ankylosing spondylitis, psoriatic arthritis, giant cell arteritis, Behcet syndrome, relapsing polychondritis, Reiter syndrome)

Ulcerative colitis

Table 2. ACC/AHA 2020 GL on VHD. Stages of Chronic AR

Stage	Definition	Valve Anatomy	Valve Hemodynamics	Hemodynamic Consequences	Symptoms
A	At risk of AR	■ BAV (or other congenital valve anomaly) ■ Aortic valve sclerosis ■ Diseases of the aortic sinuses or ascending aorta ■ History of rheumatic fever or known rheumatic heart disease ■ IE	AR severity: none or trace	None	None
B	Progressive AR	■ Mild to moderate calcification of a trileaflet valve BAV (or other congenital valve anomaly) ■ Dilated aortic sinuses ■ Rheumatic valve changes ■ Previous IE	■ Mild AR: ■ Jet width <25% of LVOT ■ Vena contracta <0.3 cm ■ Regurgitant volume <30 mL/beat ■ Regurgitant fraction <30% ■ ERO <0.10 cm² ■ Angiography grade 1 ■ Moderate AR: ■ Jet width 25%-64% of LVOT ■ Vena contracta 0.3-0.6 cm ■ Regurgitant volume 30-59 mL/beat ■ Regurgitant fraction 30% to 49% ■ ERO 0.10-0.29 cm² ■ Angiography grade 2	■ Normal LV systolic function ■ Normal LV volume or mild LV dilation	None
C	Asymptomatic severe AR	■ Calcific aortic valve disease ■ Bicuspid valve (or other congenital abnormality) ■ Dilated aortic sinuses or ascending aorta ■ Rheumatic valve changes ■ IE with abnormal leaflet closure or perforation	■ Severe AR: ■ Jet width ≥65% of LVOT ■ Vena contracta >0.6 cm ■ Holodiastolic flow reversal in the proximal abdominal aorta ■ Regurgitant volume ≥60 mL/beat ■ Regurgitant fraction ≥50% ■ ERO ≥0.3 cm² ■ Angiography grade 3 to 4 ■ In addition, diagnosis of chronic severe AR requires evidence of LV dilation	■ C1: Normal LVEF (>55%) and mild to moderate LV dilation (LVESD <50 mm) ■ C2: Abnormal LV systolic function with depressed LVEF (≤55%) or severe LV dilation (LVESD >50 mm or indexed LVESD >25 mm/m²)	None; exercise testing is reasonable to confirm symptom status
D	Symptomatic severe AR	■ Calcific valve disease ■ Bicuspid valve (or other congenital abnormality) ■ Dilated aortic sinuses or ascending aorta ■ Rheumatic valve changes ■ Previous IE with abnormal leaflet closure or perforation	■ Severe AR: ■ Doppler jet width ≥65% of LVOT ■ Vena contracta >0.6 cm ■ Holodiastolic flow reversal in the proximal abdominal aorta ■ Regurgitant volume ≥60 mL/beat ■ Regurgitant fraction ≥50% ■ ERO ≥0.3 cm² ■ Angiography grade 3 to 4 ■ In addition, diagnosis of chronic severe AR requires evidence of LV dilation	■ Symptomatic severe AR may occur with normal systolic function (LVEF >55%), mild to moderate LV dysfunction (LVEF 40% to 55%), or severe LV dysfunction (LVEF <40%) ■ Moderate to severe LV dilation is present	■ Exertional dyspnea or angina or more severe HF symptoms

AR indicates aortic regurgitation; BAV, bicuspid aortic valve; ERO, effective regurgitant orifice; HF, heart failure; IE, infective endocarditis; LV, left ventricular; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic dimension; and LVOT, left ventricular outflow tract.

Table 3. ACC/AHA 2020 GL on Valvular Heart Disease. Diagnostic testing for Chronic AR.

