ESC/EACTS Guidelines for the management of valvular heart disease

Official ESC Guidelines slide set

ESC Guidelines for the management of valvular heart disease
(European Heart Journal; 2025 – doi: 10.1093/eurheartj/ehaf194)

ESC/EACTS Guidelines for the management of VHD

The material was adapted from the *‘2025 ESC/EACTS Guidelines for the management of valvular heart disease’* (*European Heart Journal*; doi: 10.1093/eurheartj/ehaf194) as published on 29/08/25.

ESC/EACTS Guidelines for the management of VHD

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ESC Classes of recommendations

Classes of recommendations

	Definition	Wording to use
Class I	Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective.	Is recommended or is indicated
Class II	Conflicting evidence and/or a divergence of opinion about the usefulness/ efficacy of the given treatment or procedure.	
Class IIa	Weight of evidence/opinion is in favour of usefulness/efficacy.	Should be considered
Class IIb	Usefulness/efficacy is less well established by evidence/opinion.	May be considered
Class III	Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful.	Is not recommended

ESC Levels of evidence

Level of evidence A	Data derived from multiple randomized clinical trials or meta-analyses.
Level of evidence B	Data derived from a single randomized clinical trial or large non-randomized studies.
Level of evidence C	Consensus of opinion of the experts and/or small studies, retrospective studies, registries.

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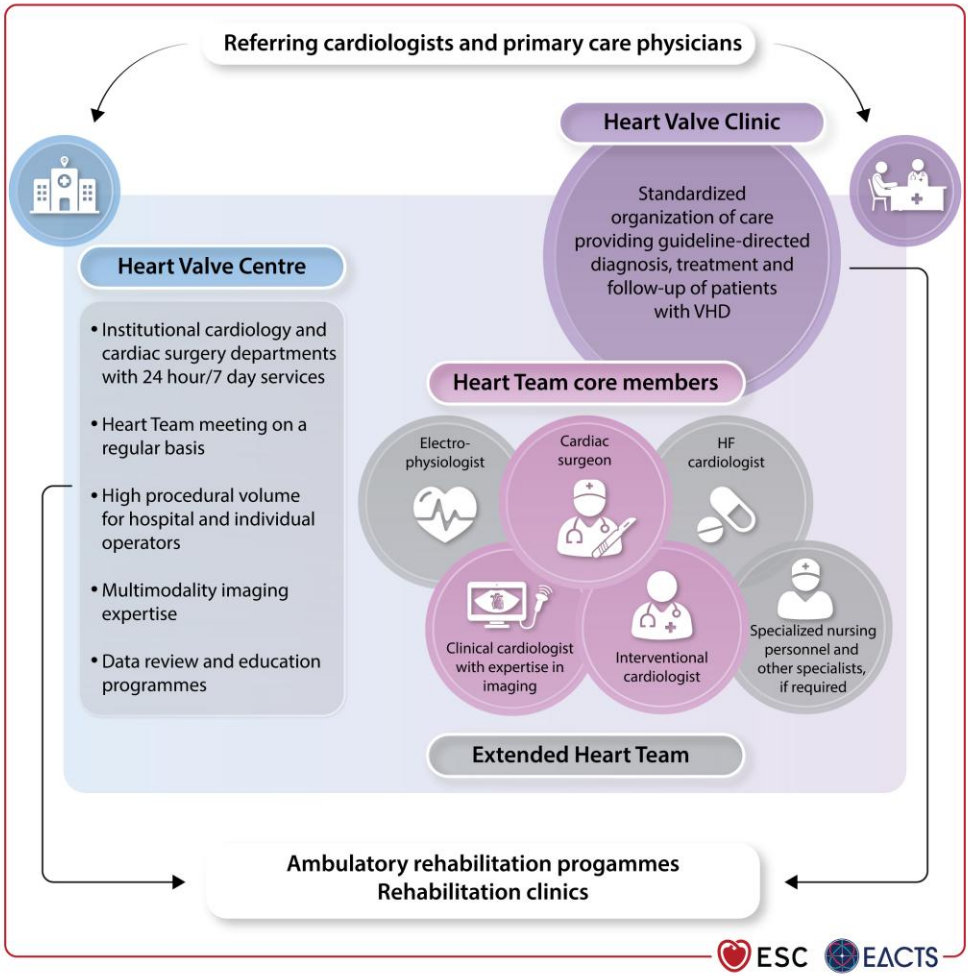
Figure 1

The Heart Valve Network



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Requirements for a Heart Valve Centre

Requirements
Centre performing heart valve procedures with on-site interventional cardiology and cardiac surgery departments providing 24 h/7 day services. **Heart Team core members:** Cardiologist with imaging expertise, interventional cardiologist, cardiac surgeon. **Additional specialists, if required (Extended Heart Team):** Specialized nursing personnel, HF specialist, electrophysiologist, cardiovascular anaesthetist, geriatrician, and other specialists (e.g. intensive care, vascular surgery, infectious diseases, neurology, radiology). The Heart Team must meet on a regular basis and work according to locally defined standard operating procedures and clinical governance arrangements. A hybrid cardiac catheterization laboratory is desirable. High volume for hospital and individual operators.
Multimodality imaging (including advanced echocardiography, CCT, CMR, and nuclear techniques) and expertise in peri-procedural imaging guidance of surgical and transcatheter procedures.
Heart Valve Clinic for outpatient assessment and follow-up.
Data review: continuous monitoring, evaluation, and reporting of procedural volumes and quality indicators, including clinical outcomes, as well as PROMs complemented by local/external audits. Education programmes targeting primary care and referring physicians, operators, and diagnostic and interventional imaging specialists.

Complex procedures ideally performed in the most experienced Heart Valve Centres

Transcatheter interventions	Surgical interventions

• Transfemoral TAVI in patients with high-risk features:
  ○ Low coronary ostia
  ○ Difficult femoral anatomy
  ○ Bicuspid valve
  ○ Severe calcification protruding into the LVOT
  ○ Severe LV and/or RV impairment
  ○ Pure AV regurgitation
  ○ Multiple valve disease
  ○ Complex coronary artery disease
  ○ Severe extracardiac disease (e.g. renal failure, PH)
• Non-transfemoral TAVI
• Valve-in-valve (including TAV-in-TAV)
• All leaflet modification procedures (BASILICA, LAMPOON etc.)
• PVL closure
• Complex M-TEER
• Redo M-TEER procedures
• Tricuspid or mitral valve-in-ring or valve-in-valve, valve-in-MAC
• TMVI
• All tricuspid procedures
	• High-risk procedures (especially in patients with LV and/or RV impairment)
	• Redo procedures
	• Minimally invasive and robotic valve surgery
	• Complex MV repair
	  ○ Barlow disease
	  ○ Anterior or bileaflet prolapse
	  ○ High risk of SAM
	  ○ Severe MAC
	• AV repair
	• Ross procedure
	• Valve surgery combined with complex surgery of the aorta
	• Endocarditis surgery

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Figure 2

Integrative imaging assessment of patients with valvular heart disease

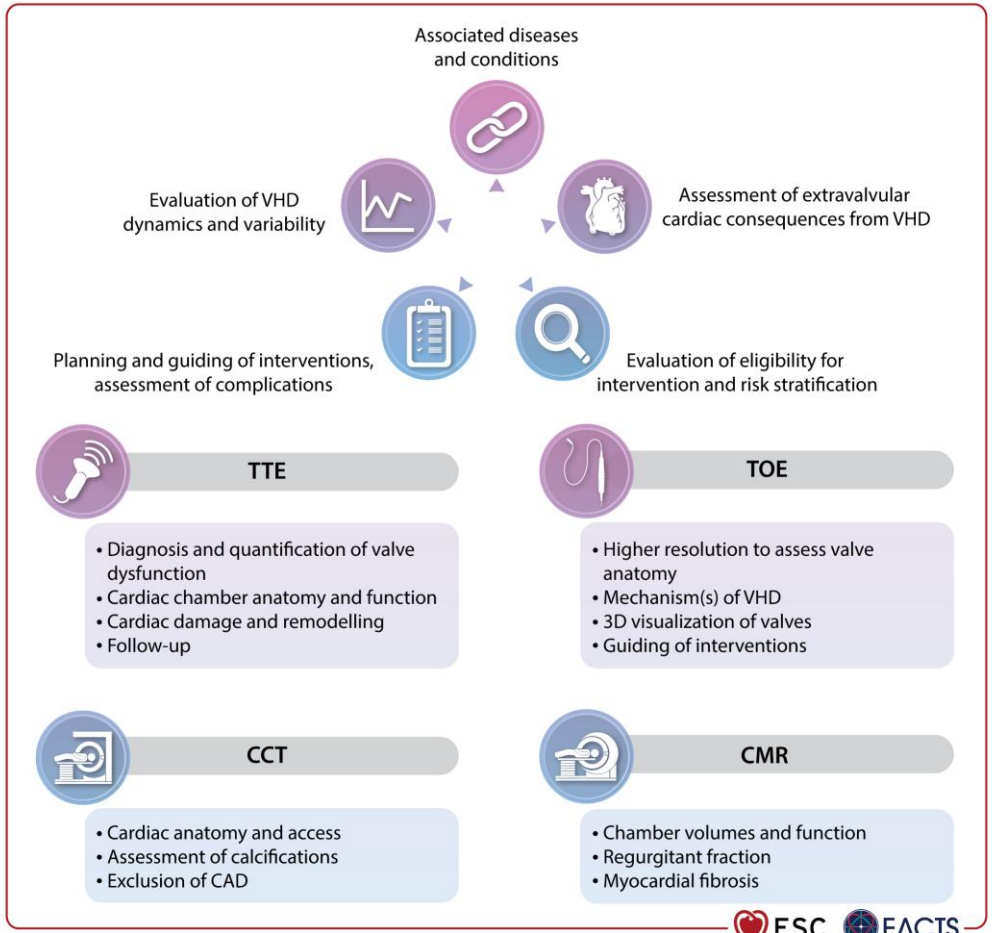

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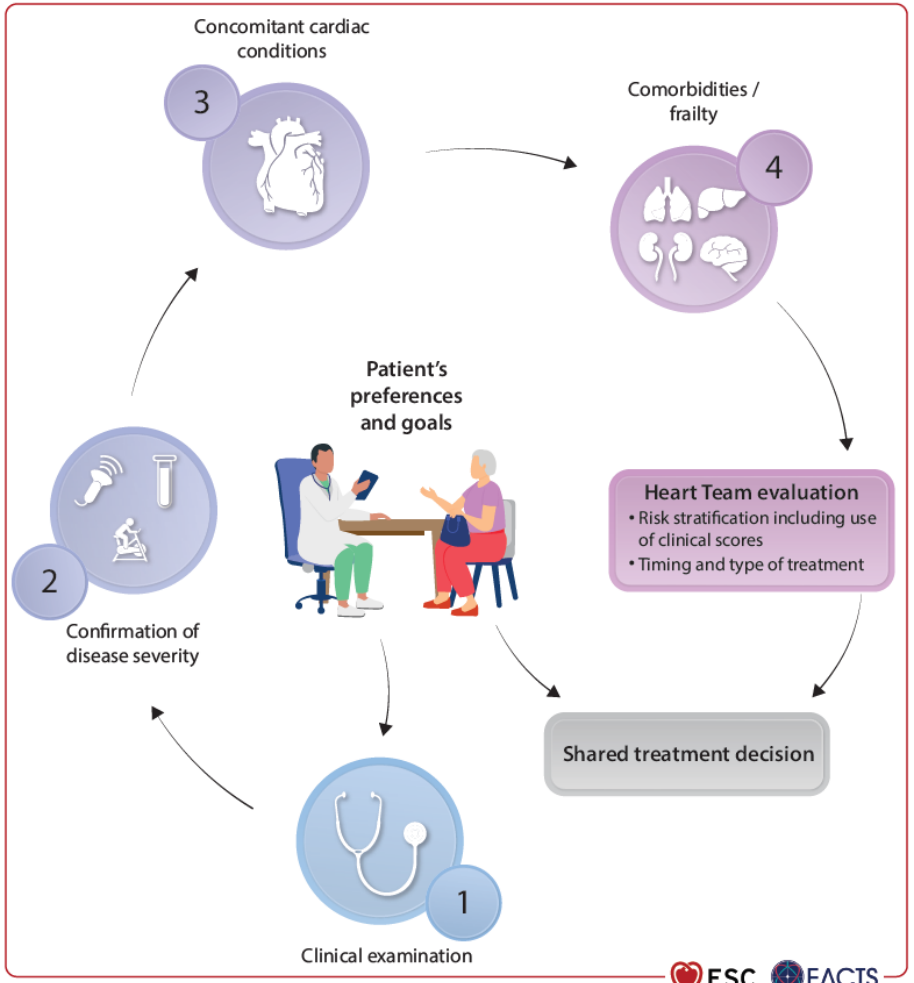
Figure 3

Central illustration
Patient-centred evaluation for treatment



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New recommendations (1)

Recommendations	Class	Level
Diagnosis of coronary artery disease		
Omission of invasive coronary angiography should be considered in TAVI candidates, if procedural planning CCTA is of sufficient quality to rule out significant CAD.	IIa	B
PCI should be considered in patients with a primary indication to undergo TAVI and ≥90% coronary artery stenosis in segments with a reference diameter ≥2.5 mm.	IIa	B
Indications for intervention in severe aortic regurgitation		
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.	IIb	B
Indications for intervention in symptomatic and asymptomatic severe aortic stenosis, and recommended mode of intervention		
Intervention should be considered in asymptomatic patients (confirmed by a normal exercise test, if feasible) with severe, high-gradient AS and LVEF ≥50%, as an alternative to close active surveillance, if the procedural risk is low.	IIa	A
TAVI may be considered for the treatment of severe BAV stenosis in patients at increased surgical risk, if the anatomy is suitable.	IIb	B

