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REVIEW
Heart failure and cardiomyopathies

ACC/AHA vs. ESC/EACTS guidelines on valvular heart disease: EJPC guideline comparison review

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Abstract

Valvular heart disease poses persistent challenges for clinical decision-making, and international guidelines provide essential frameworks for its management. The American College of Cardiology/American Heart Association last issued a full update in 2020 and an expert consensus on tricuspid regurgitation in 2025. The European Society of Cardiology/European Association for Cardio-Thoracic Surgery released their updated guidelines in 2025. Although there is broad alignment in principles of intervention, prosthesis choice, and the role of Heart Teams, the European document incorporates substantial new trial evidence. Key areas of divergence include thresholds for earlier intervention in aortic stenosis and regurgitation, expanded recommendations for transcatheter edge-to-edge repair and mitral replacement, formal integration of tricuspid repair and transcatheter therapies, evolving strategies for coronary assessment in transcatheter aortic valve implantation, and sex-specific considerations. This review highlights consistencies, discrepancies, and priorities for future research.

Lay summary

This review explains the main similarities and differences between the American and European guidelines on how to diagnose and treat heart valve disease.

- Both guidelines agree on most major principles but differ in areas such as timing of intervention, imaging requirements, and approaches to aortic stenosis, mitral regurgitation, tricuspid regurgitation, and coronary assessment before valve procedures.
- The European 2025 guidelines include newer evidence and often recommend earlier treatment or wider use of less invasive transcatheter procedures compared with the American 2020 guidance.

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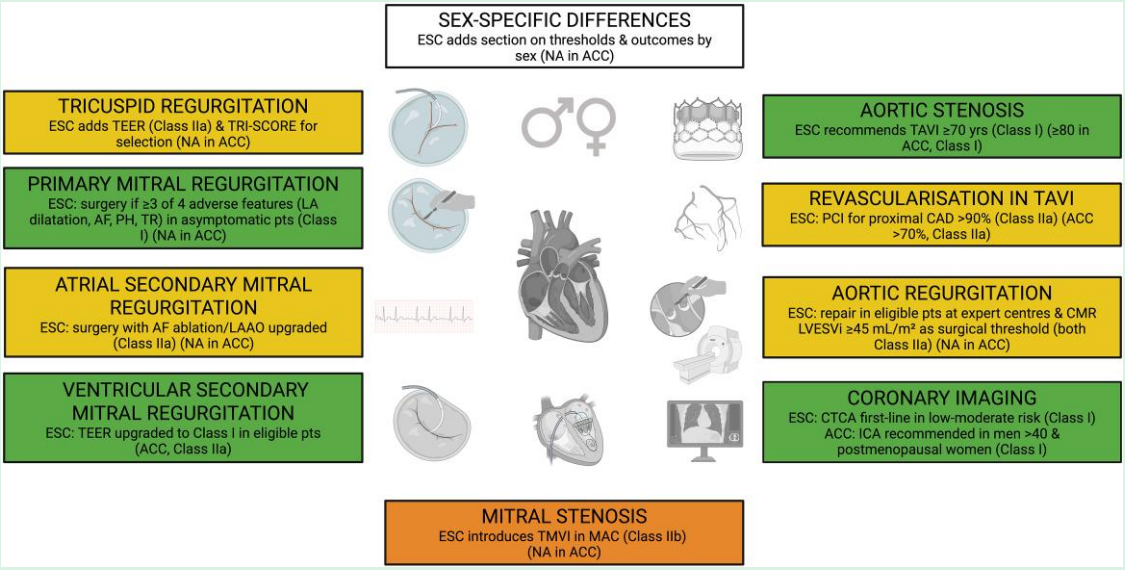
Graphical Abstract



Comparison of valvular heart disease guidelines: 2020 ACC/AHA vs. 2025 ESC/EACTS. Colours of the boxes denote the class of recommendation—green is Class I, yellow is Class IIa, and orange is Class IIb. ACC, American College of Cardiology; AF, atrial fibrillation; CAD, coronary artery disease; CMR, cardiac magnetic resonance; CTCA, computed tomography coronary angiography; ESC, European Society of Cardiology; ICA, invasive coronary angiography; LA, left atrium; LAAO, left atrial appendage occlusion; LVESVi, left ventricular end-systolic volume index; MAC, mitral annular calcification; NA, not addressed; PCI, percutaneous coronary intervention; PH, pulmonary hypertension; SAVR, surgical aortic valve replacement; TAVI, transcatheter aortic valve implantation; TEER, transcatheter edge-to-edge repair; TMVI, transcatheter mitral valve implantation; TR, tricuspid regurgitation; TRI-SCORE, operative risk score for isolated TR surgery; VHD, valvular heart disease.

Keywords Aortic stenosis • Guideline comparison • Mitral regurgitation • Transcatheter aortic valve implantation • Valvular heart disease

Introduction

The prevalence of valvular heart disease continues to rise with the progressive ageing of the global population, imposing a substantial and growing burden on healthcare systems worldwide.[1] The American and European guidelines on the management of valvular heart disease (VHD) form the basis of modern clinical practice in their respective regions. The American College of Cardiology/American Heart Association (ACC/AHA) last issued a full update in 2020 with the next comprehensive revision planned for late 2026.[2] The European Society of Cardiology/European Association for Cardio-Thoracic Surgery (ESC/EACTS) released their updated guidelines in 2025 incorporating substantial new evidence accumulated since the 2021 ESC/EACTS guideline.[3,4]

Coisne *et al.* compared the 2020 ACC/AHA and 2021 ESC/EACTS guidelines and found broad alignment but several important differences, especially in intervention timing and transcatheter therapy use.[5] Building on that work, this review compares the 2020 ACC/AHA guideline with the new 2025 ESC/EACTS guideline and incorporates the insights from the recent ACC expert consensus on tricuspid regurgitation.

The objectives of this review are to (i) identify recommendations that remain consistent across both societies; (ii) highlight key areas of divergence and their clinical implications; and (iii) outline persisting gaps in evidence to inform future guideline updates.

Multidisciplinary heart valve team

Both guidelines endorse multidisciplinary assessment for patients with valvular heart disease. Each highlights the importance of coordinated input from primary clinical cardiologist, imaging, interventional, and surgical specialists, and both emphasize shared decision-making and the central role of the patient in treatment planning. Both the 2020 ACC/AHA and 2025 ESC/EACTS also state that Heart Team evaluation is essential in severe, complex, or high-risk disease and that outcomes are improved when care is delivered in experienced centres with high procedural volume.

The two guidelines differ in how they integrate the Heart Team. ACC/AHA gives a Class I recommendation for Heart Team review when intervention is planned in severe valve disease and a Class IIa recommendation for referral to specialist valve centres in selected situations such as asymptomatic severe disease, possible repair, or multiple comorbidities. The ESC 2025 positions the Heart Team at the beginning of most treatment pathways and includes it in a regional Heart Valve Network with valve clinics and specialist centres. The ESC also links the Heart Team to clear requirements, such as higher procedural volumes, access to advanced imaging such as computed tomography (CT) and cardiovascular magnetic resonance (CMR), and structured follow-up across the network. ESC supports

flexible processes, using local protocols for straightforward cases and *ad hoc* discussions in urgent situations.