In patients with signs or symptoms of AR, TTE for assessment of the cause and severity of regurgitation, LV size and systolic function, prognosis, and timing of valve intervention.	I-B-NR
In patients with a BAV or with known dilation of the aortic sinuses or ascending aorta, TTE to evaluate the presence and severity of AR.	I-B-NR
In patients with moderate or severe AR and suboptimal TTE images or a discrepancy between clinical and TTE findings, TEE, CMR, or cardiac catheterization for the assessment of LV systolic function, systolic and diastolic volumes, aortic size, and AR severity.	I-B-NR

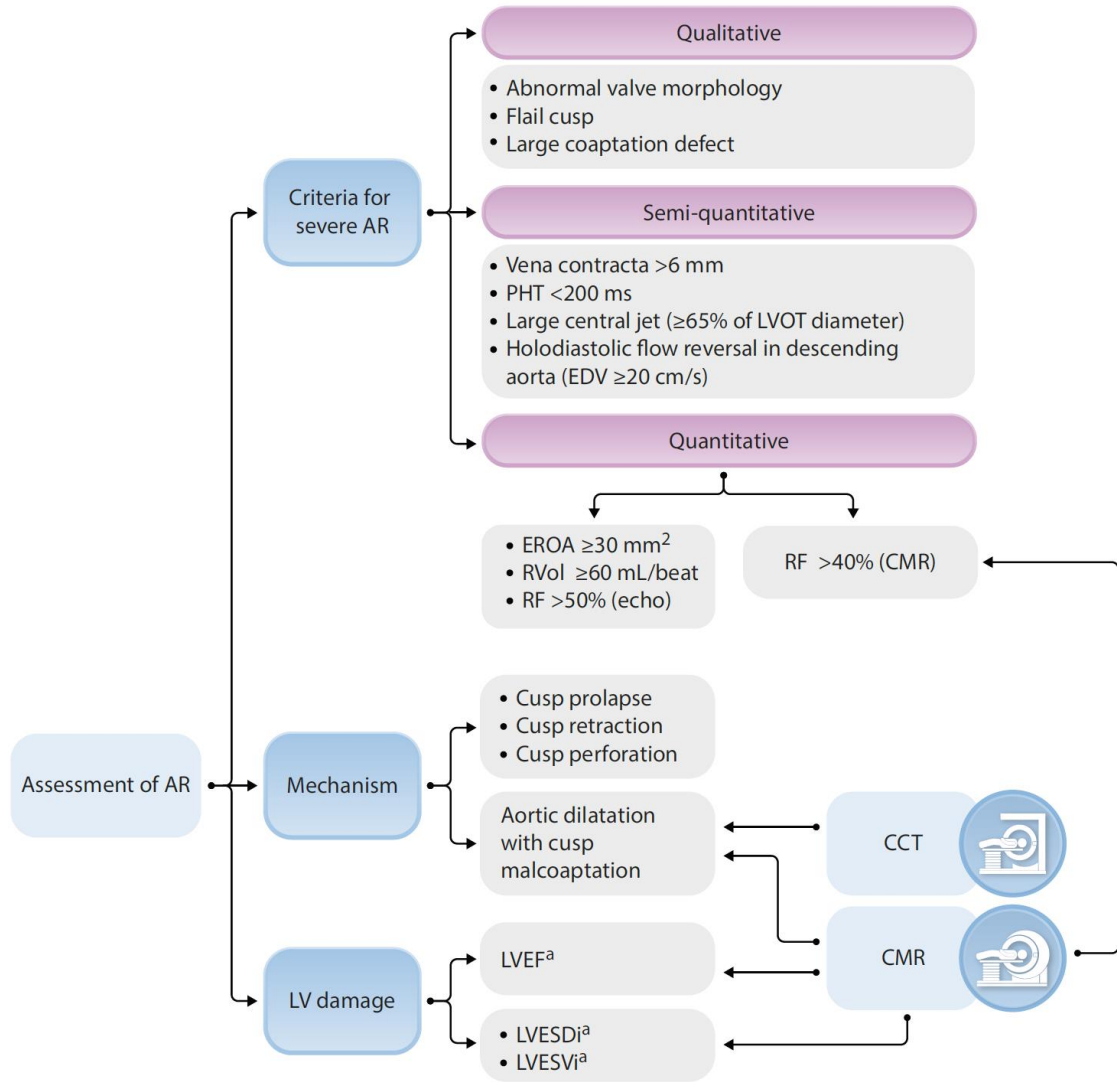


Figure 1. ESC/EACT 2025 GL on valvular heart disease. Imaging assessment of patients with aortic regurgitation.