New recommendations (2)

Recommendations	Class	Level
Indications for intervention in severe primary mitral regurgitation		
Surgical MV repair is recommended in low-risk asymptomatic patients with severe PMR without LV dysfunction (LVESD <40 mm, LVESDi <20 mm/m^2, and LVEF >60%) when a durable result is likely, if at least three of the following criteria are fulfilled: •AF •SPAP at rest >50 mmHg •LA dilatation (LAVI ≥60 mL/m^2 or LA diameter ≥55 mm) •Concomitant secondary TR ≥ moderate.	I	B
Minimally invasive MV surgery may be considered at experienced centres to reduce the length of stay and accelerate recovery.	IIb	B
Indications for intervention in secondary mitral regurgitation		
MV surgery, surgical AF ablation, if indicated, and LAAO should be considered in symptomatic patients with severe atrial SMR under optimal medical therapy.	IIa	B
TEER may be considered in symptomatic patients with severe atrial SMR not eligible for surgery after optimization of medical therapy including rhythm control, when appropriate.	IIb	B
MV surgery may be considered in patients with moderate SMR undergoing CABG.	IIb	B

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New recommendations (3)

Recommendations	Class	Level
Indications for mitral valve surgery and transcatheter intervention in clinically severe rheumatic and degenerative mitral stenosis		
TMVI may be considered in symptomatic patients with extensive MAC and severe MV dysfunction at experienced Heart Valve Centres with expertise in complex MV surgery and transcatheter interventions.	**IIb**	**C**
Indications for intervention in tricuspid regurgitation		
Careful evaluation of TR aetiology, stage of the disease (i.e. degree of TR severity, RV and LV dysfunction, and PH), patient operative risk, and likelihood of recovery by a multidisciplinary Heart Team is recommended in patients with severe TR prior to intervention.	**I**	**C**
Surgery of concomitant severe mitral regurgitation		
MV surgery is recommended in patients with severe MR undergoing surgery for another valve.	**I**	**C**

New recommendations (4)

Recommendations	Class	Level
Indications for intervention in patients with mixed moderate aortic stenosis and moderate aortic regurgitation		
Intervention is recommended in symptomatic patients with mixed moderate AV stenosis and moderate regurgitation, and a mean gradient ≥40 mmHg or V_{max} ≥4.0 m/s.	I	B
Intervention is recommended in asymptomatic patients with mixed moderate AV stenosis and moderate regurgitation, with V_{max} ≥4.0 m/s and LVEF <50% not attributable to other cardiac disease.	I	C
Prosthetic valve selection		
An MHV should be considered in patients with an estimated long life expectancy, if there are no contraindications for long-term OAC.	IIa	B
Management of antithrombotic therapy in patients with a mechanical heart valve		
It is recommended that INR targets are based on the type and position of MHV, patient's risk factors, and comorbidities.	I	A
Patient education is recommended to improve the quality of OAC.	I	A

New recommendations (5)

Recommendations	Class	Level
Management of antithrombotic therapy in patients with mechanical heart valves undergoing elective non-cardiac surgery or invasive procedures		
Continuing VKA treatment is recommended in patients with an MHV for minor or minimally invasive interventions associated with no or minimal bleeding.	I	A
Interruption (3–4 days before surgery), and resumption of VKA without bridging, may be considered to reduce bleeding in patients with new-generation aortic MHV and no other thrombo-embolic risk factors undergoing major non-cardiac surgery or invasive procedures.	IIb	B

New recommendations (6)

Recommendations	Class	Level
Management of antithrombotic therapy in patients with a biological heart valve or valve repair		
Surgical biological heart valve without indication for oral anticoagulation		
Lifelong low-dose ASA (75–100 mg/day) may be considered 3 months after surgical implantation of an aortic or mitral BHV in patients without clear indication for OAC.	IIb	C
Transcatheter aortic valve implantation without indication for oral anticoagulation		
DAPT is not recommended to prevent thrombosis after TAVI, unless there is a clear indication.	III	B
Surgical repair without indication for oral anticoagulation		
Low-dose ASA (75–100 mg/day) may be considered after surgical MV or TV repair in preference to OAC in patients without clear indication for OAC and at high bleeding risk.	IIb	C
Surgical biological heart valve with indication for oral anticoagulation		
OAC continuation is recommended in patients with a clear indication for OAC undergoing surgical BHV implantation.	I	B
DOAC continuation may be considered after surgical BHV implantation in patients with an indication for DOAC.	IIb	B

New recommendations (7)

Recommendations	Class	Level
Surgical repair with indication for oral anticoagulation and/or antiplatelet therapy		
Continuation of OAC or antiplatelet therapy should be considered after surgical valve repair in patients with a clear indication for an antithrombotic therapy.	IIa	B
Management of mechanical heart valve failure		
Reoperation is recommended in symptomatic patients with significant valve dysfunction not attributable to valve thrombosis.	I	C
Management of valve thrombosis		
TOE and/or 4D-CT are recommended in patients with suspected valve thrombosis to confirm the diagnosis.	I	C

Revised recommendations (1)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of coronary artery disease in patients with valvular heart disease					
CCTA should be considered as an alternative to coronary angiography before valve surgery in patients with severe VHD and low probability of CAD.	**IIa**	**C**	CCTA is recommended before valve intervention in patients with moderate or lower (≤50%) pre-test likelihood of obstructive CAD.	**I**	**B**
Coronary angiography is recommended before valve surgery in patients with severe VHD and any of the following: • History of cardiovascular disease • Suspected myocardial ischaemia • LV systolic dysfunction • In men >40 years of age and post-menopausal women • One or more cardiovascular risk factors.	**I**	**C**	Invasive coronary angiography is recommended before valve intervention in patients with high and very high (>50%) pre-test likelihood of obstructive CAD.	**I**	**C**

Revised recommendations (2)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of coronary artery disease in patients with valvular heart disease (Continued)					
Coronary angiography is recommended in the evaluation of severe SMR	I	C	Invasive coronary angiography is recommended in the evaluation of CAD in patients with severe ventricular SMR.	I	C
PCI should be considered in patients with a primary indication to undergo TAVI and coronary artery diameter stenosis >70% in proximal segments.	IIa	C	PCI may be considered in patients with a primary indication to undergo transcatheter valve interventions and coronary artery stenosis ≥70% in proximal segments of main vessels.	IIb	B
PCI should be considered in patients with a primary indication to undergo transcatheter MV intervention and coronary artery diameter stenosis >70% in proximal segments.	IIa	C			

Revised recommendations (3)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of atrial fibrillation in patients with native valvular heart disease					
LAAO should be considered to reduce the thrombo-embolic risk in patients with AF and a CHA_2DS_2-VASc score ≥2 undergoing valve surgery	**IIa**	**B**	Surgical closure of the LA appendage is recommended as an adjunct to OAC in patients with AF undergoing valve surgery to prevent cardioembolic stroke and systemic thrombo-embolism.	**I**	**B**

Revised recommendations (4)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of atrial fibrillation in patients with native valvular heart disease (Continued)					
Concomitant AF ablation should be considered in patients undergoing valve surgery, balancing the benefits of freedom from atrial arrhythmias and the risk factors for recurrence (LA dilatation, years in AF, age, renal dysfunction, and other cardiovascular risk factors).	IIa	A	Concomitant surgical ablation is recommended in patients undergoing MV surgery with AF suitable for a rhythm control strategy to prevent symptoms and recurrence of AF, according to an experienced team of electrophysiologists and arrhythmia surgeons.	I	A
			Concomitant surgical ablation should be considered in patients undergoing non-MV surgery with AF suitable for a rhythm control strategy to prevent symptoms and recurrence of AF, according to an experienced team of electrophysiologists and arrhythmia surgeons.	IIa	B

Revised recommendations (5)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of atrial fibrillation in patients with native valvular heart disease (Continued)					
The use of DOACs is not recommended in patients with AF and moderate-to-severe MS	**III**	**C**	The use of DOACs is not recommended in patients with AF and rheumatic MS with an MVA ≤2.0 cm^2.	**III**	**B**
Indications for surgery in severe aortic regurgitation					
AV repair may be considered in selected patients at experienced centres when durable results are expected.	**IIb**	**C**	AV repair should be considered in selected patients with severe AR at experienced centres, when durable results are expected.	**IIa**	**B**
Surgery may be considered in asymptomatic patients with LVESD >20 mm/m^2 BSA (especially in patients with small body size) or resting LVEF ≤55%, if surgery is at low risk.	**IIb**	**C**	AV surgery may be considered in asymptomatic patients with severe AR and LVESDi >22 mm/m^2 or LVESVi >45 mL/m^2 [especially in patients with small body size (BSA <1.68 m^2)], or resting LVEF ≤55%, if surgical risk is low.	**IIb**	**B**

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Revised recommendations (6)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Indications for intervention in symptomatic severe aortic stenosis					
Intervention is recommended in symptomatic patients with severe low-flow (SVi ≤35 mL/m^2), low-gradient (<40 mmHg) AS with reduced LVEF (<50%), and evidence of flow (contractile) reserve.	I	B	Intervention is recommended in symptomatic patients with severe low-flow (SVi ≤35 mL/m^2), low-gradient (<40 mmHg) AS with reduced LVEF (<50%) after careful confirmation that AS is severe.	I	B
Intervention should be considered in symptomatic patients with low-flow, low-gradient (<40 mmHg) AS with normal LVEF after careful confirmation that the AS is severe	IIa	C	Intervention should be considered in symptomatic patients with low-flow (SVi ≤35 mL/m^2), low-gradient (<40 mmHg) AS with normal LVEF (≥50%) after careful confirmation that the AS is severe.	IIa	B

Revised recommendations (7)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Indications for intervention in asymptomatic severe aortic stenosis					
Intervention should be considered in asymptomatic patients with severe AS and LV dysfunction (LVEF <55%) without another cause. Intervention should be considered in asymptomatic patients with LVEF >55% and a normal exercise test if the procedural risk is low and one of the following parameters is present: • Very severe AS (mean gradient ≥60 mmHg or Vmax >5 m/s). • Severe valve calcification (ideally assessed by CCT) and Vmax progression ≥.3 m/s/year. • Markedly elevated BNP levels (more than three times age- and sex-corrected normal range) confirmed by repeated measurements and without other explanation.	**IIa**	**B**	Intervention should be considered in asymptomatic patients with severe AS and LVEF ≥50%, if the procedural risk is low and one of the following parameters is present: • Very severe AS (mean gradient ≥60 mmHg or Vmax >5.0 m/s). • Severe valve calcification (ideally assessed by CCT) and Vmax progression ≥.3 m/s/year. • Markedly elevated BNP/NT-proBNP levels (more than three times age- and sex-corrected normal range, confirmed on repeated measurement without other explanation). • LVEF <55% without another cause.	**IIa**	**B**

Revised recommendations (8)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Mode of intervention in symptomatic severe aortic stenosis					
The choice between surgical and transcatheter intervention must be based upon careful evaluation of clinical, anatomical, and procedural factors by the Heart Team, weighing the risks and benefits of each approach for an individual patient. The Heart Team recommendation should be discussed with the patient who can then make an informed treatment choice.	**I**	**C**	It is recommended that the mode of intervention is based on Heart Team assessment of individual clinical, anatomical, and procedural characteristics, incorporating lifetime management considerations and estimated life expectancy.	**I**	**C**

Revised recommendations (9)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Mode of intervention in aortic stenosis					
TAVI is recommended in older patients (≥75 years), or in those who are high risk (STS-PROM/EuroSCORE II >8%) or unsuitable for surgery.	I	A	TAVI is recommended in patients ≥70 years of age with tricuspid AV stenosis, if the anatomy is suitable.	I	A
SAVR is recommended in younger patients who are low risk for surgery (<75 years and STS-PROM/EuroSCORE II <4%), or in patients who are operable and unsuitable for transfemoral TAVI.	I	B	SAVR is recommended in patients <70 years of age, if the surgical risk is low.	I	B
SAVR or TAVI are recommended for remaining patients according to individual clinical, anatomical, and procedural characteristics.	I	B	SAVR or TAVI are recommended for all remaining candidates for an aortic BHV according to Heart Team assessment	I	B
Non-transfemoral TAVI may be considered in patients who are inoperable and unsuitable for transfemoral TAVI.	IIb	C	Non-transfemoral TAVI should be considered in patients who are unsuitable for surgery and transfemoral access.	IIa	B

Revised recommendations (10)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Indications for intervention in severe primary mitral regurgitation					
Surgery should be considered in asymptomatic patients with preserved LV function (LVESD <40 mm and LVEF >60%) and AF secondary to MR or PH (SPAP at rest >50 mmHg).	**IIa**	**B**	MV surgery should be considered in asymptomatic patients with severe PMR without LV dysfunction (LVESD <40 mm, LVESDi <20 mm/m^2, and LVEF >60%) in the presence of PH (SPAP at rest >50 mmHg), or AF secondary to MR.	**IIa**	**B**
Surgical MV repair should be considered in low-risk asymptomatic patients with LVEF >60%, LVESD <40 mm, and significant LA dilatation (volume index ≥60 mL/m^2 or diameter ≥55 mm) when performed in a Heart Valve Centre and a durable repair is likely.	**IIa**	**B**	Surgical MV repair should be considered in low-risk asymptomatic patients with severe PMR without LV dysfunction (LVESD <40 mm, LVESDi <20 mm/m^2, and LVEF >60%) significant LA dilatation (LAVI ≥60 mL/m^2 or LA diameter ≥55 mm), when performed in a Heart Valve Centre and a durable repair is likely.	**IIa**	**B**