Valvular pathologies

Aortic stenosis

Similarities

Both the 2020 ACC/AHA and 2025 ESC/EACTS guidelines give a Class I recommendation for aortic valve replacement in symptomatic severe AS and in asymptomatic patients with left ventricular (LV) systolic dysfunction defined as left ventricular ejection fraction (LVEF) < 50%.[2,3] In bicuspid valve disease, both favour surgery in younger and lower-risk patients and advise that transcatheter treatment be considered only in carefully selected older or higher-risk patients with favourable anatomy. Regarding prosthesis selection, both documents emphasize that the decision should first be made through Heart Team assessment and shared decision-making with the informed patient. In general, guidelines favour a mechanical valve in younger patients who can accept anticoagulation, a bioprosthesis in older patients or those who wish to avoid long-term anticoagulation, and individualized choice in the middle age ranges.

Differences

Most differences in AS reflect new evidence published after the 2020 ACC/AHA guideline, especially the randomized trials of early intervention in asymptomatic severe AS.[6–10] In asymptomatic severe AS, the 2020 ACC/AHA guideline recommends intervention in selected patients with very severe valve obstruction with a peak velocity of at least 5.0 m/s, an abnormal exercise test with symptoms or hypotension, rapid progression with an increase in velocity of at least 0.3 m/s per year, or markedly elevated B-type natriuretic peptide (BNP) above three times the upper limit of normal. ACC/AHA also allows a Class IIb pathway when there is a progressive fall in LVEF into the 50–60% range on at least three serial studies (*Figure 1*). The 2025 ESC/EACTS guideline adopts similar early intervention triggers but adds a Class IIa, Level A recommendation for early intervention in asymptomatic severe high-gradient AS in low-risk patients with LVEF >50%. This offers an alternative to routine watchful waiting and is supported by several recently published randomized trials.[6–10] It also maintains LVEF <55% as a Class IIa, Level B indication in asymptomatic low-risk patients and lists very high peak aortic jet velocity, markedly elevated BNP, rapid progression, and heavy calcification as additional features that strengthen the case for early intervention. The ESC 2025 guideline also incorporates global longitudinal strain as an adjunctive marker of subclinical ventricular dysfunction in asymptomatic severe AS, noting that global longitudinal strain (GLS) worse than −15% identifies patients at increased risk of clinical deterioration or premature mortality.

The choice between surgical aortic valve replacement (SAVR) and transcatheter aortic valve implantation (TAVI) is framed differently. The 2020 ACC/AHA guideline recommends SAVR in patients younger than 65 years or those with life expectancy beyond 20 years, TAVI in patients older than 80 years or with life expectancy under 10 years, and either strategy in those aged 65–80 years with both options Class I depending on anatomy, comorbidity, and preference. The 2025 ESC/EACTS guideline revises age-based thresholds for intervention. It recommends TAVI as Class I in patients aged 70 years or older with tricuspid AS and suitable anatomy and recommends SAVR as Class I in patients younger than 70 years at low surgical risk. This shift is supported by newer randomized evidence available after 2021, including 5-year follow-up from PARTNER 3, 4-year follow-up from Evolut Low Risk trial, and the NOTION-2 trial, all of which show that in patients in their 70s, TAVI provides similar rates of death, stroke, rehospitalization, and bioprosthetic valve failure to surgery over midterm follow-up.[11–13] Across all age groups, ESC emphasizes that the choice of intervention should be guided first by Heart Team assessment, incorporating clinical features, anatomy, procedural considerations, expected durability, and life expectancy.

With bicuspid valves, the 2020 ACC/AHA guideline remains cautious about transcatheter treatment because pivotal trials largely excluded these patients and it favours surgery in younger and lower-risk individuals. The 2025 ESC/EACTS guideline is more permissive in older or higher-risk patients with favourable bicuspid anatomy while still preferring surgery in younger patients.

On the prosthesis type within the AS chapter, the 2020 ACC/AHA guideline suggests a mechanical valve in patients younger than 50 years, a bioprosthesis in those older than 65 years, and individualized choice between 50 and 65 years. The 2025 ESC/EACTS guideline places the mechanical preference below 60 years, the bioprosthetic preference above 65 years, and individualized choice between 60 and 65 years. In both guidelines, these age thresholds are Class IIa considerations, while the primary Class I criterion for selecting the prosthesis type is shared decision-making and the informed patient's preference following Heart Team assessment, integrating life expectancy, bleeding risk, and the feasibility of future valve-in-valve interventions.

Evidence gaps and future directions

The key unresolved question remains how broadly to apply early intervention in asymptomatic severe AS with preserved LVEF. The 2025 ESC/EACTS guideline integrates several trials published after the 2020 ACC/AHA guideline that support earlier treatment in selected low-risk patients, but a consistent mortality or stroke benefit has not been demonstrated, with the main positive signal being fewer unplanned admissions and earlier conversion to TAVI. Additional trials in asymptomatic severe AS are ongoing, including DANAVR and EASY-AS.[14,15] If these trials report a reduction in mortality that is similar to the pooled mortality effect seen across the four existing randomized trials, then an updated meta-analysis would be expected to produce a hazard ratio of about 0.70 for overall mortality, reaching statistical significance and potentially shifting the balance of recommendations towards earlier intervention.[16] Multimodality imaging represents another major evidence gap. ESC 2025 highlights the prognostic value of GLS, CT calcium scoring, and CMR-detected midwall fibrosis for risk stratification in apparently asymptomatic severe AS, but these metrics do not yet constitute independent decision thresholds for intervention. Defining how these markers should be integrated into treatment pathways and determining validated cut-points that predict benefit from pre-emptive intervention remains a priority for future