AR, aortic regurgitation; CCT, cardiac computed tomography; CMR, cardiac magnetic resonance; EDV, end-diastolic velocity; EROA, effective regurgitant orifice area; LV, left ventricle/left ventricular; LVEF, left ventricular ejection fraction; LVESD_i, left ventricular end-systolic diameter indexed to body surface area; LVESV_i, left ventricular end-systolic volume indexed to body surface area; LVOT, left ventricular outflow tract; PHT, pressure half-time; RF, regurgitant fraction; RVol, regurgitant volume. ^aSee Table 6 for specific cut-offs.

Table 4. ACC/AHA 2020 GL on Valvular Heart Disease. Medical Therapy for Chronic AR.

Treatment of hypertension (systolic blood pressure >140 mmHg) in asymptomatic patients with chronic AR (Stages B and C)	I-B-NR
In patients with severe AR who have symptoms and/or LV systolic dysfunction (Stages C2 and D) but a prohibitive surgical risk, GDMT for reduced LVEF with ACE inhibitors, ARBs, and/or sacubitril/valsartan.	I-B-NR

Table 5. ACC/AHA 2020 GL on Valvular Heart Disease. Timing of Intervention for Chronic AR.

In symptomatic patients with severe AR (Stage D), aortic valve surgery regardless of LV systolic function.	I-B-NR
In asymptomatic patients with chronic severe AR and LV systolic dysfunction (LVEF ≤55%) (Stage C2), aortic valve surgery if no other cause for systolic dysfunction is identified.	I-B-NR
Aortic valve surgery in patients with severe AR (Stage C or D) who are undergoing cardiac surgery for other indications, is indicated.	I-C-EO
In asymptomatic patients with severe AR and normal LV systolic function (LVEF >55%), aortic valve surgery when the LV is severely enlarged (LVESD >50 mm or indexed LVESD >25 mm/m ²) (Stage C2).	IIa-B-NR
Aortic valve surgery in patients with moderate AR (Stage B) who are undergoing cardiac or aortic surgery for other indications.	IIa-C-EO
In asymptomatic patients with severe AR and normal LV systolic function at rest (LVEF >55%; Stage C1) and low surgical risk, aortic valve surgery when there is a progressive decline in LVEF on at least 3 serial studies to the low-normal range (LVEF 55% to 60%) or a progressive increase in LV dilation into the severe range (LV end-diastolic dimension [LVEDD] >65 mm).	IIb-B-NR
In patients with isolated severe AR who have indications for SAVR and are candidates for surgery, TAVI should not be performed.	III-B-NR (Harm)

Table 6. ESC/EACT 2021 GL on valvular heart disease. Recommendations on indications for intervention in severe aortic regurgitation

Severe aortic regurgitation		
AV surgery is recommended in symptomatic patients with severe AR regardless of LV function. ^{224–228}	I	B
AV surgery is recommended in asymptomatic patients with severe AR and LVESD >50 mm or LVESDi >25 mm/m ² [especially in patients with small body size (BSA <1.68 m ²)] or resting LVEF ≤50%. ^{226,228,231,233,234}	I	B
AV surgery is recommended in symptomatic and asymptomatic patients with severe AR undergoing CABG or surgery of the ascending aorta.	I	C
AV repair should be considered in selected patients with severe AR at experienced centres, when durable results are expected. ^{220,245,246,259}	IIa	B
AV surgery may be considered in asymptomatic patients with severe AR and LVESDi >22 mm/m ² , ^{226,228,231–234} or LVESVi ^c >45 mL/m ² [especially in patients with small body size (BSA <1.68 m ²), ^{235–241} or resting LVEF ≤55%, if the surgical risk is low.	IIb	B
TAVI may be considered for the treatment of severe AR in symptomatic patients ineligible for surgery according to the Heart Team, if the anatomy is suitable. ^{264,265,268,269}	IIb	B
Concomitant surgery of the ascending aorta		
Valve-sparing aortic root replacement is recommended in young patients with aortic root dilatation at experienced centres, when durable results are expected. ^{247,250–253,255}	I	B
When AV surgery is indicated and the predicted surgical risk is low, replacement of the aortic root or ascending aorta should be considered if the maximal diameter is ≥45 mm. ^d	IIa	C