Revised recommendations (11)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Indications for intervention in severe primary mitral regurgitation					
TEER may be considered in symptomatic patients who fulfil the echocardiographic criteria of eligibility, are judged inoperable or at high surgical risk by	**IIb**	**B**	TEER should be considered in symptomatic patients with severe PMR who are anatomically suitable and at high surgical risk according to the Heart Team.	**IIa**	**B**
Severe ventricular secondary mitral regurgitation and concomitant coronary artery disease					
In symptomatic patients who are judged not appropriate for surgery by the Heart Team on the basis of their individual characteristics, PCI (and/or TAVI) possibly followed by TEER (in case of persisting severe SMR) should be considered.	**IIa**	**C**	PCI followed by TEER after re-evaluation of MR may be considered in symptomatic patients with chronic severe ventricular SMR and non-complex CAD.	**IIb**	**C**

Revised recommendations (12)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Indications for intervention severe ventricular secondary mitral regurgitation without concomitant coronary artery disease					
TEER should be considered in selected symptomatic patients not eligible for surgery and fulfilling criteria suggesting an increased chance of responding to the treatment.	**IIa**	**B**	TEER is recommended to reduce HF hospitalizations and improve quality of life in haemodynamically stable, symptomatic patients with impaired LVEF (<50%) and persistent severe ventricular SMR, despite optimized GDMT and CRT (if indicated), fulfilling specific clinical and echocardiographic criteria.	**I**	**A**
In high-risk symptomatic patients not eligible for surgery and not fulfilling the criteria suggesting an increased chance of responding to TEER, the Heart Team may consider in selected cases a TEER procedure or other transcatheter valve therapy if applicable, after careful evaluation for ventricular assist device or heart transplant.	**IIb**	**C**	TEER may be considered for symptom improvement in selected symptomatic patients with severe ventricular SMR not fulfilling the specific clinical and echocardiographic criteria, after careful evaluation of LVAD or HTx	**IIb**	**B**

Revised recommendations (13)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Severe ventricular secondary mitral regurgitation without concomitant coronary artery disease (Continued)					
Valve surgery may be considered in symptomatic patients judged appropriate for surgery by the Heart Team.	IIb	C	MV surgery may be considered in symptomatic patients with severe ventricular SMR without advanced HF who are not suitable for TEER.	IIb	C
Indications for intervention in tricuspid regurgitation in patients with left-sided valvular heart disease requiring surgery					
Surgery is recommended in patients with severe primary TR undergoing left- sided valve surgery	I	C	Concomitant TV surgery is recommended in patients with severe primary or secondary TR.	I	B
Surgery is recommended in patients with severe secondary TR undergoing left-sided valve surgery.	I	B			
Surgery should be considered in patients with moderate primary TR undergoing left-sided valve surgery.	IIa	C	Concomitant TV repair should be considered in patients with moderate primary or secondary TR, to avoid progression of TR and RV remodelling.	IIa	B

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Revised recommendations (14)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Indications for intervention in tricuspid regurgitation in patients with left-sided valvular heart disease requiring surgery (Continued)					
Surgery should be considered in patients with mild or moderate secondary TR with a dilated annulus (≥40 mm or >21 mm/m2 by 2D echocardiography) undergoing left-sided valve surgery.	IIa	B	Concomitant TV repair may be considered in selected patients with mild secondary TR and tricuspid annulus dilatation (≥40 mm or >21 mm/m2) to avoid progression of TR and RV remodelling.	IIb	B
Indications for intervention in in patients with severe tricuspid regurgitation without left-sided valvular heart disease requiring surgery					
Transcatheter treatment of symptomatic secondary severe TR may be considered in inoperable patients at a Heart Valve Centre with expertise in the treatment of TV disease.	IIb	C	Transcatheter TV treatment should be considered to improve quality of life and RV remodelling in high-risk patients, with symptomatic severe TR despite optimal medical therapy, in the absence of severe RV dysfunction or pre-capillary PH.	IIa	A

Revised recommendations (15)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Prosthetic valve selection					
A mechanical prosthesis may be considered in patients already on long-term anticoagulation due to the high risk for thrombo-embolism.	IIb	C	An MHV may be considered in patients with a clear indication for long-term OAC.	IIb	C
Management of antithrombotic therapy in patients with a mechanical heart valve					
OAC using a VKA is recommended lifelong for all patients with an MHV prosthesis	I	B	Lifelong OAC with a VKA is recommended for all patients with MHVs to prevent thrombo-embolic complications.	I	A
For patients with a VKA, INR self-management is recommended provided appropriate training and quality control are performed.	I	B	INR self-monitoring and self-management are recommended over standard monitoring in selected, trained patients to improve efficacy	I	A

Revised recommendations (16)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of antithrombotic therapy in patients with a mechanical heart valve (Continued)					
In patients with MHVs, it is recommended to (re)initiate the VKA on the first post-operative day.	**I**	**C**	Following cardiac surgery with MHV implantation, it is recommended to start UFH or LMWH bridging and VKA within 24 h, or as soon as considered safe.	**I**	**B**
In patients who have undergone valve surgery with an indication for post-operative therapeutic bridging, it is recommended to start either UFH or LMWH 12–24 h after surgery.	**I**	**C**			
The addition of low-dose ASA (75–100 mg/day) to VKA may be considered in selected patients with MHVs in case of concomitant atherosclerotic disease and low risk of bleeding.	**IIb**	**C**	The addition of low-dose ASA (75–100 mg/day) to VKA should be considered in selected patients with MHVs in case of concomitant symptomatic atherosclerotic disease, considering the individual bleeding risk profile.	**IIa**	**B**

Revised recommendations (17)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of antithrombotic therapy in patients with a mechanical heart valve (Continued)					
The addition of low-dose ASA (75–100 mg/day) to VKA should be considered after thrombo-embolism despite an adequate INR.	**IIa**	**C**	Either an increase in INR target or the addition of low-dose ASA (75–100 mg/day) should be considered in patients with MHVs who develop a major thrombo-embolic complication despite documented adequate INR.	**IIa**	**C**
DOACs are not recommended in patients with an MHV prosthesis.	**III**	**B**	DOACs and/or DAPT are not recommended to prevent thrombosis in patients with an MHV.	**III**	**A**

Revised recommendations (18)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of antithrombotic therapy in patients with mechanical heart valves undergoing elective non-cardiac surgery or invasive procedures					
It is recommended that VKAs are timely discontinued prior to elective surgery to aim for an INR <1.5	I	C	It is recommended to discontinue VKA at least 4 days before major elective non-cardiac surgery, aiming for an INR <1.5, and to resume VKA treatment within 24 h after surgery, or as soon as considered safe.	I	B
In patients with MHVs, it is recommended to (re)initiate the VKA on the first post-operative day.	I	C			

Revised recommendations (19)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of antithrombotic therapy in patients with mechanical heart valves undergoing elective non-cardiac surgery or invasive procedures (Continued)					
Therapeutic doses of either UFH or subcutaneous LMWH are recommended for bridging.	I	B	VKA interruption and resumption with bridging should be considered in patients with an MHV and thrombo-embolic risk factors undergoing major non-cardiac surgery.	IIa	B
Bridging of OAC, when interruption is needed, is recommended in patients with any of the following indications: - MHV - AF with significant MS - AF with CHA_2DS_2-VASc score ≥3 for women or 2 for men - Acute thrombotic event within the previous 4 weeks - High acute thrombo-embolic risk.	I	C			

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(European Heart Journal; 2025 – doi: 10.1093/eurheartj/ehaf194)

Revised recommendations (20)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of antithrombotic therapy in patients with a biological heart valve or valve repair					
Therapeutic doses of either UFH or subcutaneous LMWH are recommended for bridging.	I	A	Low-dose ASA (75–100 mg/day) is recommended for 12 months after TAVI in patients without indication for OAC.	I	A
			Long-term (after the first 12 months) low-dose ASA (75–100 mg/day) should be considered after TAVI in patients with no clear indication for OAC.	IIa	C
OAC is recommended lifelong for TAVI patients who have other indications for OAC.	I	B	OAC is recommended for TAVI patients who have other indications for OAC.	I	B
OAC with VKA should be considered during the first 3 months after mitral and tricuspid repair.	IIa	C	OAC, with either VKAs or DOACs, should be considered during the first 3 months after surgical MV or TV repair.	IIa	B
Routine use of OAC is not recommended after TAVI in patients without baseline indication.	III	B	Routine use of OAC is not recommended after TAVI in patients without baseline indication.	III	A

Revised recommendations (21)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of haemolysis and paravalvular leak					
Decision on transcatheter or surgical closure of clinically significant PVLs should be considered based on patient risk status, leak morphology, and local expertise.	**IIa**	**C**	It is recommended that the decision between transcatheter or surgical closure of clinically significant PVLs is based on Heart Team evaluation, including patient risk, leak morphology, and local expertise.	**I**	**C**
Transcatheter closure should be considered for suitable PVLs with clinically significant regurgitation and/or haemolysis in patients at high or prohibitive surgical risk.	**IIa**	**B**	Transcatheter closure should be considered for suitable PVLs with clinically significant regurgitation and/or haemolysis.	**IIa**	**B**

Revised recommendations (22)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of biological heart valve failure					
Reoperation is recommended in symptomatic patients with a significant increase in transprosthetic gradient (after exclusion of valve thrombosis) or severe regurgitation.	**I**	**C**	Reintervention is recommended in symptomatic patients with significant valve dysfunction not attributable to valve thrombosis.	**I**	**C**
Transcatheter, transfemoral valve-in-valve implantation in the aortic position should be considered by the Heart Team depending on anatomical considerations, features of the prosthesis, and in patients who are at high operative risk or inoperable.	**IIa**	**B**	Transcatheter transfemoral valve-in-valve implantation in the aortic position should be considered in patients with significant valve dysfunction who are at intermediate or high surgical risk, and have suitable anatomical and prosthesis features, as assessed by the Heart Team.	**IIa**	**B**

Revised recommendations (24)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of biological heart valve failure (Continued)					
Transcatheter valve-in-valve implantation in the mitral and tricuspid position may be considered in selected patients at high risk for surgical reintervention.	**IIb**	**B**	Transcatheter transvenous mitral or tricuspid valve-in-valve implantation should be considered in patients with significant valve dysfunction at intermediate or high surgical risk, if anatomy is suitable.	**IIa**	**B**

Revised recommendations (24)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of mechanical heart valve thrombosis					
Urgent or emergency valve replacement is recommended for obstructive thrombosis in critically ill patients without serious comorbidity.	I	B	Heart Team evaluation is recommended in patients with acute HF (NYHA class III or IV) due to obstructive MHV thrombosis to determine appropriate management (repeat valve replacement or low-dose slow infusion fibrinolysis).	I	B
Fibrinolysis (using recombinant tissue plasminogen activator 10 mg bolus + 90 mg in 90 min with UFH or streptokinase 1 500 000 U in 60 min without UFH) should be considered when surgery is not available or is very high risk, or for thrombosis of right-sided prostheses.	IIa	B			

Revised recommendations (25)

Recommendations in 2021 version	Class	Level	Recommendations in 2025 version	Class	Level
Management of biological heart valve thrombosis					
Anticoagulation using a VKA and/or UFH is recommended in BHV thrombosis before considering reintervention	I	C	OAC using VKA is recommended in BHV thrombosis before considering reintervention.	I	B

Recommendations for the management of chronic coronary syndrome in patients with valvular heart disease

Recommendations	Class	Level
Diagnosis of coronary artery disease		
CCTA is recommended before valve intervention in patients with moderate or lower (≤50%) pre-test likelihood of obstructive CAD.	I	B
Invasive coronary angiography is recommended before valve intervention in patients with high and very high (>50%) pre-test likelihood of obstructive CAD.	I	C
Invasive coronary angiography is recommended in the evaluation of CAD in patients with severe ventricular SMR.	I	C
Omission of invasive coronary angiography should be considered in TAVI candidates, if procedural planning CT angiography is of sufficient quality to rule out significant CAD.	IIa	B

Recommendations for the management of chronic coronary syndrome in patients with valvular heart disease (Continued)