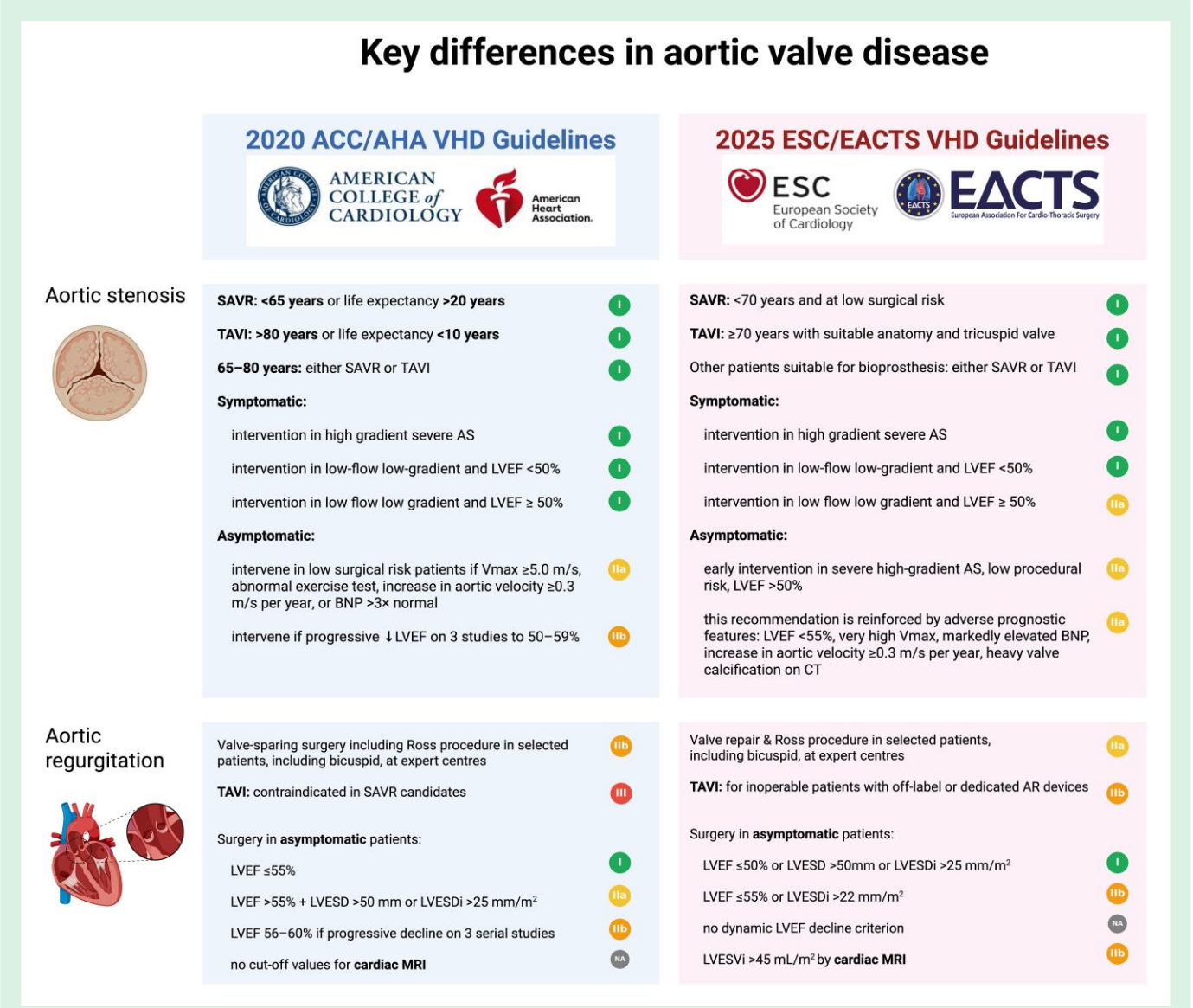


Figure 1 Key differences in aortic valve disease between ACC/AHA 2020 and ESC/EACTS 2025 guidelines. ACC, American College of Cardiology; AHA, American Heart Association; AR, aortic regurgitation; AS, aortic stenosis; CMR, cardiovascular magnetic resonance; CT, computed tomography; ESC, European Society of Cardiology; EACTS, European Association for Cardio-Thoracic Surgery; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic diameter; LVESDi, left ventricular end-systolic diameter index; LVESVi, left ventricular end-systolic volume index; NA, not addressed; SAVR, surgical aortic valve replacement; TAVI, transcatheter aortic valve implantation; VHD, valvular heart disease; Vmax, peak aortic jet velocity.

research. The durability of transcatheter valves beyond a decade, the impact of repeated transcatheter reinterventions, and long-term coronary access after TAVI are active concerns that drive the different age thresholds. The forthcoming ACC/AHA update is expected to incorporate the recent trial data and may narrow the residual differences between the documents.

Aortic regurgitation

Similarities

Both the 2020 ACC/AHA and 2025 ESC/EACTS guidelines agree that surgery is indicated in all patients with symptomatic severe aortic regurgitation (AR) and in asymptomatic patients with evidence of LV dysfunction or dilatation.[2,3] Both use left ventricular end-systolic diameter (LVESD) > 50 mm or left ventricular end-systolic diameter indexed (LVESDi) > 25 mm/m² as a Class I threshold. Both recommend valve replacement when other cardiac surgery is being undertaken. Valve repair is recognized as an option in expert centres, particularly in younger patients or those with root pathology, and both documents note the importance of advanced imaging modalities such as CMR when echocardiographic measurements are inconclusive.

Differences

Differences between the two guidelines for AR are small and are not driven by major new evidence. The main divergence

concerns the definition of LV dysfunction in asymptomatic patients. The 2020 ACC/AHA guideline recommends surgery once LVEF falls to 55% or less (Class I) and considers intervention reasonable when there is a progressive decline in LVEF into the 55–60% range on serial imaging (Class IIb) (*Figure 1*). The 2025 ESC/EACTS guideline maintains 50% as the Class I trigger but introduces a Class IIb recommendation for early surgery in selected low-risk patients when LVEF is 55% or less, LVESDi exceeds 22 mm/m², or left ventricular end-systolic volume indexed (LVESVi) exceeds 45 mL/m² by echocardiography. ESC/EACTS also incorporates CMR, proposing LVESVi ≥45 mL/m² as a threshold that may guide surgery,[17] and highlights left ventricular end-diastolic diameter (LVEDD) > 65 mm, progressive LV enlargement, or falling LVEF during follow-up as factors that may influence decision-making, although these features are not assigned a formal class of recommendation.[3]

Valve preservation is also treated differently. The 2025 ESC/EACTS guideline assigns a Class IIa recommendation to valve repair in selected patients with suitable anatomy, including bicuspid valves, when performed in high-volume centres. It also highlights the Ross procedure as a valid alternative in well-selected young patients. The 2020 ACC/AHA guideline acknowledges valve-sparing and Ross operations as a Class IIb, stressing that these complex procedures should be confined to Comprehensive Valve Centres.[2]

Transcatheter therapy is framed conservatively by both the ACC/AHA and ESC/EACTS guidelines. The 2020 ACC/AHA guideline states that TAVI is rarely feasible, limited to carefully selected patients with prohibitive surgical risk and suitable anatomy for anchoring. The 2025 ESC/EACTS guideline introduces a Class IIb recommendation for transcatheter aortic valve implantation in patients with severe AR who are ineligible for surgery, reflecting growing experience with non-dedicated and dedicated TAVI devices in this setting.

Evidence gaps and future directions

Despite convergence between the two societies, important uncertainties remain. The optimal timing of surgery in asymptomatic severe AR with preserved LVEF is unresolved, particularly for patients with values in the 50–55% range. The 2025 ESC/EACTS guideline highlights the promise of volumetric thresholds from CMR, but these require prospective validation before they can replace conventional diameter-based metrics.[17] ESC 2025 also emphasizes the potential role of global longitudinal strain as an earlier marker of LV systolic dysfunction in AR, noting that impaired strain often appears before LVEF declines or LV dimensions cross surgical thresholds. However, no guideline incorporates GLS cut-off points as triggers for surgery, and their prognostic and therapeutic significance remains unproven. Clarifying how CMR-derived regurgitant fraction, LV volumes, myocardial fibrosis, and strain abnormalities should guide timing of referral and surgery remains a major research priority. While valve repair and the Ross procedure are gaining traction in selected centres, wider dissemination is limited by technical complexity and lack of long-term data from contemporary series. For transcatheter therapy, registry and early trial results of dedicated AR devices are encouraging, but durability and late outcomes are unknown. Ongoing randomized trials and longitudinal studies will be critical to refining patient selection and integrating advanced imaging and novel therapies into standard practice.