AR, aortic regurgitation; AV, aortic valve; BSA, body surface area; CABG, coronary artery bypass grafting; CMR, cardiac magnetic resonance; LV, left ventricle/left ventricular; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic diameter; LVESDi, left ventricular end-systolic diameter indexed to BSA; LVESVi, left ventricular end-systolic volume indexed to BSA; TAVI, transcatheter aortic valve implantation.

cUsing echocardiography or CMR.

dConsidering age, BSA, the aetiology of the valvular disease, the presence of a bicuspid AV, and the intraoperative shape and thickness of the ascending aorta.

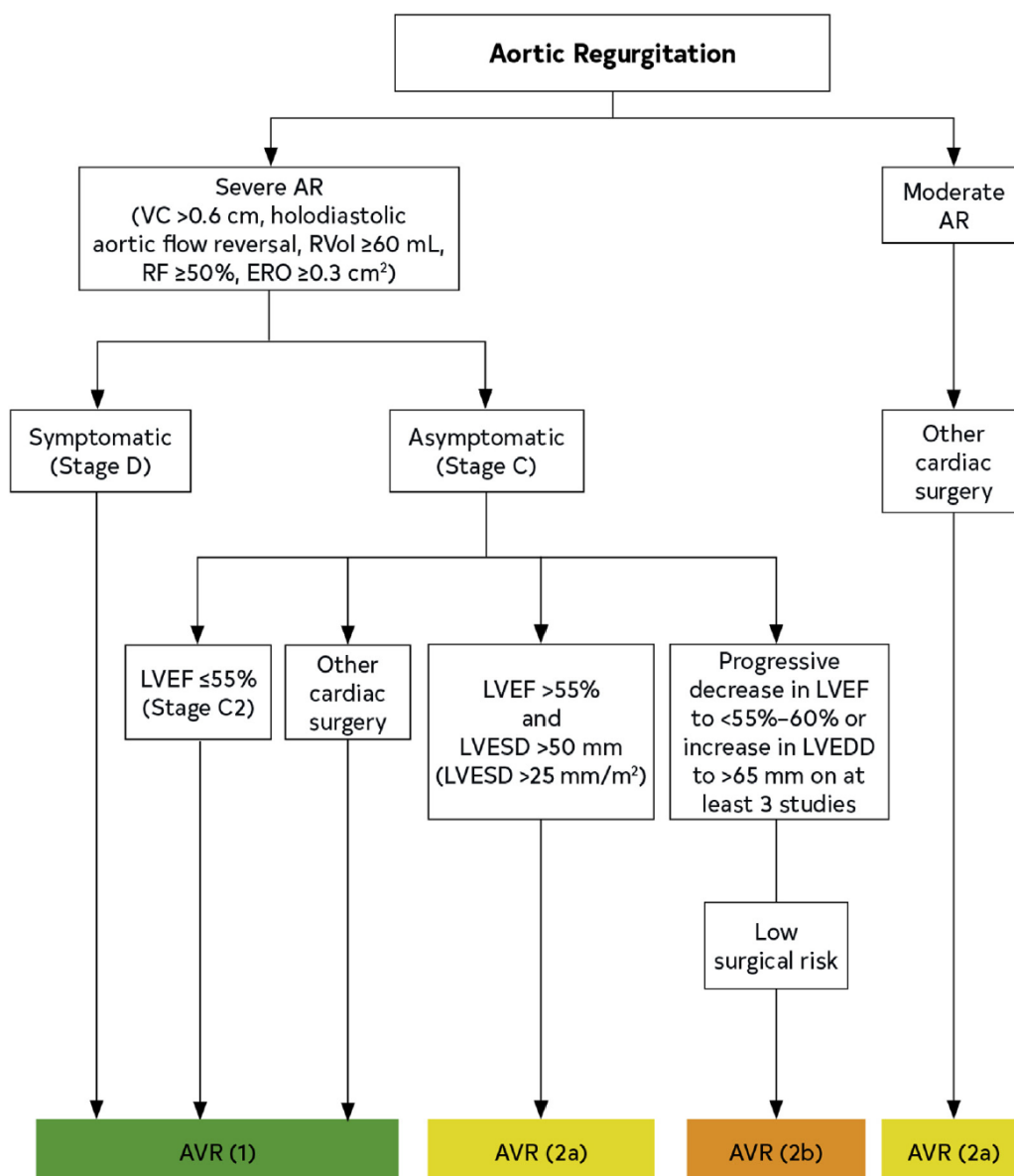


Figure 2. ACC/AHA 2020 GL on VHD. Timing of intervention for AR

AR indicates aortic regurgitation; AVR, aortic valve replacement; EDD, end-diastolic dimension; ERO, effective regurgitant orifice; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic dimension; RF, regurgitant fraction; RVol, regurgitant volume; and VC, vena contracta