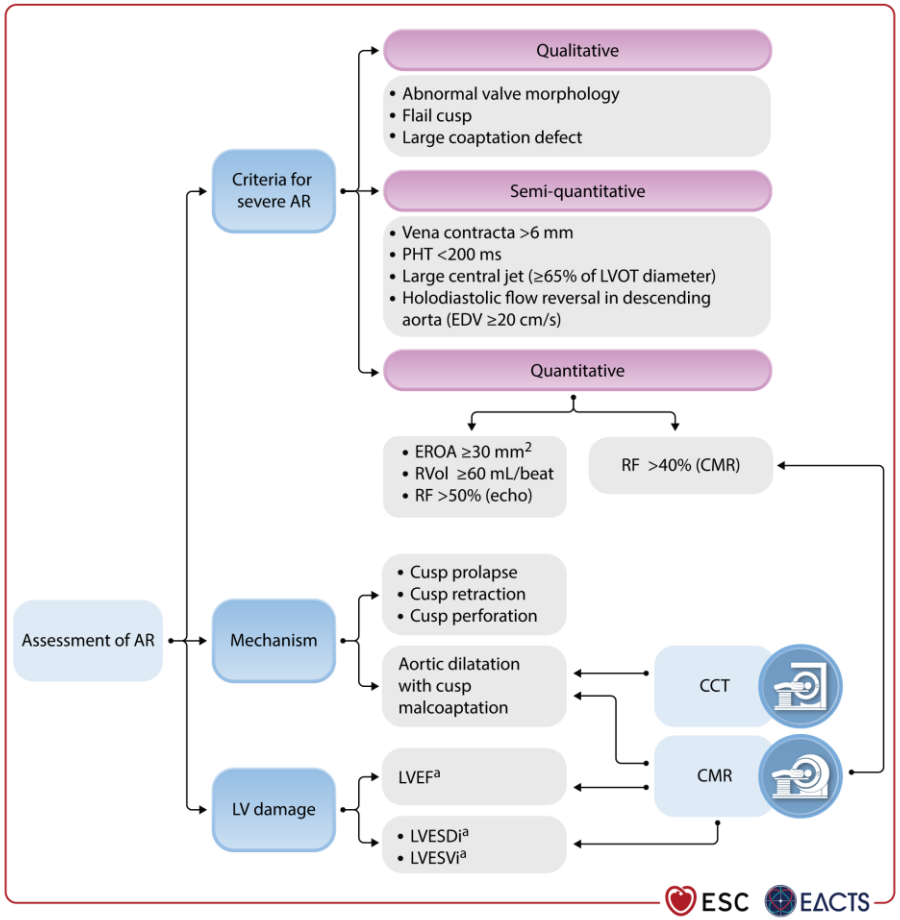
Recommendations	Class	Level
Indications for myocardial revascularization		
CABG is recommended in patients with a primary indication for valve surgery and coronary artery stenosis ≥70%.	I	C
CABG should be considered in patients with a primary indication for valve surgery and coronary artery stenosis ≥50%–70%.	IIa	C
PCI should be considered in patients with a primary indication to undergo TAVI and ≥90% coronary artery stenosis in segments with a reference diameter ≥2.5 mm.	IIa	B
PCI may be considered in patients with a primary indication to undergo transcatheter valve interventions and coronary artery stenosis ≥70% in proximal segments of main vessels.	IIb	B

Recommendations for the management of atrial fibrillation in patients with native valvular heart disease

Recommendations	Class	Level
Anticoagulation		
DOACs are recommended for stroke prevention in preference to VKAs in patients with AF and AS, AR, or MR who are eligible for OAC.	I	A
The use of DOACs is not recommended in patients with AF and rheumatic MS with an MVA ≤2.0 cm^2.	III	B
Surgical interventions		
Concomitant surgical ablation is recommended in patients undergoing MV surgery with AF suitable for a rhythm control strategy to prevent symptoms and recurrence of AF, according to an experienced team of electrophysiologists and arrhythmia surgeons.	I	A
Surgical closure of the LA appendage is recommended as an adjunct to OAC in patients with AF undergoing valve surgery to prevent cardioembolic stroke and systemic thrombo-embolism.	I	B
Concomitant surgical ablation should be considered in patients undergoing non-MV surgery with AF suitable for a rhythm control strategy to prevent symptoms and recurrence of AF, according to an experienced team of electrophysiologists and arrhythmia surgeons.	IIa	B

Figure 4

Imaging assessment of patients with aortic regurgitation



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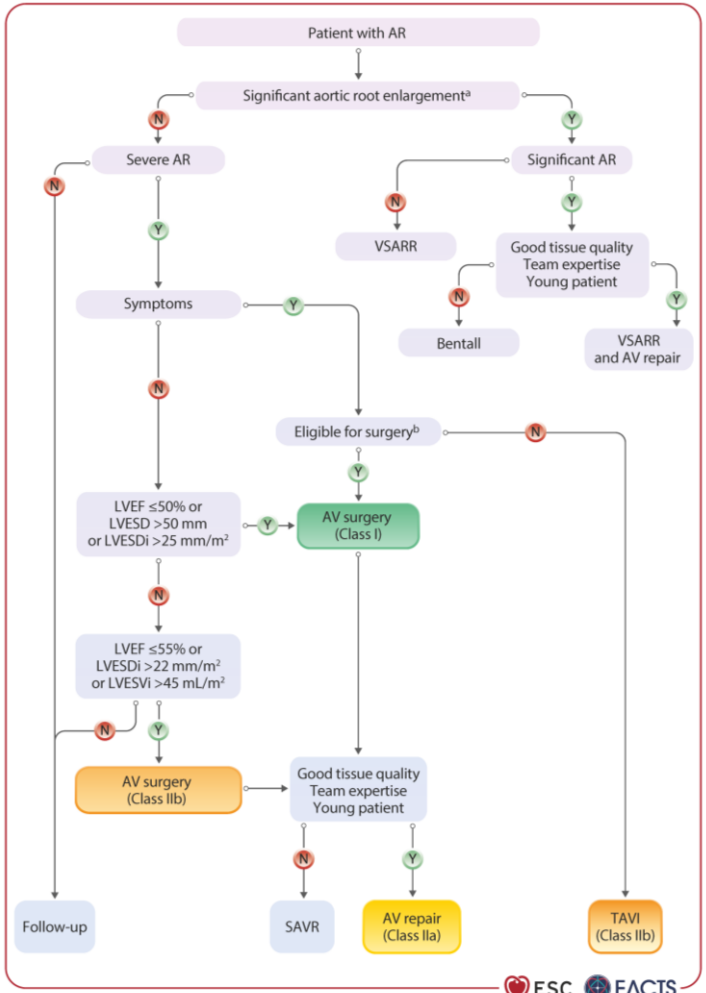
(European Heart Journal; 2025 – doi: 10.1093/eurheartj/ehaf194)

Figure 5

Management of patients with aortic regurgitation



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Recommendations on indications for intervention in severe aortic regurgitation

Recommendations	Class	Level
Severe aortic regurgitation		
AV surgery is recommended in symptomatic patients with severe AR regardless of LV function.	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%.	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.	IIa	B
AV surgery may be considered in asymptomatic patients with severe AR and LVESDi >22 mm/m^2, or LVESVi >45 mL/m^2 [especially in patients with small body size (BSA <1.68 m^2)], 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.	IIb	B

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Recommendations on indications for intervention in severe aortic regurgitation (Continued)

Recommendations	Class	Level
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.	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.	IIa	C

Figure 6

Integrative imaging assessment of patients with aortic stenosis.

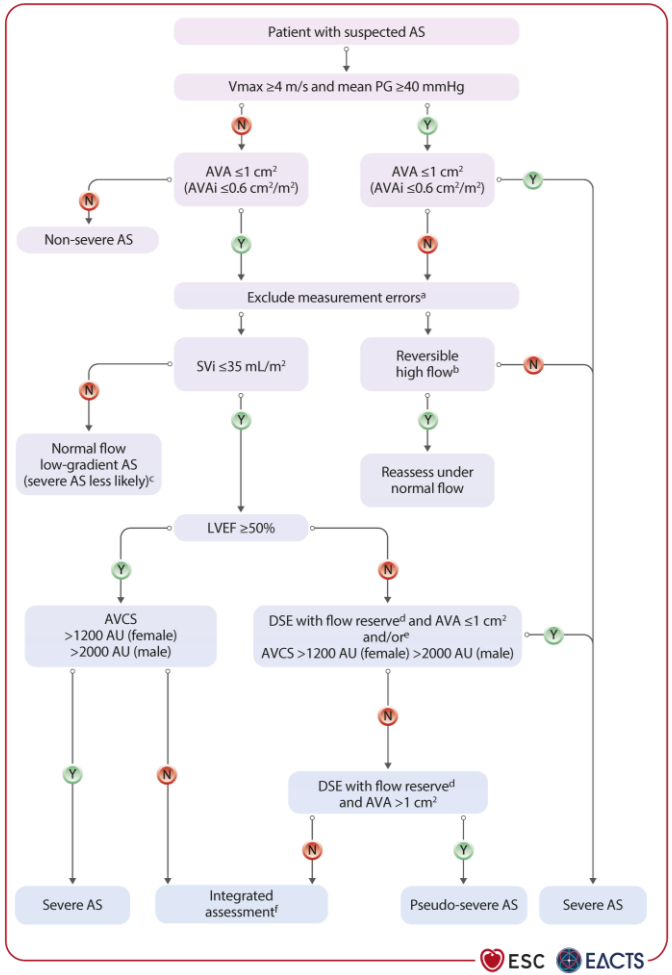

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Figure 7

Management of patients with severe aortic stenosis.