Mitral regurgitation

Primary

Similarities

Both 2020 ACC/AHA and 2025 ESC/EACTS guidelines agree that surgery is indicated in symptomatic severe primary MR and in asymptomatic patients once LV dysfunction is present. The shared Class I thresholds are an LVEF of 60% or less or an LVESD of 40 mm or more or indexed equivalent. Both emphasize durable surgical repair over replacement whenever a lasting result is likely.[18] For patients at prohibitive surgical risk with suitable anatomy, TEER is supported by both societies with a Class IIa recommendation. Both also acknowledge that a minimally invasive approach can be appropriate in expert centres. The 2020 ACC/AHA guideline states that outcomes can be comparable to full sternotomy when the procedure is performed by highly experienced surgeons, and the 2025 ESC/EACTS guideline notes potential for shorter hospital stay and faster recovery in centres with the necessary expertise.[19]

Differences

Differences in early surgery thresholds reflect divergent interpretation of prognostic markers and repair durability, rather than new trial evidence. In asymptomatic patients with preserved LV function, the 2020 ACC/AHA and 2025 ESC/EACTS guidelines diverge in their thresholds and approach to early intervention. The 2020 ACC/AHA guideline allows early surgery in expert centres when the likelihood of durable repair exceeds 95% and operative mortality is below 1%, which is a Class IIa recommendation that does not require additional clinical or imaging criteria. The 2020 ACC/AHA guideline also considers intervention reasonable when there is progressive LV dilatation or a fall in LVEF on serial imaging before the conventional thresholds of LVEF ≤60% or LVESD ≥40 mm are reached (*Figure 2*). Earlier triggers from previous 2017 guidelines [new atrial fibrillation (AF) or resting pulmonary hypertension (PH)] were removed in 2020.[20]

In contrast, the 2025 ESC/EACTS guideline does not offer an expert centre early intervention pathway. It defines early LV systolic dysfunction by introducing an indexed LVESD threshold (LVESDi ≥20 mm/m²) alongside the conventional criteria of LVEF ≤60% and LVESD ≥40 mm. The 2025 ESC/EACTS also maintains the three clinical adverse features first introduced in 2021 which are new AF, pulmonary artery systolic pressure >50 mmHg, and significant left atrial enlargement, as individual Class IIa triggers for early surgery in low-risk patients when a durable repair is likely.[3,4] Finally, the 2025 ESC/EACTS guideline introduces a new pathway in which surgery becomes Class I when any three of four adverse features are present, the fourth being the newly incorporated criterion of moderate secondary TR. Secondary TR is not an independent Class IIa trigger; it contributes only within the three-of-four criteria pathway.

The 2025 ESC/EACTS guideline also goes further than the 2020 ACC/AHA guideline in formally positioning minimally invasive repair, assigning it a Class IIb recommendation in experienced centres.[19] The 2020 ACC/AHA guideline describes feasibility and outcome equivalence in experienced hands but does not attach a class.