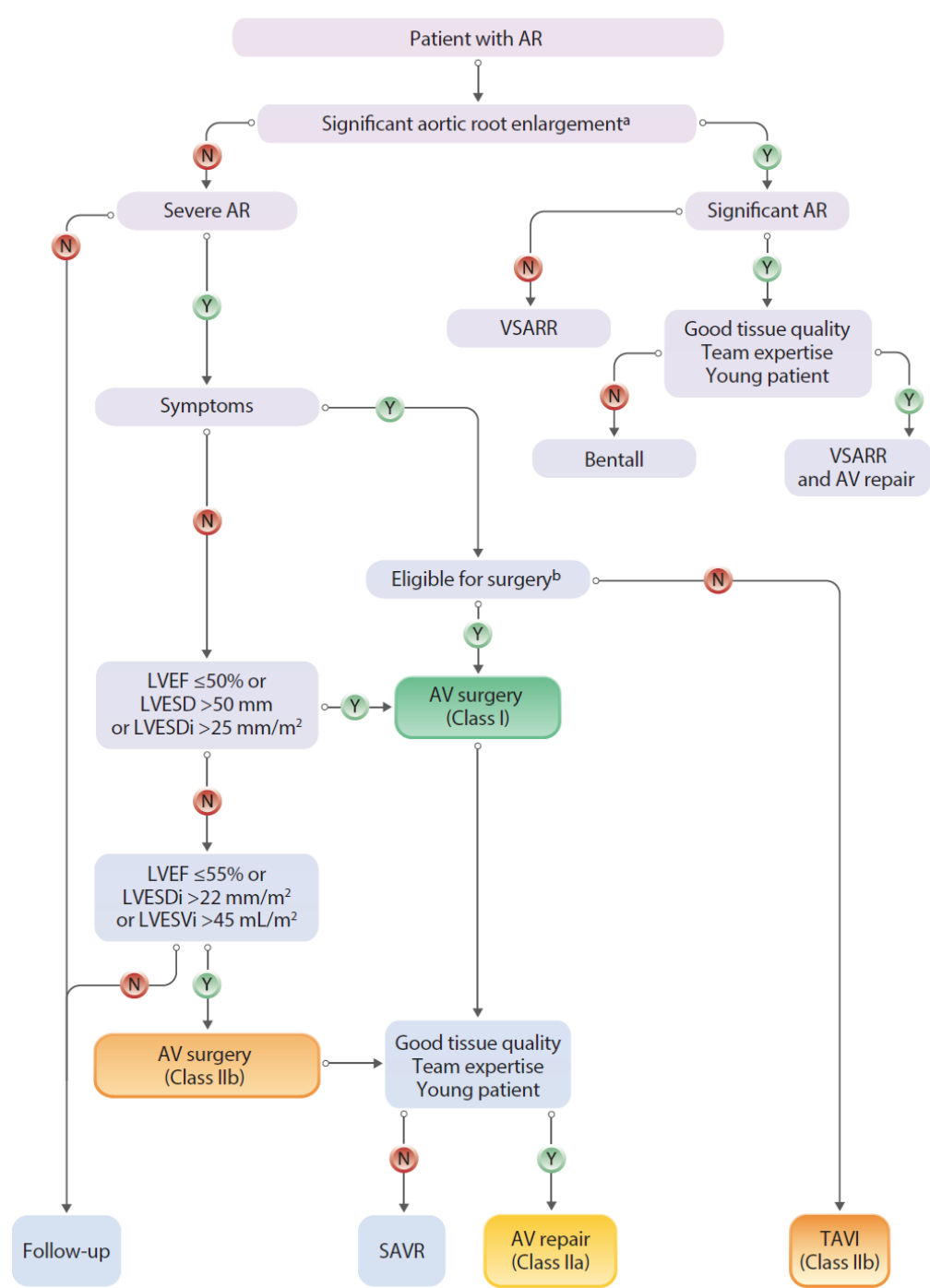


Figure 3. ESC/EACT 2025 GL on valvular heart disease Management of patients with aortic regurgitation.

AR, aortic regurgitation; AV, aortic valve; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic diameter; LVESDi, left ventricular end-systolic diameter indexed to body surface area; LVESVi, left ventricular end-systolic volume indexed to body surface area; SAVR, surgical aortic valve replacement; TAVI, transcatheter aortic valve replacement; VSARR, valve-sparing aortic root replacement.

a Indications for surgery on the root/ascending aorta are described in the *2024 ESC Guidelines for the management of peripheral arterial and aortic diseases*.

b Concomitant replacement of the aortic root or ascending aorta should be considered if the maximal diameter is ≥ 45 mm and the predicted surgical risk is low.

Table 7. Noncardiac Surgery

ESC 2022 GL on Noncardiac Surgery

Aortic valve regurgitation		
In patients with symptomatic severe AR or asymptomatic severe AR and LVESD >50 mm or LVESDi (LVESD/BSA) >25 mm/m ² (in patients with small body size) or resting LVEF ≤50%, valve surgery is recommended prior to elective intermediate- or high-risk NCS.	I	C

AHA/ACC 2024 GL on Noncardiac Surgery

2a	C-LD	4. In asymptomatic patients with moderate or severe aortic regurgitation and normal LV systolic function (LVEF >55%), it is reasonable to perform elective NCS.* ⁶
----	------	---