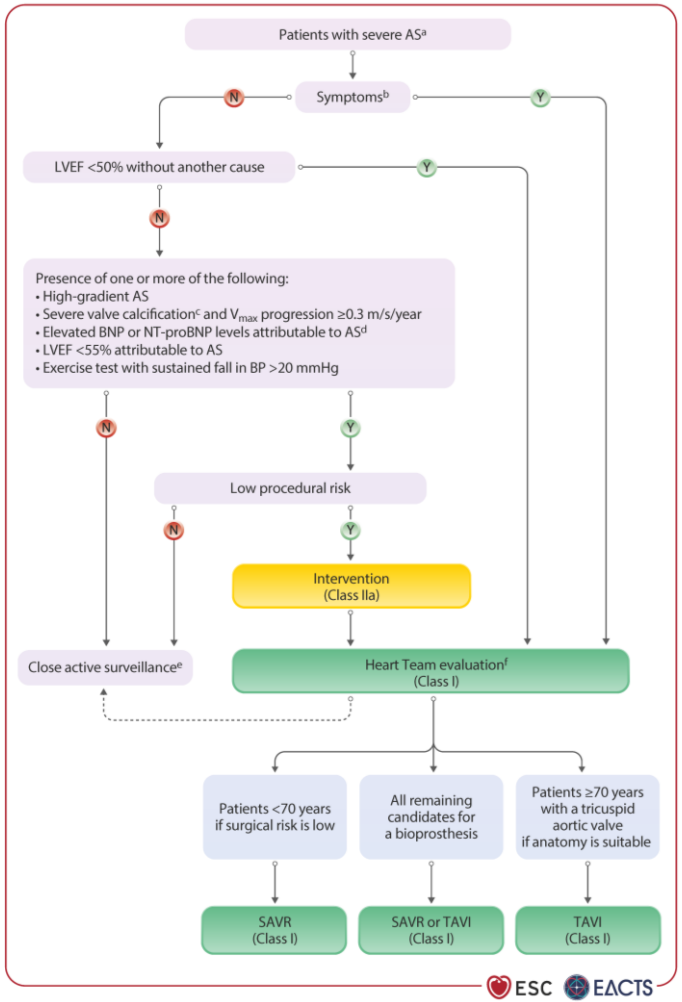

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Figure 8

Aortic valve treatment options

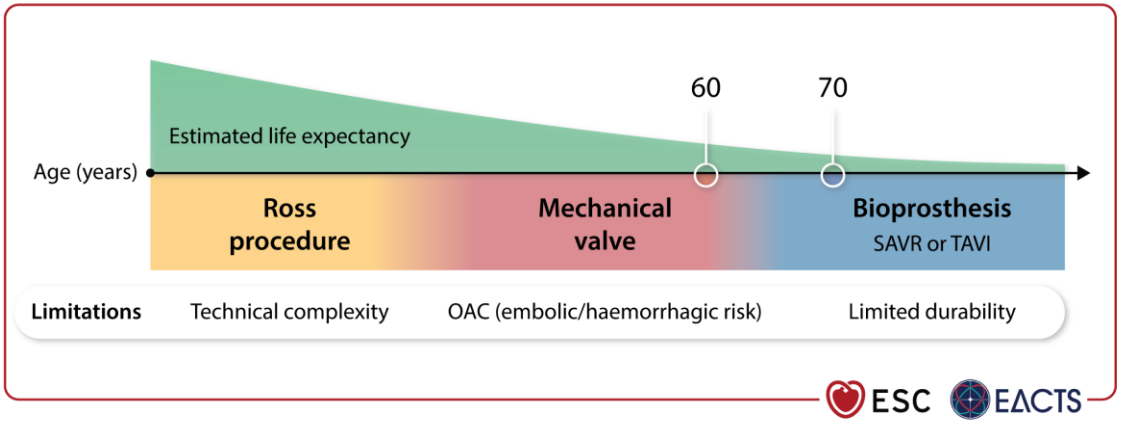

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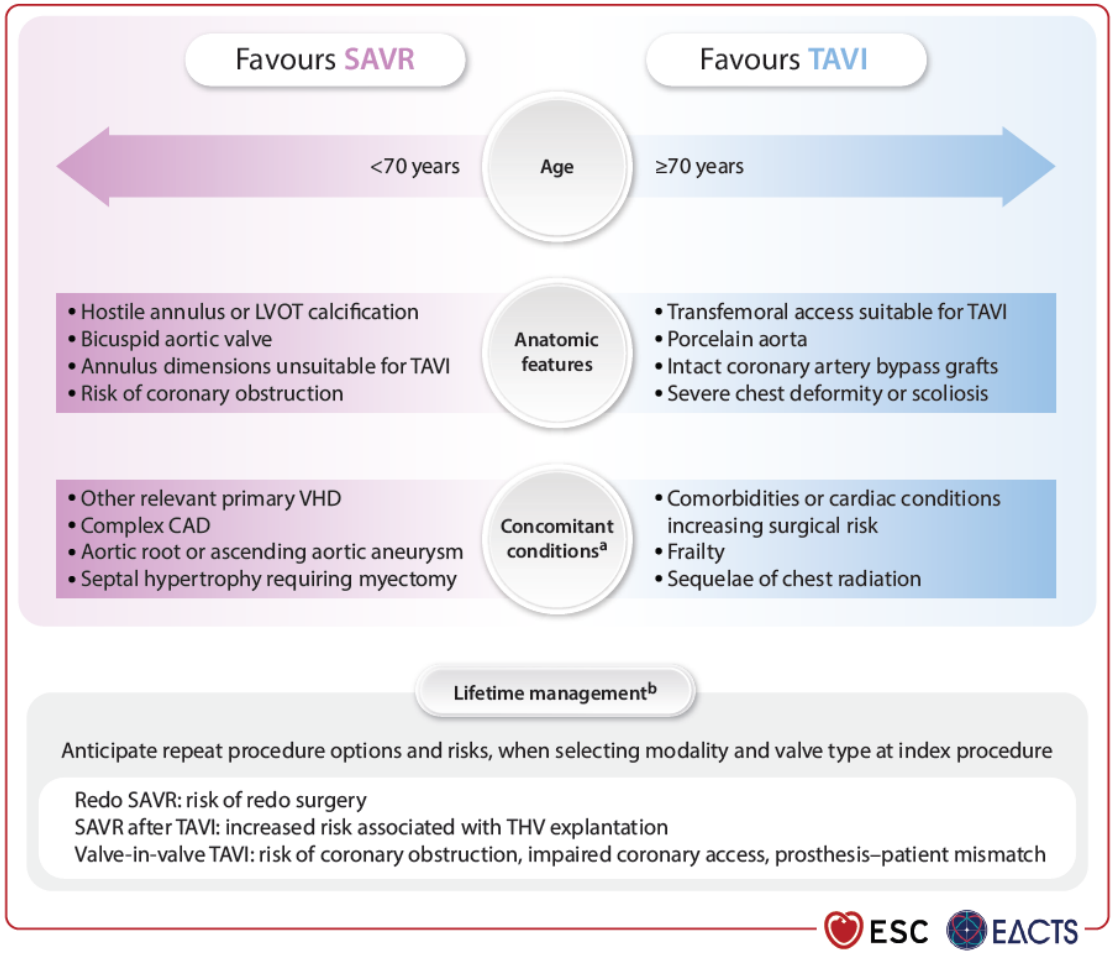
Figure 9

Factors to be considered when selecting the mode of intervention for aortic stenosis



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Recommendations for intervention in symptomatic and asymptomatic aortic stenosis, and recommended mode of intervention

Recommendations	Class	Level
Symptomatic aortic stenosis		
Intervention is recommended in symptomatic patients with severe, high-gradient AS [mean gradient ≥40 mmHg, V_{max} ≥4.0 m/s, AVA ≤1.0 cm^2 (or ≤0.6 cm^2/m^2 BSA)].	I	B
Intervention is recommended in symptomatic patients with low-flow (SVi ≤35 mL/m^2), low-gradient (<40 mmHg) AS with reduced LVEF (<50%) after careful confirmation that AS is severe.	I	B
Intervention should be considered in symptomatic patients with low-flow (SVi ≤35 mL/m^2), low-gradient (<40 mmHg) AS with normal LVEF (≥50%) after careful confirmation that AS is severe.	IIa	B

Recommendations for intervention in symptomatic and asymptomatic aortic stenosis, and recommended mode of intervention (Continued)

Recommendations	Class	Level
Asymptomatic patients with severe aortic stenosis		
Intervention is recommended in asymptomatic patients with severe AS and LVEF <50% without another cause.	I	B
Intervention should be considered in asymptomatic patients (confirmed by a normal exercise test, if feasible) with severe, high-gradient AS and LVEF ≥50% as an alternative to close active surveillance, if the procedural risk is low.	IIa	A
Intervention should be considered in asymptomatic patients with severe AS and LVEF ≥50% if the procedural risk is low and one of the following parameters is present: •Very severe AS (mean gradient ≥60 mmHg or V_{max} >5.0 m/s) •Severe valve calcification (ideally assessed by CCT) and V_{max} progression ≥0.3 m/s/year. •Markedly elevated BNP/NT-proBNP levels (more than three times age- and sex-corrected normal range, confirmed on repeated measurement without other explanation). •LVEF <55% without another cause.	IIa	B
Intervention should be considered in asymptomatic patients with severe AS and a sustained fall in BP (>20 mmHg) during exercise testing.	IIa	C

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Indications for intervention in symptomatic and asymptomatic aortic stenosis, and recommended mode of intervention (Continued)

Recommendations	Class	Level
Mode of intervention		
It is recommended that AV interventions are performed in Heart Valve Centres that report their local expertise and outcome data, have on-site interventional cardiology and cardiac surgical programmes, and a structured collaborative Heart Team.	I	C
It is recommended that the mode of intervention is based on Heart Team assessment of individual clinical, anatomical, and procedural characteristics, incorporating lifetime management considerations and estimated life expectancy.	I	C
TAVI is recommended in patients ≥70 years of age with tricuspid AV stenosis, if the anatomy is suitable.	I	A
SAVR is recommended in patients <70 years of age, if the surgical risk is low.	I	B
SAVR or TAVI are recommended for all remaining candidates for an aortic BHV according to Heart Team assessment.	I	B

Indications for intervention in symptomatic and asymptomatic aortic stenosis, and recommended mode of intervention (Continued)

Recommendations	Class	Level
Mode of intervention (Continued)		
Non-transfemoral TAVI should be considered in patients who are unsuitable for surgery and transfemoral access.	IIa	B
TAVI may be considered for the treatment of severe BAV stenosis in patients at increased surgical risk, if the anatomy is suitable.	IIb	B
Balloon aortic valvotomy may be considered as a bridge to SAVR or TAVI in haemodynamically unstable patients, and (if feasible) in those with severe AS who require urgent high-risk NCS.	IIb	C

Recommendations on Indications for concomitant aortic valve replacement at time of coronary artery bypass grafting or ascending aorta surgery

Recommendations	Class	Level
SAVR is recommended in symptomatic and asymptomatic patients with severe AS undergoing CABG or surgical intervention on the ascending aorta.	I	C
SAVR should be considered in symptomatic and asymptomatic patients with moderate AS undergoing CABG or surgical intervention on the ascending aorta.	IIa	C

Figure 10

Echocardiographic assessment of patients with mitral regurgitation

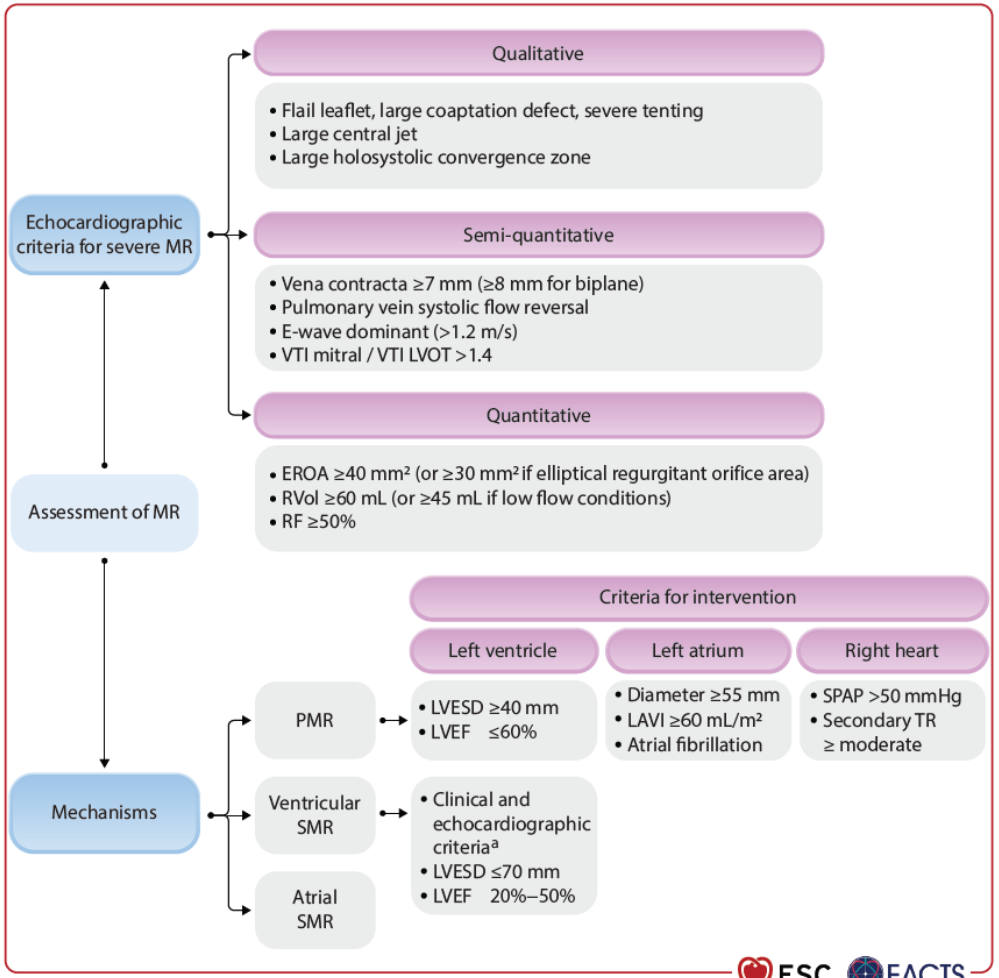

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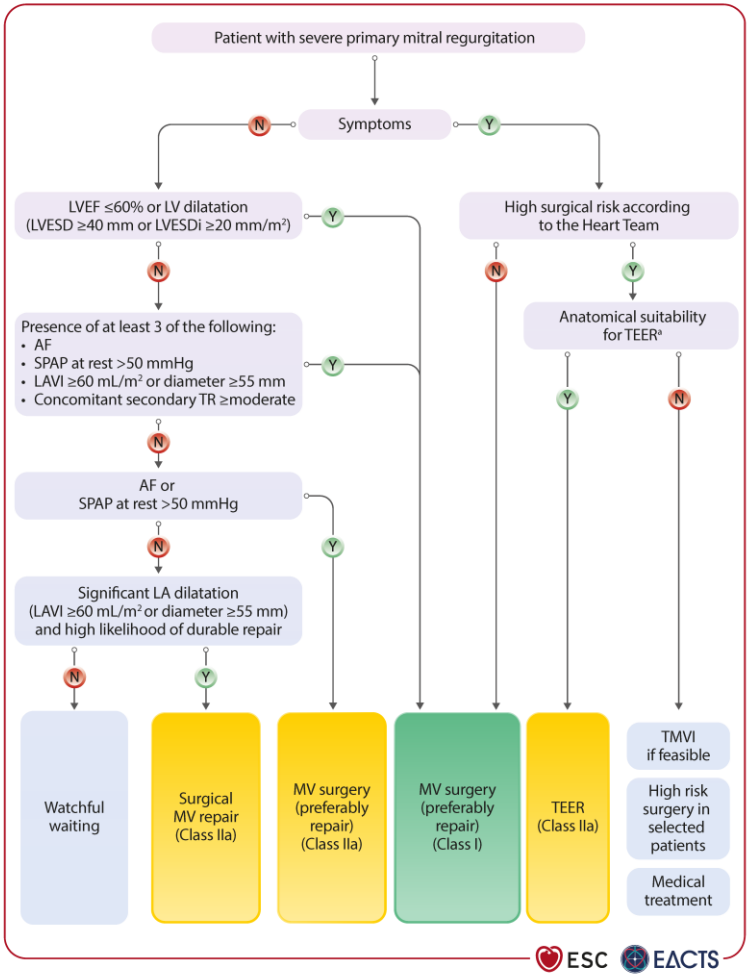
Figure 11

Management of patients with severe primary mitral regurgitation



ESC Guidelines for the management of valvular heart disease
(European Heart Journal; 2025 – doi: 10.1093/eurheartj/ehaf194)

Recommendations on indications for intervention in severe primary mitral regurgitation

Recommendations	Class	Level
MV repair is the recommended surgical technique to treat patients with severe PMR when the result is expected to be durable.	I	B
MV surgery is recommended in symptomatic patients with severe PMR considered operable by the Heart Team.	I	B
MV surgery is recommended in asymptomatic patients with severe PMR and LV dysfunction (LVESD ≥40 mm or LVESDi ≥20 mm/m^2 or LVEF ≤60%).	I	B
Surgical MV repair is recommended in low-risk asymptomatic patients with severe PMR without LV dysfunction (LVESD <40 mm, LVESDi <20 mm/m^2, and LVEF >60%) when a durable result is likely, if at least three of the following criteria are fulfilled: -AF -SPAP at rest >50 mmHg -LA dilatation (LAVI ≥60 mL/m^2 or LA diameter ≥55 mm) -Concomitant secondary TR ≥ moderate.	I	B

Recommendations on indications for intervention in severe primary mitral regurgitation (Continued)