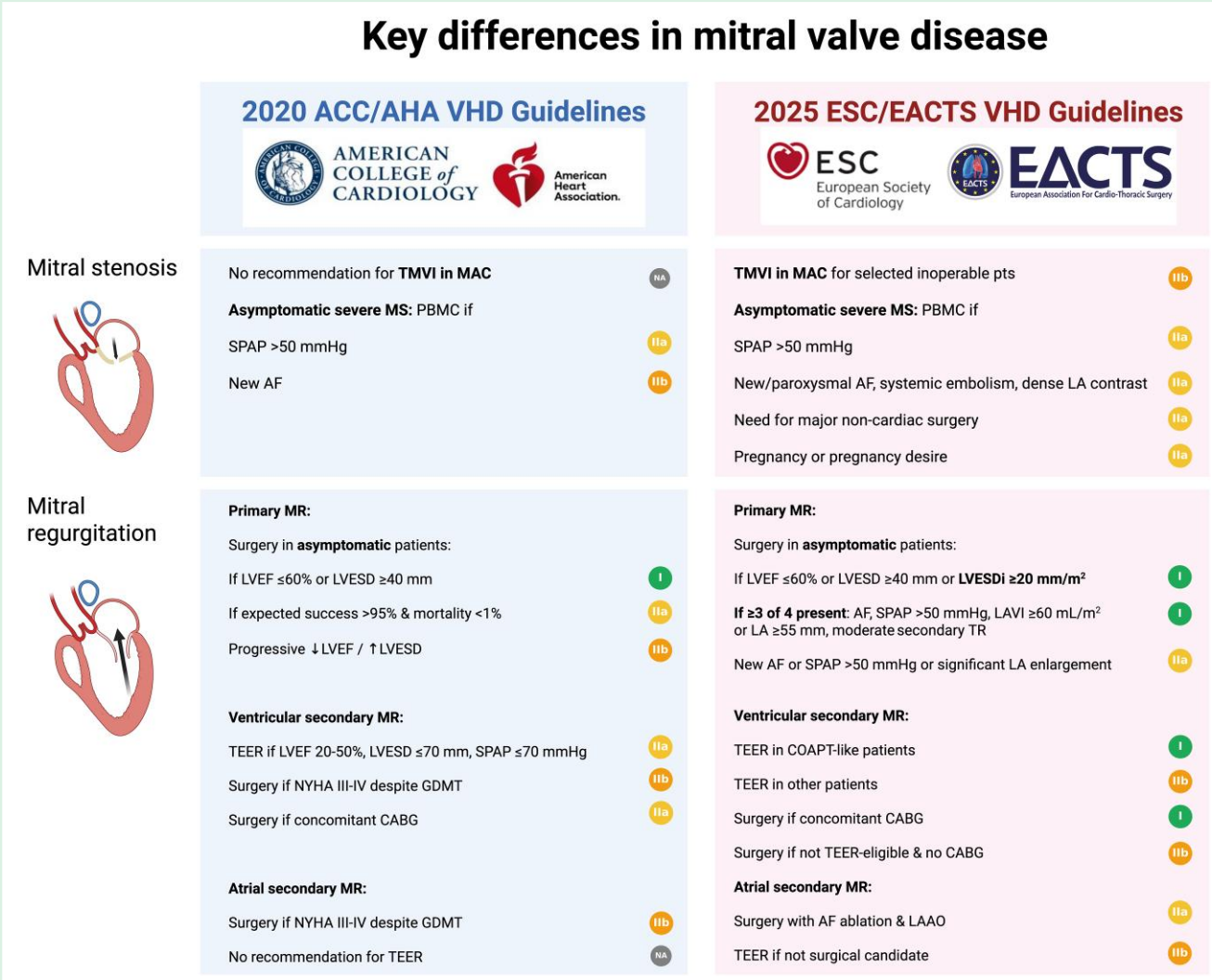


Figure 2 Key differences in mitral valve disease between ACC/AHA 2020 and ESC/EACTS 2025 guidelines. ACC, American College of Cardiology; AHA, American Heart Association; AF, atrial fibrillation; CABG, coronary artery bypass grafting; COAPT, Cardiovascular Outcomes Assessment of the MitraClip Percutaneous Therapy for Heart Failure Patients with Functional Mitral Regurgitation; ESC, European Society of Cardiology; EACTS, European Association for Cardio-Thoracic Surgery; GDMT, guideline-directed medical therapy; LA, left atrium; LAAO, left atrial appendage occlusion; LAVI, left atrial volume index; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic diameter; LVESDi, left ventricular end-systolic diameter index; MAC, mitral annular calcification; MR, mitral regurgitation; MS, mitral stenosis; NA, not addressed; SPAP, systolic pulmonary artery pressure; PBMC, percutaneous balloon mitral commissurotomy; TEER, transcatheter edge-to-edge repair; TMVI, transcatheter mitral valve implantation; VHD, valvular heart disease.

Secondary

Similarities

Both 2020 ACC/AHA and 2025 ESC/EACTS guidelines require optimization of guideline-directed medical therapy and cardiac resynchronization therapy (CRT) when indicated and consider valve intervention only in patients who remain symptomatic despite these measures. Both recommend correcting severe secondary MR at the time of coronary artery bypass grafting (CABG). Both also recognize TEER for ventricular secondary MR in appropriately selected patients with suitable anatomy once medical therapy has been optimized.

Differences

The differences in recommendations for secondary MR are mainly driven by new evidence published after the ACC/AHA guideline in 2020. In ventricular secondary MR, the 2020 ACC/AHA guideline supports TEER as a Class IIa therapy in patients who resemble those enrolled in the COAPT trial,[21] for example, with LVEF roughly 20–50%, an LV that is not excessively dilated, pulmonary pressures within a treatable range, and anatomy suitable for the device (*Figure 2*). The 2025 ESC/EACTS guideline upgrades this to Class I, Level A after longer-term outcomes while retaining a Class IIb pathway for patients who do

not meet COAPT-like criteria when symptom relief is the goal and advanced therapies such as left ventricular assist device (LVAD) or transplantation have been considered.

The treatment of moderate secondary MR at the time of CABG also differs. The 2020 ACC/AHA guideline gives no formal recommendation, as the 2017 focused update pathway (Class IIb, 'usefulness uncertain') was not carried forward.[20] The 2021 ESC/EACTS guideline likewise did not issue a classed recommendation and described the issue as debated.[4] The 2025 ESC/EACTS guideline now states that mitral surgery may be considered in patients with moderate secondary MR undergoing CABG, assigning a Class IIb recommendation.

For atrial secondary MR, the 2020 ACC/AHA guideline acknowledges the entity with a Class IIb recommendation for surgery in selected symptomatic patients with atrial annular dilatation and preserved LV function when a durable repair is possible. The 2025 ESC/EACTS guideline provides a more structured pathway. In symptomatic patients despite rhythm and medical therapy, surgery with concomitant AF ablation and left atrial appendage closure is Class IIa, and TEER may be considered as Class IIb when surgery is not feasible.

Evidence gaps and future directions

According to the 2025 ESC/EACTS guideline, several important uncertainties remain. In primary MR, further research is needed to clarify the association between MR and ventricular arrhythmias and to determine whether intervention reduces arrhythmic risk. The role of TEER in patients with advanced heart failure remains unclear, and the long-term durability of TEER, including the clinical impact of post-procedural transmitral gradients, requires further evaluation. Results of ongoing trials comparing surgical repair with TEER in non-high-risk primary MR patients are awaited, as are mid- and long-term data on transcatheter mitral valve replacement. Advanced imaging markers such as GLS, left atrial strain, and CMR volumetrics are increasingly used to detect early dysfunction but lack outcome-based validation and therefore do not yet inform guideline thresholds.

In secondary MR, more evidence is required on the clinical impact of both surgical and transcatheter therapies in atrial secondary MR, where optimal management remains unclear.

Mitral stenosis

Similarities

Both the 2020 ACC/AHA and 2025 ESC/EACTS guidelines recommend percutaneous mitral commissurotomy for symptomatic patients with rheumatic MS when valve morphology is favourable and no contraindications are present. Surgery is indicated when commissurotomy is not feasible. Anticoagulation with a vitamin K antagonist (VKA) remains mandatory in patients with MS and AF, while direct oral anticoagulants (DOAC) are contraindicated.

Differences

The 2025 ESC/EACTS guidelines introduce a refinement by explicitly defining the anticoagulation threshold as mitral valve area (MVA) ≤ 2.0 cm² in patients with AF, whereas ACC 2020 and ESC 2021 referred more generally to 'moderate-to-severe' rheumatic MS. This difference reflects evidence from the INVICTUS trial, which enrolled patients with AF and moderate-to-severe rheumatic MS defined by a MVA of no more than 2.0 cm² or the presence of left atrial thrombus or spontaneous echo contrast and demonstrated the superiority of VKA over rivaroxaban.[22] ESC 2025 also adds a new Class IIb, Level C recommendation that transcatheter mitral valve implantation (TMVI) may be considered in highly selected inoperable patients with severe dysfunction due to mitral annular calcification (MAC) (*Figure 2*).

Evidence gaps and future directions

ESC 2025 highlights that the role of TMVI using dedicated devices in high-risk patients, particularly those with severe MAC, remains to be determined. Prospective data are required to establish feasibility, durability, and long-term clinical outcomes before wider adoption can be recommended.

Tricuspid regurgitation

Similarities

The 2020 ACC/AHA and 2025 ESC/EACTS guidelines both recognize that TR is most often secondary and should be addressed when left-sided valve surgery is performed. In both, concomitant tricuspid intervention is indicated when TR is severe (Class I). Repair is also reasonable at the time of left-sided surgery for moderate TR with annular dilatation to prevent progression. Neither guideline supports intervention for isolated mild TR without additional risk factors, and both emphasize that medical therapy alone does not alter long-term outcomes once TR becomes severe. The 2025 ACC Expert Consensus echoes these principles and emphasizes that intervention for TR has historically been underused, encouraging earlier referral before advanced right ventricular dysfunction develops.[23]