Table 9. ESC 202 GL on Sports. Aortic Regurgitation**Recommendations for participation in recreational/leisure-time sports in asymptomatic individuals with aortic regurgitation*****Mild**

Participation in all recreational sports I C

Moderate

Participation in all recreational sports, if desired, in asymptomatic individuals with a non-dilated LV with LVEF>50% and normal exercise stress test. IIa C

Severe

Participation in all recreational sports involving low and moderate intensity, in a mild or moderately dilated LV with LVEF>50% and normal exercise stress test. IIb C

Participation in any moderate- or high-intensity recreational exercise is not recommended with LVEF<_50% and/or exercise-induced arrhythmias. III C

Recommendations for participation in competitive sports in asymptomatic individuals with aortic regurgitation**Mild**

Participation in all competitive sports. I C

Moderate

Participation in all competitive sports, if LVEF>50% and normal exercise test. IIa C

Severe

Participation in most competitive sports involving low to moderate intensity in mild or moderately dilated LV with LVEF>50% and normal exercise stress test. IIb C

Participation in any moderate- or high-intensity competitive sports in severe AR and/or LVEF<_50% and/or exercise-induced arrhythmias III C

* For mixed valvular disease, the recommendation for the predominant lesion should be followed.

AR = aortic regurgitation; LV = left ventricle; LVEF = left ventricular ejection fraction.