Recommendations	Class	Level
MV surgery should be considered in asymptomatic patients with severe PMR without LV dysfunction (LVESD <40 mm, LVESDi <20 mm/m^2, and LVEF >60%) in the presence of PH (SPAP at rest >50 mmHg), or AF secondary to MR.	IIa	B
Surgical MV repair should be considered in low-risk asymptomatic patients with severe PMR without LV dysfunction (LVESD <40 mm, LVESDi <20 mm/m^2, and LVEF >60%) in the presence of significant LA dilatation (LAVI ≥60 mL/m^2 or LA diameter ≥55 mm), when performed in a Heart Valve Centre and a durable repair is likely.	IIa	B
TEER should be considered in symptomatic patients with severe PMR who are anatomically suitable and at high surgical risk according to the Heart Team.	IIa	B
Minimally invasive MV surgery may be considered at experienced centres to reduce the length of stay and accelerate recovery.	IIb	B

Figure 12

Most frequently used criteria for the diagnosis of atrial secondary mitral regurgitation

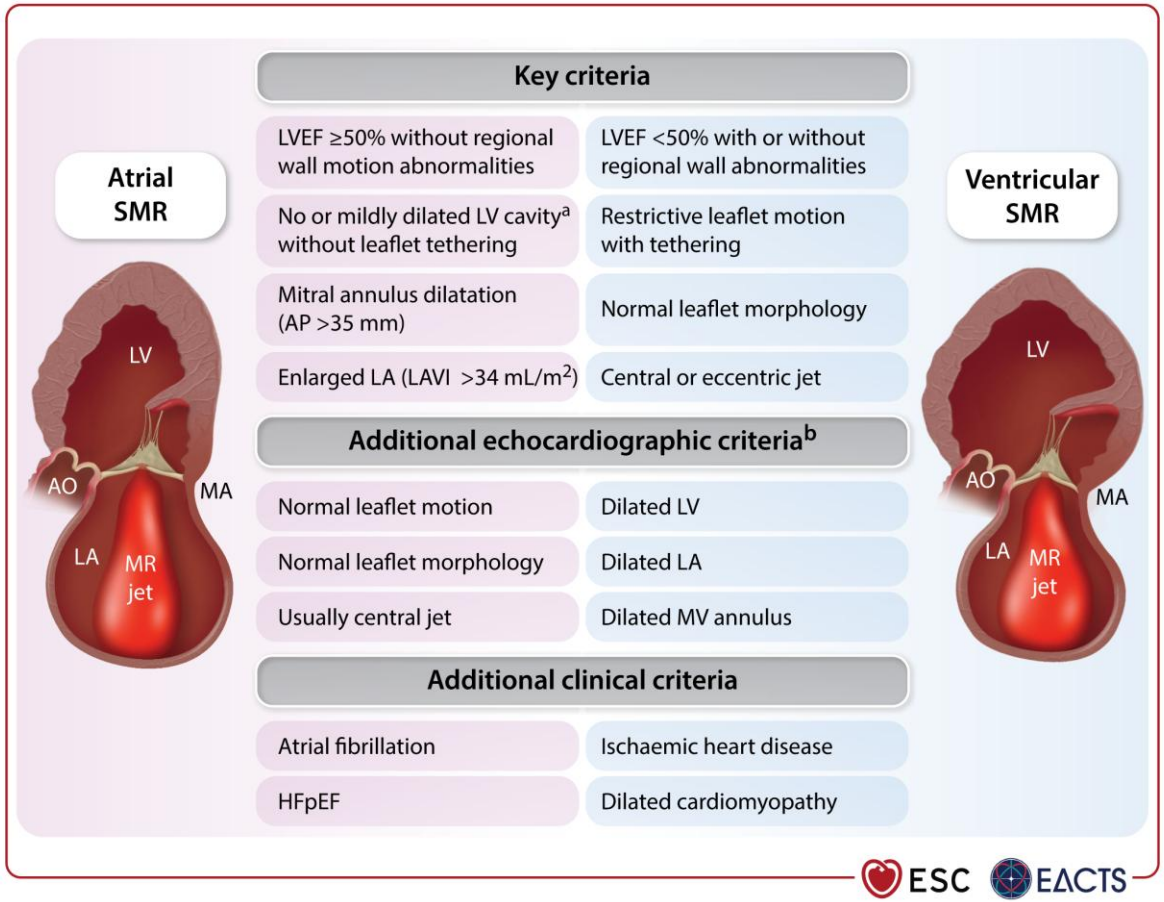


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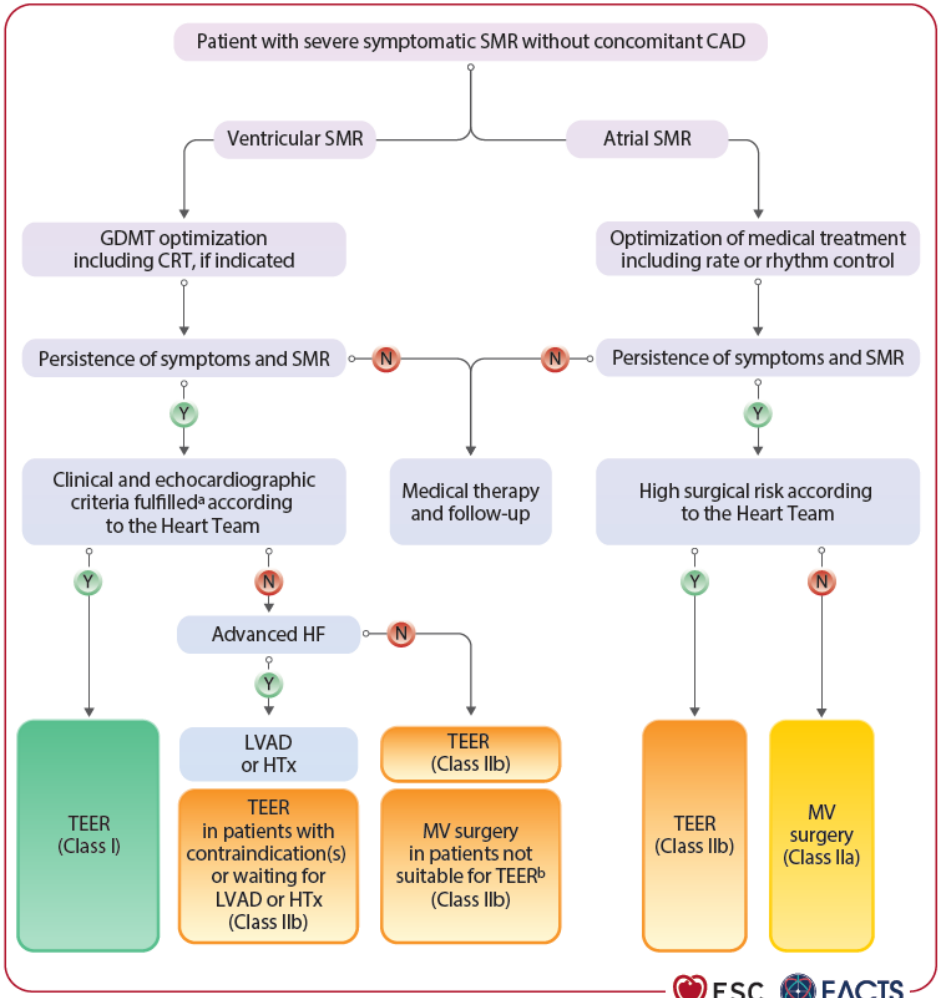
Figure 13

Treatment of severe secondary mitral regurgitation without concomitant coronary artery disease



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Clinical and echocardiographic criteria predicting outcome improvement in patients with severe ventricular secondary mitral regurgitation undergoing mitral transcatheter edge-to-edge repair

Anatomy deemed suitable for M-TEER
NYHA class ≥II
LVEF 20%–50%
LVESD ≤70 mm
At least one HF hospitalization within the previous year or increased natriuretic peptide levels (BNP ≥300 pg/mL or NT-proBNP ≥1000 pg/mL)
SPAP ≤70 mmHg
No severe RV dysfunction
No Stage D or advanced HF
No CAD requiring revascularization
No severe AV and/or TV disease
No hypertrophic, restrictive, or infiltrative cardiomyopathies

Recommendations on indications for intervention in secondary mitral regurgitation

Recommendations	Class	Level
Severe atrial secondary mitral regurgitation		
MV surgery, surgical AF ablation, if indicated, and LAAO should be considered in symptomatic patients with severe atrial SMR under optimal medical therapy.	IIa	B
TEER may be considered in symptomatic patients with severe atrial SMR not eligible for surgery after optimization of medical therapy including rhythm control, when appropriate.	IIb	B
Severe ventricular secondary mitral regurgitation and concomitant coronary artery disease		
MV surgery is recommended in patients with severe ventricular SMR undergoing CABG.	I	B
MV surgery may be considered in patients with moderate SMR undergoing CABG.	IIb	B
PCI followed by TEER after re-evaluation of MR may be considered in symptomatic patients with chronic severe ventricular SMR and non-complex CAD.	IIb	C

ESC Guidelines for the management of valvular heart disease
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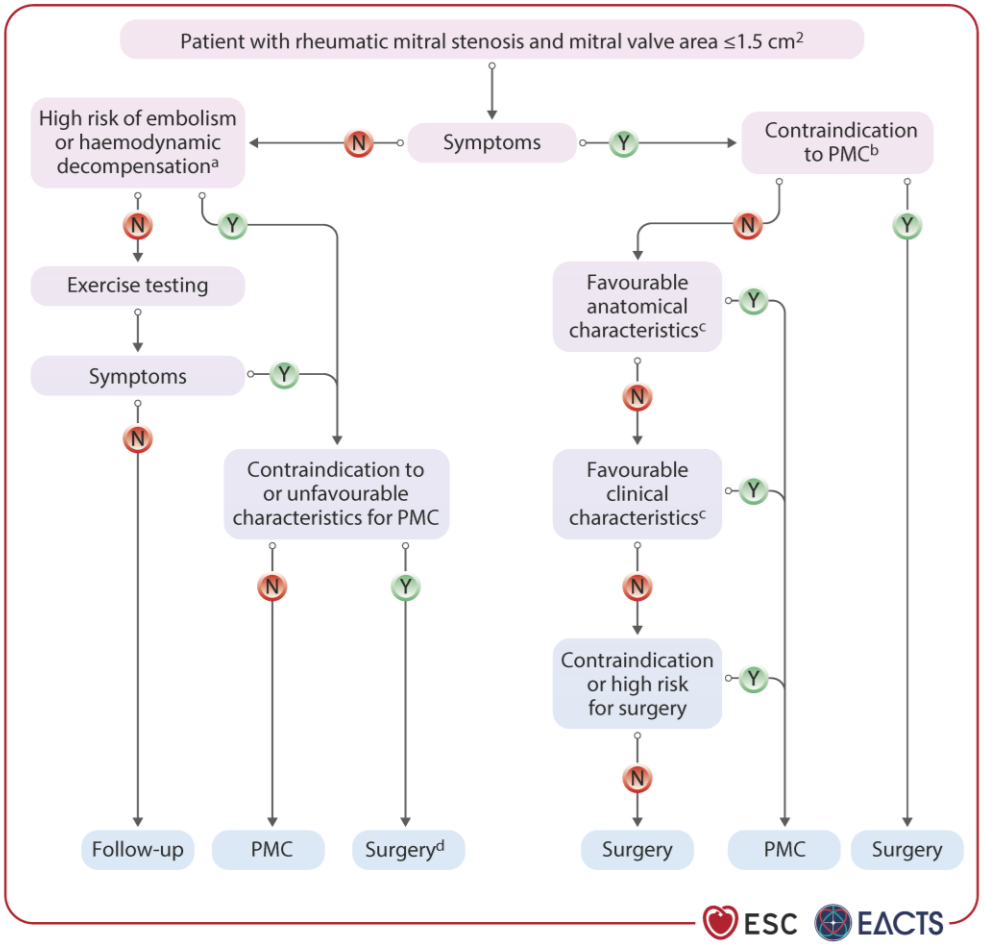
Recommendations on indications for intervention in secondary mitral regurgitation (Continued)

Recommendations	Class	Level
Severe ventricular secondary mitral regurgitation without concomitant coronary artery disease		
TEER is recommended to reduce HF hospitalizations and improve quality of life in haemodynamically stable, symptomatic patients with impaired LVEF (<50%) and persistent severe ventricular SMR, despite optimized GDMT and CRT (if indicated), fulfilling specific clinical and echocardiographic criteria.	I	A
TEER may be considered for symptom improvement in selected symptomatic patients with severe ventricular SMR not fulfilling the specific clinical and echocardiographic criteria, after careful evaluation of LVAD or HTx.	IIb	B
MV surgery may be considered in symptomatic patients with severe ventricular SMR without advanced HF who are not suitable for TEER.	IIb	C

Figure 14

Management of clinically severe rheumatic mitral stenosis (mitral valve area ≤1.5 cm2)



ESC Guidelines for the management of valvular heart disease
(European Heart Journal; 2025 – doi: 10.1093/eurheartj/ehaf194)

Recommendations on Indications for percutaneous mitral commissurotomy, mitral valve surgery, and transcatheter intervention in clinically severe rheumatic and degenerative mitral stenosis