Differences

The differences in recommendations for tricuspid regurgitation are mainly driven by new evidence that became available after the 2020 ACC/AHA guideline. The greatest divergence concerns isolated disease (*Figure 3*). ACC 2020 recommends surgery in symptomatic severe primary TR with preserved RV function and without severe pulmonary hypertension (Class IIa) and allows consideration in asymptomatic patients with progressive RV dilatation or dysfunction (Class IIb). For severe secondary TR without another surgical indication, ACC 2020 offers isolated surgery only as a Class IIb option in carefully selected symptomatic patients. ESC 2025 broadens these thresholds: surgery is a Class I indication for symptomatic severe primary TR when ventricular function is preserved and pulmonary pressures are not prohibitive. In severe secondary TR, ESC 2025 assigns Class IIa recommendation both in symptomatic patients and in asymptomatic patients who show progressive RV dilatation or dysfunction, again contingent on preserved ventricular function and acceptable pulmonary pressures. At the time of left-sided surgery, ESC 2025 maintains Class I for severe TR and Class IIa for moderate TR with annular dilatation but downgrades concomitant repair for mild secondary TR with annular dilatation from Class IIa in 2021 to Class IIb. The 2025 ACC Expert Consensus, while not issuing formal recommendations, introduces a practical classification framework distinguishing atrial and ventricular secondary TR, recognizing device-related TR, and highlighting massive and torrential TR as prognostically important stages not formally captured in guideline grading.[23]

Transcatheter therapy is another point of separation. While ACC 2020 issued no formal recommendation because devices

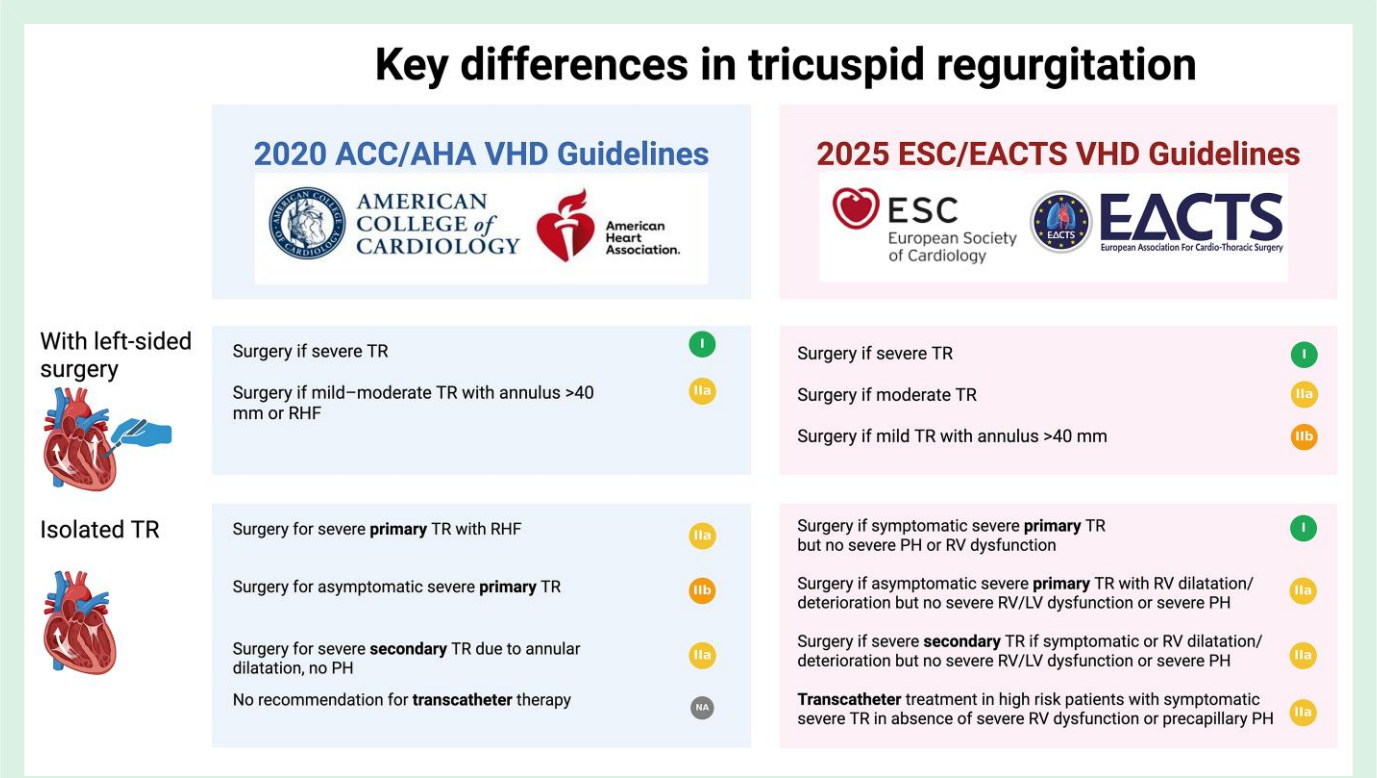


Figure 3 Key differences in tricuspid regurgitation between ACC/AHA 2020 and ESC/EACTS 2025 guidelines. ACC, American College of Cardiology; AHA, American Heart Association; ESC, European Society of Cardiology; EACTS, European Association for Cardio-Thoracic Surgery; LV, left ventricle; NA, not addressed; PH, pulmonary hypertension; RHF, right heart failure; RV, right ventricle; TR, tricuspid regurgitation; VHD, valvular heart disease.

were investigational, ESC 2025 now upgrades transcatheter repair or replacement to Class IIa, Level A in inoperable patients with severe symptomatic TR despite optimal medical therapy, provided right ventricular (RV) function is not severely impaired and pulmonary pressures are acceptable. ESC 2025 also highlights the TRI-SCORE, a validated tool for predicting operative mortality in isolated TR surgery, and recommends its use to support Heart Team decision-making and improve patient selection.[24] The 2025 ACC Expert Consensus notes that FDA-approved transcatheter devices improve quality of life in symptomatic severe TR, while emphasizing that a survival benefit has not yet been demonstrated.[23] An emerging option is heterotopic caval valve implantation (CAVI), in which bioprosthetic valves are implanted in the superior and/or inferior vena cava to reduce venous congestion in patients who are unsuitable for orthotopic repair or replacement. CAVI is technically simpler and avoids some anatomical constraints, but it does not correct leaflet pathology and its long-term role remains uncertain.

Evidence gaps and future directions

Key uncertainties remain regarding the optimal timing of isolated intervention, particularly in asymptomatic patients with progressive RV remodelling. The thresholds for RV dysfunction and pulmonary pressures that should preclude intervention are not well defined. Long-term durability of both surgical and transcatheter repair or replacement is incompletely characterized, and comparative data between approaches remain limited. The 2025 ACC Expert Consensus also notes that even moderate TR may carry adverse prognosis and stresses the need for improved imaging and structured shared decision-making.[23] The role of CAVI and other heterotopic approaches is also uncertain and requires further evaluation in prospective studies. Ongoing trials and prospective registries, along with integration of risk stratification tools such as the TRI-SCORE, are expected to refine timing, improve patient selection, and clarify outcomes of emerging transcatheter devices.

Coronary artery disease

Management of concomitant coronary artery disease (CAD) in patients undergoing TAVI has evolved substantially over the past 5 years. The 2020 ACC/AHA guidelines recommended routine invasive coronary angiography before TAVI and permitted percutaneous coronary intervention (PCI) in patients with significant proximal CAD but without defining anatomical thresholds. The 2021 ESC/EACTS guidelines refined this approach, giving PCI a Class IIa recommendation in patients with severe proximal stenoses prior to TAVI.