Recommendations	Class	Level
PMC is recommended in symptomatic patients in the absence of unfavourable characteristics for PMC.	I	B
PMC is recommended in any symptomatic patients with a contraindication or at high risk for surgery.	I	C
MV surgery is recommended in symptomatic patients who are not suitable for PMC.	I	C
PMC should be considered as initial treatment in symptomatic patients with suboptimal anatomy but no unfavourable clinical characteristics for PMC.	IIa	C

Indications for percutaneous mitral commissurotomy, mitral valve surgery, and transcatheter intervention in clinically severe rheumatic and degenerative mitral stenosis (Continued)

Recommendations	Class	Level
PMC should be considered in asymptomatic patients without unfavourable clinical and anatomical characteristics for PMC and: •High thrombo-embolic risk (history of systemic embolism, dense spontaneous contrast in the LA, new-onset or paroxysmal AF), and/or •High risk of haemodynamic decompensation (SPAP >50 mmHg at rest, need for major NCS, pregnant or desire for pregnancy).	IIa	C
TMVI may be considered in symptomatic patients with extensive MAC and severe MV dysfunction at experienced Heart Valve Centres with expertise in complex MV surgery and transcatheter interventions.	IIb	C

Contraindications for percutaneous mitral commissurotomy in rheumatic mitral stenosis

Contraindications
MVA >1.5 cm^2
LA thrombus
More than mild MR
Severe or bi-commissural calcification
Absence of commissural fusion
Severe concomitant AV disease, or severe combined tricuspid stenosis and regurgitation requiring surgery
Concomitant CAD requiring bypass surgery

Figure 15

Echocardiographic and invasive assessment of tricuspid regurgitation

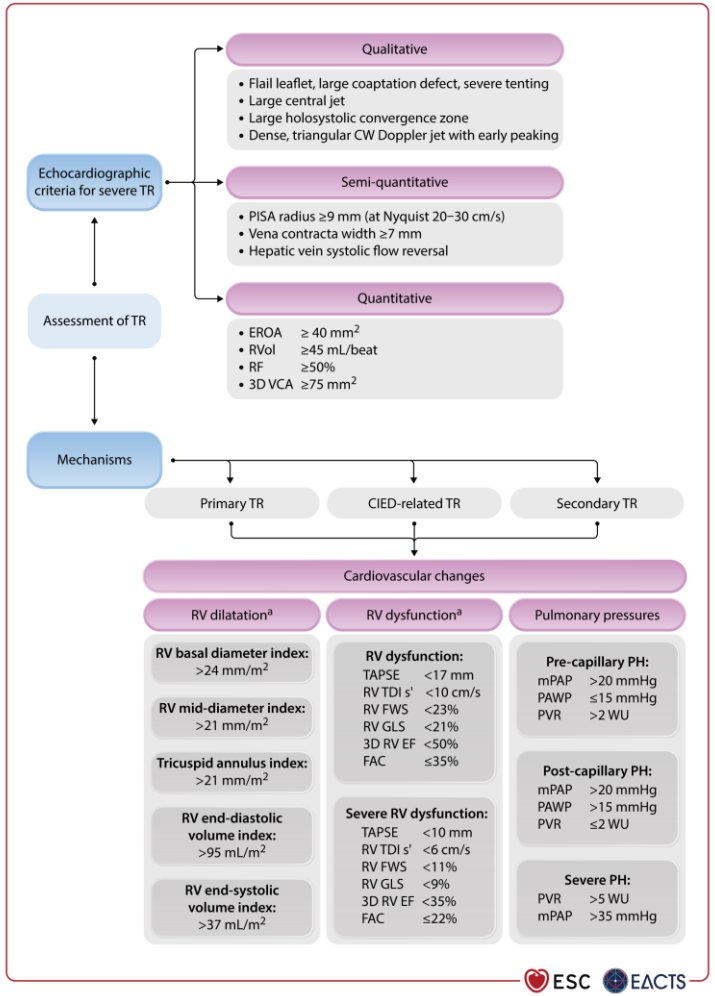


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Figure 16

Stepwise evaluation of patients with tricuspid regurgitation

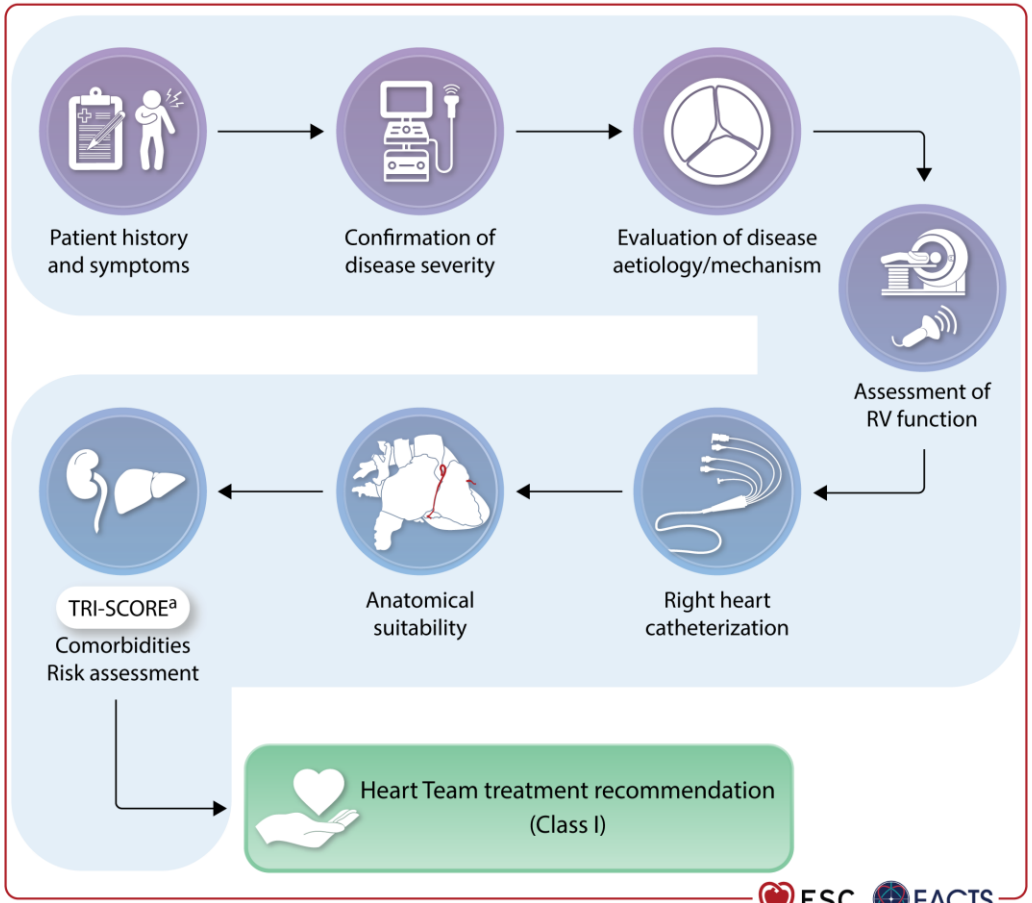
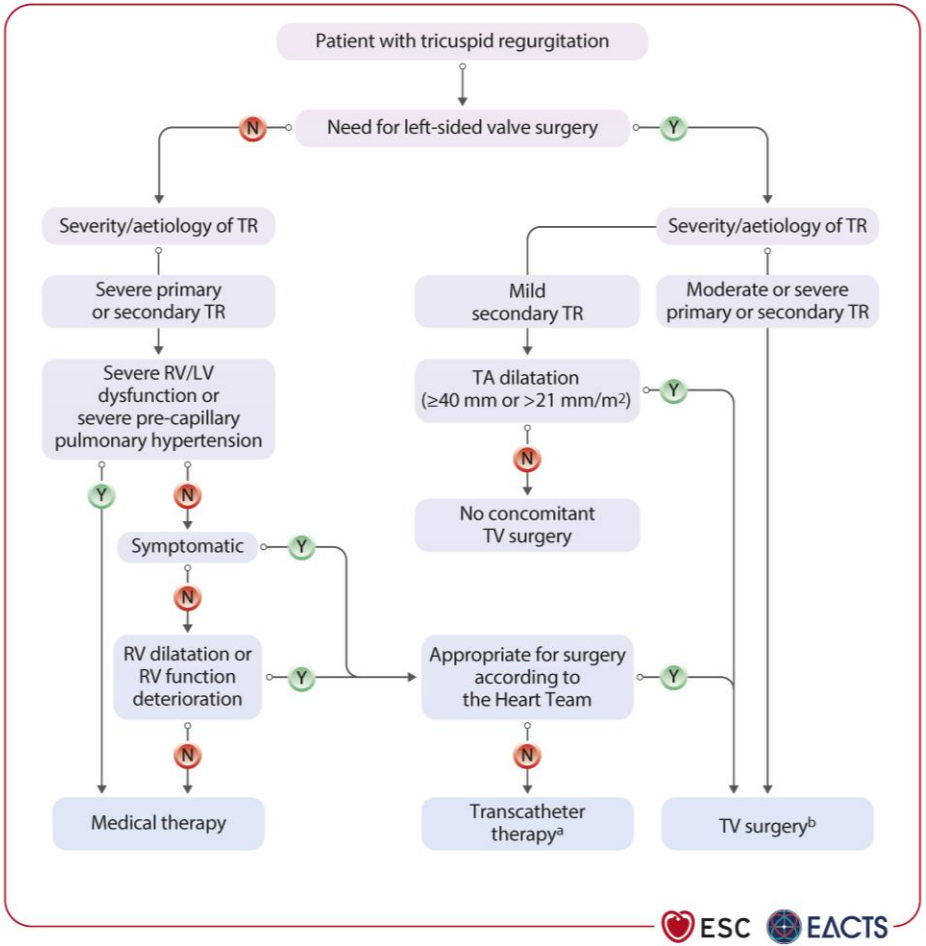


Figure 17

Management of patients with tricuspid regurgitation



ESC Guidelines for the management of valvular heart disease
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Recommendations on indications for intervention in tricuspid regurgitation

Recommendations	Class	Level
Careful evaluation of TR aetiology, stage of the disease (i.e. degree of TR severity, RV and LV dysfunction, and PH), patient operative risk, and likelihood of recovery by a multidisciplinary Heart Team is recommended in patients with severe TR prior to intervention.	I	C
Patients with tricuspid regurgitation and left-sided valvular heart disease requiring surgery		
Concomitant TV surgery is recommended in patients with severe primary or secondary TR.	I	B
Concomitant TV repair should be considered in patients with moderate primary or secondary TR, to avoid progression of TR and RV remodelling.	IIa	B
Concomitant TV repair may be considered in selected patients with mild secondary TR and tricuspid annulus dilatation (≥40 mm or >21 mm/m^2), to avoid progression of TR and RV remodelling.	IIb	B

ESC Guidelines for the management of valvular heart disease
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Recommendations on indications for intervention in tricuspid regurgitation (Continued)

Recommendations	Class	Level
Patients with severe tricuspid regurgitation without left-sided valvular heart disease requiring surgery		
TV surgery is recommended in symptomatic patients with severe primary TR without severe RV dysfunction or severe PH.	I	C
TV surgery should be considered in asymptomatic patients with severe primary TR who have RV dilatation/RV function deterioration, but without severe LV/RV dysfunction or severe PH.	IIa	C
TV surgery should be considered in patients with severe secondary TR who are symptomatic or have RV dilatation/RV function deterioration, but without severe LV/RV dysfunction or PH.	IIa	B
Transcatheter TV treatment should be considered to improve quality of life and RV remodelling in high-risk patients with symptomatic severe TR despite optimal medical therapy in the absence of severe RV dysfunction or pre-capillary PH.	IIa	A

Recommendations on tricuspid stenosis

Recommendations	Class	Level
Surgery is recommended in symptomatic patients with severe TS.	I	C
Surgery is recommended in patients with severe TS undergoing left-sided valve intervention.	I	C

Echocardiographic pitfalls, robust measures, and complementary multimodality imaging parameters in multiple or mixed valvular heart disease

Concomitant valve lesion	Valve lesion to be assessed: AS	AR	MS	MR
AS		PHT unreliable LV volume increase less pronounced *(hypertrophy, disproportionate diastolic LV pressure overload)*	PHT unreliable *(LV compliance ↓)* Low gradient due to low flow possible *(low-flow state)*	Regurgitant volume ↑ MR colour-flow jet area ↑ *(increased afterload and transmitral systolic pressure gradient)*
AR	Simplified Bernoulli equation overestimates gradient if LVOT velocity ↑		PHT unreliable *(gradient ↓, altered LV compliance)* MVA by continuity equation using aortic forward flow unreliable	Doppler volumetric method using net aortic forward flow invalid Mitral-to-aortic VTI ratio unreliable *(increased transaortic flow)*
MS	Low-flow low-gradient possible *(low-flow state)*	LV volume increase less pronounced *(reduced preload)*		Mitral-to-aortic VTI ratio unreliable *(increased mitral VTI due to stenosis)* Calcifications may shadow jet area
MR	Low-flow low-gradient *(MR-induced low-flow state)* AS confused with MR jet	PHT unreliable *(increased LV compliance)* Doppler volumetric method using net mitral forward flow invalid *(increased flow)*	PHT unreliable *(altered LA and LV compliance)* Continuity equation unreliable *(increased transmitral flow)*	
TR	Low-flow low-gradient possible *(TR induced low-flow state)*	—	Low gradient possible *(low-flow state)* PHT may be less reliable *(impaired LV filling due to ventricular interdependence)*	Regurgitant volume↓ in SMR possible *(decreased preload)*