The 2025 ESC/EACTS guidelines mark a major shift. CT coronary angiography (CTCA) is now recommended as the preferred modality for CAD assessment in most patients undergoing TAVI, with invasive coronary angiography reserved for those at high or very high clinical risk or when CTCA is inconclusive (*Figure 4*). The strength of recommendations for PCI has also changed: PCI of lesions >90% or left main disease in vessels

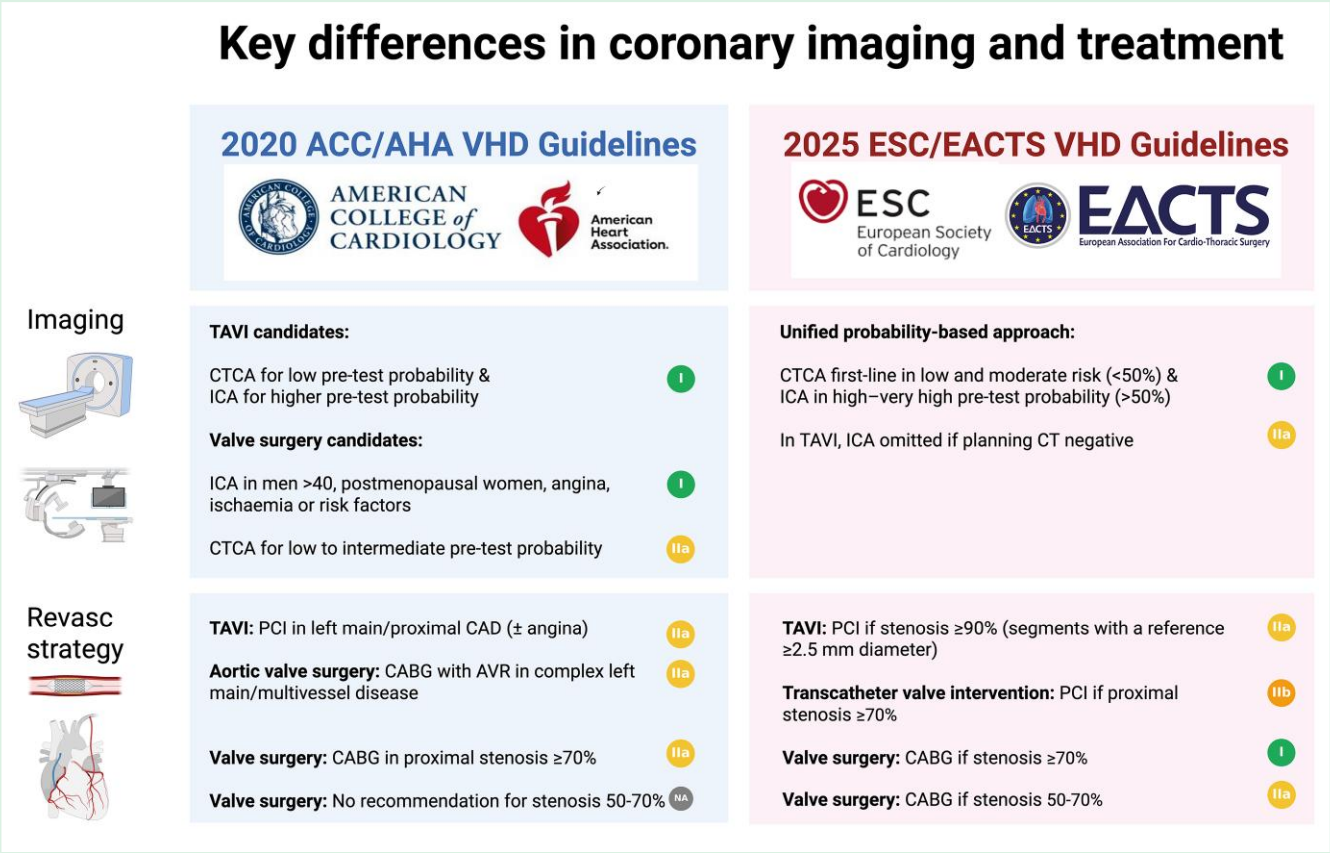


Figure 4 Key differences in coronary imaging and revascularization strategies between ACC/AHA 2020 and ESC/EACTS 2025 guidelines. ACC, American College of Cardiology; AHA, American Heart Association; AVR, aortic valve replacement; CABG, coronary artery bypass grafting; CAD, coronary artery disease; CT, computed tomography; CTCA, computed tomography coronary angiography; ESC, European Society of Cardiology; EACTS, European Association for Cardio-Thoracic Surgery; ICA, invasive coronary angiography; NA, not addressed; PCI, percutaneous coronary intervention; TAVI, transcatheter aortic valve implantation; VHD, valvular heart disease.

≥2.5 mm carries a Class IIa recommendation, while PCI of >70% stenoses in vessels ≥2.5 mm has been revised to Class IIb. These refinements reflect accumulating trial evidence, including ACTIVATION,[25] NOTION-3,[26] and REVASC-TAVI,[27] which have failed to demonstrate a consistent clinical benefit of routine revascularization prior to TAVI.

Evidence gaps and future directions

Important questions remain regarding the role of physiology-guided lesion assessment, the long-term outcomes of deferred CAD treatment in TAVI recipients, and strategies to maintain coronary access following valve-in-valve procedures. Further trials are needed to define optimal revascularization strategies and their integration with antithrombotic therapy in this high-risk population.

Prosthetic valves

The 2020 ACC/AHA, 2021 ESC/EACTS, and 2025 ESC/EACTS guidelines share the same fundamental principles: prosthesis choice should be individualized to age, life expectancy, anticoagulation tolerance, re-intervention planning, and patient preference.[2–4] Mechanical valves require lifelong VKA therapy, and DOACs remain contraindicated. Lifelong surveillance is essential, and valve-in-valve strategies are considered where anatomy permits.

Age thresholds differ, but both guidelines emphasize that prosthesis choice should ultimately be made through a structured Heart Team process incorporating informed patient preference. The 2020 ACC/AHA guideline recommends mechanical heart valves (MHV) under 50 years and bioprostheses above 65 years. The ESC guidelines favour MHV under 60 years in the aortic position and under 65 years in the mitral and bioprostheses above 65 years.

Antithrombotic regimens after surgical bioprosthesis also vary. The 2020 ACC/AHA guideline suggests VKA for 3–6 months postoperatively, whereas the ESC guidelines recommend 3 months of VKA after mitral or tricuspid bioprosthesis and either VKA or single antiplatelet therapy after aortic bioprosthesis, before transitioning to long-term single antiplatelet therapy.

The most notable divergence is in antithrombotic management after TAVI. The 2020 ACC/AHA guideline allowed several strategies in patients without another indication for oral anticoagulation: aspirin alone (Class IIa), dual antiplatelet therapy for 3–6 months (Class IIb), or VKA for 3 months (Class IIb). The ESC, by contrast, moved earlier to a simplified regimen,

recommending single antiplatelet therapy as default and explicitly advising against routine DAPT or OAC unless there is another indication. These positions, introduced in 2021, are unchanged in the 2025 ESC/EACTS guideline.

The 2025 ESC/EACTS update also introduces unified definitions of structural valve deterioration, more detailed guidance on lifetime management, and specific peri-procedural recommendations for mechanical-valve patients. Notably, it advises continuation of therapeutic VKA during device implantation procedures such as pacemakers and implantable cardioverter-defibrillators, without interruption or bridging, reserving perioperative modification for high-bleeding-risk surgeries or the very highest thromboembolic-risk valve types.

Evidence gaps and future directions

The 2025 ESC/EACTS guideline identifies several important gaps. Further development of prosthetic devices is needed to reduce the key complications of current designs, including degeneration of bioprostheses and thrombosis of MHV. In antithrombotic management, uncertainties remain about the optimal bridging strategy after MHV implantation, particularly the role and timing of unfractionated heparin (UFH) vs. low molecular weight heparin (LMWH), as well as perioperative management of VKA in major non-cardiac surgery. Data on hypo-attenuated leaflet thickening and bioprosthetic valve thrombosis remain limited, particularly regarding the efficacy of DOACs since emerging evidence suggests they may be inadequate and that warfarin may be more beneficial.[28] The potential use of pharmacogenomics for patients with highly variable international normalized ratio (INR) control, low therapeutic ranges, or recurrent complications despite adherence requires investigation. Finally, more data are needed on the risks and benefits of slow thrombolysis in patients with prosthetic valve thrombosis.

Sex-specific considerations

ESC 2025 introduces a dedicated section on sex-specific differences in VHD, which is novel compared with earlier guidelines. Women are more often affected by mitral valve disease, rheumatic lesions, and tricuspid regurgitation, while men more frequently present with aortic valve disease and endocarditis. In surgical mitral valve disease, observational data show persistent sex inequities: women tend to present at older ages and are less likely to be offered minimally invasive repair, even though adjusted survival is similar between sexes, supporting the need for earlier referral and equitable access to specialized valve procedures.[29] In parallel, most major valve trials have not been powered for sex-stratified analyses, and female representation has remained static at about 41% over the past two decades, limiting the certainty of sex-specific recommendations.[30] Improving recruitment will require trials that actively target female enrolment, address structural and socioeconomic barriers to participation, and mandate prespecified sex-stratified analyses to ensure adequate statistical power.[31]

In aortic stenosis, women typically have less calcification but more fibrosis, concentric remodelling, and smaller ventricular size and are more likely to present with paradoxical low-flow states. Sex-specific stroke volume thresholds and CT calcium scoring are emphasized, and the RHEIA trial, first prospective female-only randomized controlled trial, suggests TAVI may offer superior outcomes in elderly women compared with SAVR.[32]

In mitral valve disease, fibroelastic degeneration and prolapse are more frequent in women, and new evidence supports lower LVESD thresholds in women when planning surgery. Atrial secondary MR is also more common in women, and women predominate in registries of transcatheter mitral replacement for MAC. In AR, emerging evidence shows that women develop adverse LV dilatation at smaller dimensions, highlighting the need for sex-specific cut-points, although these remain to be validated. Tricuspid regurgitation is more prevalent and progressive in women, though procedural outcomes appear similar between sexes.[33]

Preventive and population-level implications

Valvular heart disease is common, often silent, and rising with age. Population studies such as OxVALVE show that previously unrecognized valve disease is found in up to 50% of adults aged 65 years or older and that most cases are identified only after systematic community screening rather than routine clinical care.[34] Tsampasian *et al.* confirmed this pattern in a large cohort of people aged 60 years or older, reporting that more than one-quarter had previously undetected valvular heart disease and that age was the strongest predictor of clinically significant disease.[1] These findings highlight that many patients with aortic, mitral, and tricuspid disease remain asymptomatic until late and present only after structural changes have already occurred.

This silent burden has system-wide implications. Earlier intervention thresholds in aortic stenosis, together with expanding indications for transcatheter mitral and tricuspid therapies, will increase procedural volume and imaging demand. Specialist clinic capacity will also need to expand. Experience from EARLY TAVR suggests that many patients labelled asymptomatic already have measurable cardiac damage at diagnosis and that a large proportion undergo intervention within months.[10] Similar trends are anticipated across other valve conditions as advanced imaging becomes more widely applied and as transcatheter options expand.

These trends argue for a shift from reactive to preventive care. Community detection programmes, targeted echocardiography in older adults, and clear referral pathways may reduce late presentation and prevent irreversible cardiac damage. When conservative management is chosen, reliable surveillance with regular echocardiography, biomarkers, and exercise testing is essential to avoid missed progression.[35] A recent Lancet perspective from senior cardiothoracic experts advocates for a true lifetime management strategy, emphasizing early diagnosis and early identification of adverse features and selecting the right first procedure to maximize long-term durability.[36] They further caution that increasing transcatheter activity must not undermine surgical expertise or reduce surgical case volume, noting that high-quality surgery remains essential for younger patients and complex valve pathology and ensuring durable long-term outcomes. The authors also call for the development of regional valve networks capable of early assessment, coordinated risk stratification, structured follow-up, and timely access to both surgical and transcatheter treatments.

Looking forward, high-quality data are needed to refine thresholds for intervention in asymptomatic disease, determine durability and optimal patient selection for transcatheter approaches, and establish the prognostic value of advanced imaging and biomarkers. Uncertainty also remains around the management of CAD in TAVI candidates, including PCI thresholds, deferred revascularization, coronary access planning, and the validation of sex-specific thresholds to ensure equitable outcomes.

Conclusions

The American and European guidelines for the management of valvular heart disease remain broadly aligned in their core recommendations, with divergences concentrated in areas where evidence is still evolving (*Graphical abstract*). The ESC 2025 guidelines incorporate more recent trial and registry evidence, extending their scope to lifetime prosthesis management, CAD in the context of TAVI, and sex-specific considerations. Differences are most evident in intervention thresholds for asymptomatic disease, the use of advanced imaging and biomarkers, and the integration of new transcatheter therapies. Most of these contrasts arise because the 2025 ESC/EACTS guideline integrates evidence published after the 2020 ACC/AHA guideline. Given the rapid pace of innovation, guideline updates at 5- to 6-year intervals may not be sufficient; more frequent, data-responsive revisions will be needed to keep recommendations aligned with contemporary practice.

Author contribution

Maciej Debski (Data curation [lead]; Project administration [lead]; Writing—original draft [lead]), Vasiliki Tsampasian (Methodology [supporting]; Writing—review & editing [equal]), Joseph Zacharias (Supervision [supporting]; Writing—review & editing [supporting]), Liam Ring (Supervision [supporting]; Writing—review & editing [equal]), and Vassilios Vassiliou (MA MBBS PhD FRCP Edin FACC FESC) (Conceptualization [lead]; Data curation [supporting]; Supervision [lead]; Writing—review & editing [equal])

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