ESC Guidelines for the management of valvular heart disease
(European Heart Journal; 2025 – doi: 10.1093/eurheartj/ehaf194)

Echocardiographic pitfalls, robust measures, and complementary multimodality imaging parameters in multiple or mixed valvular heart disease

	Valve lesion to be assessed			
	AS	**AR**	**MS**	**MR**
Robust echo measurements	AVA (continuity equation), DVI *Reflection of combined burden in mixed AR and AS: V_{max} and mean gradient reflect combined burden*	EROA (PISA), vena contracta	Planimetry and 3D MVA (TOE) *Reflection of combined burden in mixed MR & MS: mean gradient reflect combined burden*	EROA (PISA), vena contracta
Alternative imaging modalities	CT: AV calcium scoring	CMR: regurgitant volume and fraction	—	CMR: regurgitant volume and fraction

Recommendations on indications for surgery of concomitant left-sided valvular heart disease

Recommendations	Class	Level
Concomitant aortic stenosis		
SAVR is recommended in patients with severe AS undergoing surgery for another valve.	I	C
SAVR should be considered in patients with moderate AS undergoing surgery for another valve.	IIa	C
Concomitant aortic regurgitation		
AV surgery is recommended in patients with severe AR undergoing surgery for another valve.	I	C
Concomitant mitral regurgitation		
MV surgery is recommended in patients with severe MR undergoing surgery for another valve.	I	C

Recommendations on indications for intervention in patients with mixed moderate aortic stenosis and moderate aortic regurgitation

Recommendations	Class	Level
Intervention is recommended in symptomatic patients with mixed moderate AV stenosis and moderate regurgitation, and a mean gradient ≥40 mmHg or V_{max} ≥4.0 m/s.	I	B
Intervention is recommended in asymptomatic patients with mixed moderate AV stenosis and moderate regurgitation with V_{max} ≥4.0 m/s, and LVEF <50% not attributable to other cardiac disease.	I	C

Recommendations for prosthetic valve selection

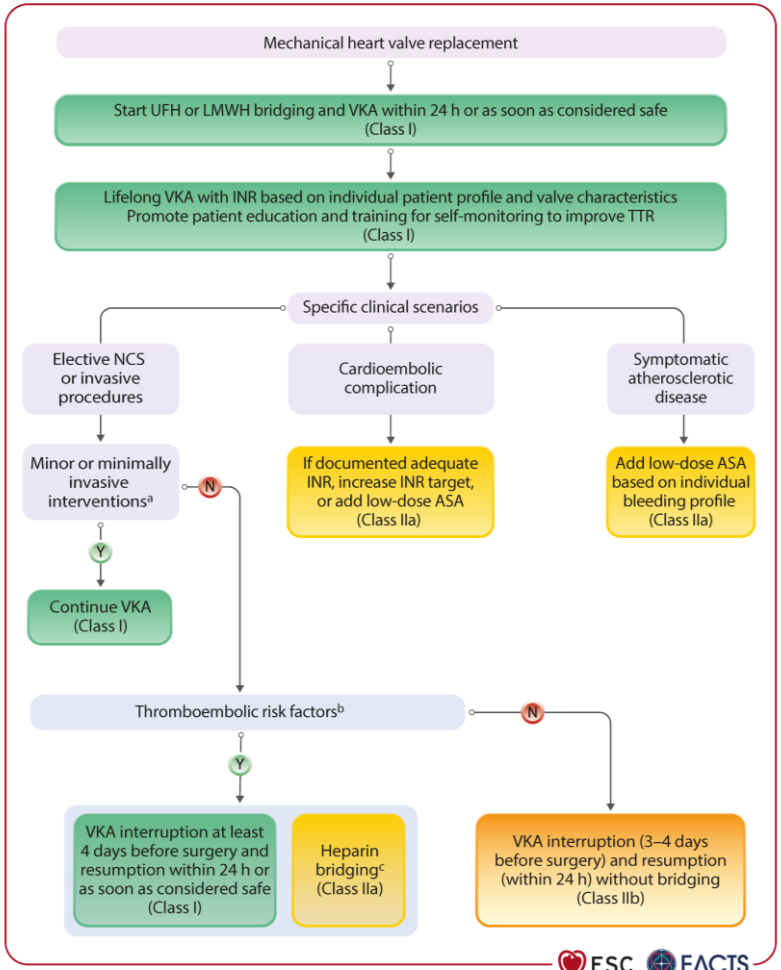
Recommendations	Class	Level
Mechanical heart valve		
An MHV is recommended according to the desire of the informed patient and if there is no contraindication to long-term anticoagulation.	I	C
An MHV should be considered in patients with an estimated long-life expectancy, if there are no contraindications for long-term OAC.	IIa	B
An MHV should be considered in patients aged <60 years for prostheses in the aortic position and aged <65 years for prostheses in the mitral position.	IIa	C
An MHV should be considered in patients with a pre-existing MHV in another position.	IIa	C
An MHV may be considered in patients with a clear indication for long-term OAC.	IIb	C

Recommendations for prosthetic valve selection (Continued)

Recommendations	Class	Level
Biological heart valve		
A BHV is recommended according to the desire of the informed patient.	I	C
A BHV is recommended when an adequate quality of anticoagulation with VKA is unlikely, in patients at high bleeding risk, or with estimated short life expectancy.	I	C
A BHV should be considered in patients aged >65 years for prostheses in the aortic position or aged >70 years for prostheses in the mitral position.	IIa	C
A BHV should be considered in women contemplating pregnancy.	IIa	C

Figure 18

Antithrombotic therapy following mechanical heart valve implantation



ESC Guidelines for the management of valvular heart disease
(European Heart Journal; 2025 – doi: 10.1093/eurheartj/ehaf194)

Recommendations for the management of antithrombotic therapy in patients with a mechanical heart valve replacement

Recommendations	Class	Level
Following cardiac surgery with MHV implantation, it is recommended to start UFH or LMWH bridging and VKA within 24 h, or as soon as considered safe.	I	B
Lifelong OAC with a VKA is recommended for all patients with MHVs to prevent thrombo-embolic complications.	I	A
INR self-monitoring and self-management are recommended over standard monitoring in selected, trained patients to improve efficacy.	I	A
It is recommended that INR targets are based on the type and position of the MHV, patient risk factors, and comorbidities.	I	A
Patient education is recommended to improve the quality of OAC.	I	A

Recommendations for the management of antithrombotic therapy in patients with a mechanical heart valve replacement (Continued)

Recommendations	Class	Level
The addition of low-dose ASA (75–100 mg/day) to VKA should be considered in selected patients with MHVs in case of concomitant symptomatic atherosclerotic disease considering the individual bleeding risk profile.	IIa	B
Either an increase in INR target or the addition of low-dose ASA (75–100 mg/day) should be considered in patients with MHVs who develop a major thrombo-embolic complication despite documented adequate INR.	IIa	C
DOACs and/or DAPT are not recommended to prevent thrombosis in patients with an MHV.	III	A

International normalized ratio targets and therapeutic ranges for patients with a mechanical heart valve

MHV type and position	Additional pro-thrombotic factors[a]	INR target and (range)
First-line treatment with VKA only		
Ball-in cage, tilting disc valve in any position, all MHV in mitral/tricuspid position	No	3 (2.5–3.5)
	Yes	3.5 (3–4)
Bileaflet, current generation single-tilting aortic MHV	No	2.5 (2–3)
	Yes	3 (2.5–3.5)

Recommendations for the management of antithrombotic therapy in patients with a mechanical heart valve undergoing elective non-cardiac surgery or invasive procedures

Recommendations	Class	Level
Recommendations for the management of antithrombotic therapy in patients with mechanical heart valves undergoing elective non-cardiac surgery or invasive procedures		
Continuing VKA treatment is recommended in patients with an MHV for minor or minimally invasive interventions associated with no or minimal bleeding.	I	A
It is recommended to discontinue VKA at least 4 days before major non-cardiac elective surgery, aiming for an INR <1.5, and to resume VKA treatment within 24 h after surgery, or as soon as considered safe.	I	B
VKA interruption and resumption with bridging should be considered in patients with an MHV and thrombo-embolic risk factors undergoing major NCS.	IIa	B
Interruption (3–4 days before surgery) and resumption of VKA without bridging may be considered to reduce bleeding in patients with new-generation aortic MHVs and no other thrombo-embolic risk factors undergoing major NCS or invasive procedures.	IIb	B

Peri-operative management of antithrombotic treatment in patients with a mechanical heart valve undergoing non-cardiac surgery based on type of procedure and underlying risk (1)

Low thrombo-embolic risk		Minimally invasive procedures		Major NCS or invasive procedures	
		Pre-procedure	Post-procedure	Pre-procedure	Post-procedure
New-generation aortic MHV and no additional risk factors	OAC	No interruption of VKA	Continue VKA	Interrupt VKA at least 3–4 days prior to procedure with target INR <1.5 on the day of surgery	Resume VKA as soon as feasible, within 24 h
	Bridging			No bridging may be considered	No bridging may be considered, unless unable to administer OAC
	Supporting measures		Topical antifibrinolytic or haemostatic agents may be considered to improve local haemostasis		Mechanical and pharmacological VTE prophylaxis, if indicated

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Peri-operative management of antithrombotic treatment in patients with a mechanical heart valve undergoing non-cardiac surgery based on type of procedure and underlying risk (2)

Moderate-to-high thrombo-embolic risk		Minimally invasive procedures		Major NCS or invasive procedures	
		Pre-procedure	Post-procedure	Pre-procedure	Post-procedure
MHV in mitral or tricuspid position or other thrombo-embolic risk factors	OAC	No interruption of VKA	Continue VKA	Interrupt VKA at least 5 days prior to procedure with target INR <1.5 the day of the procedure	Resume VKA within 24 h
	Bridging			Bridging with LMWH or UFH if CKD stage IV or V, starting at INR below the therapeutic range	Bridging with UFH or LMWH post-operatively within 24 h
	Supporting measures		Topical antifibrinolytic or haemostatic agents may be considered to improve local haemostasis		Appropriate mechanical and pharmacological VTE prophylaxis

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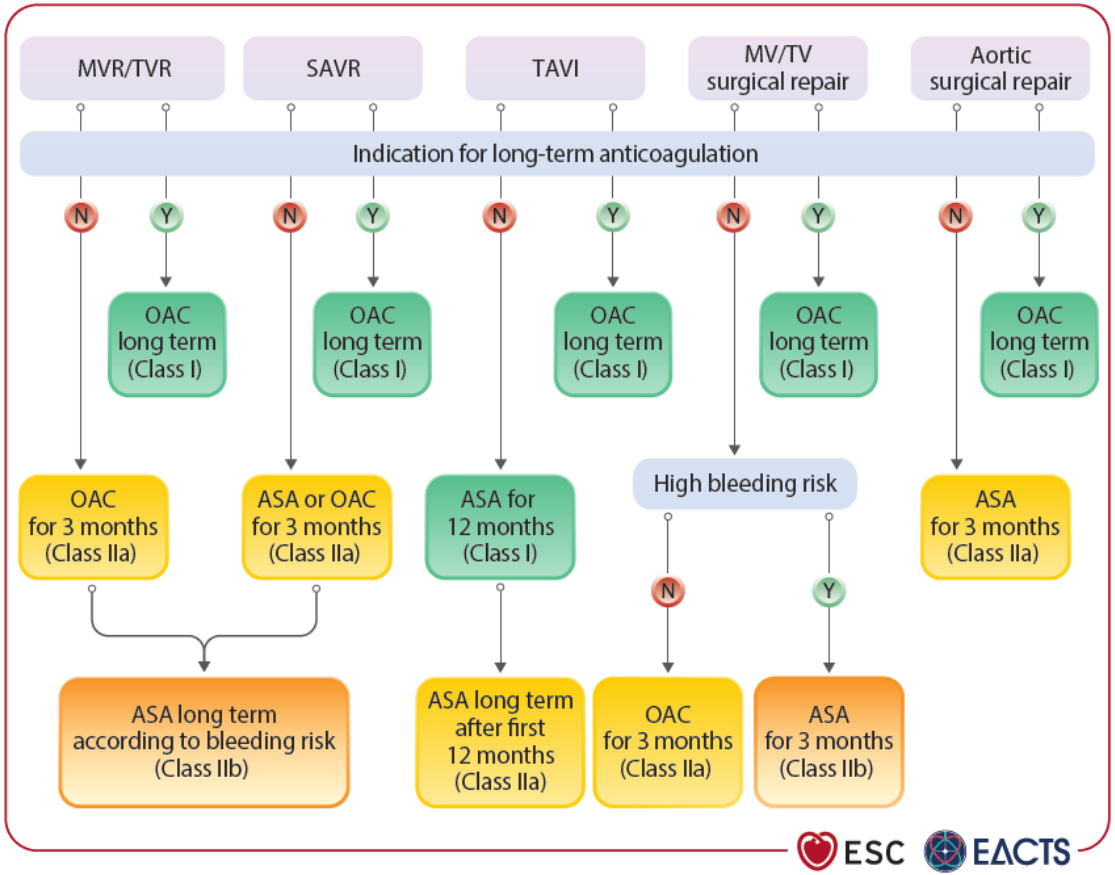
Figure 19

Antithrombotic therapy following biological heart valve implantation or surgical valve repair



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Recommendations for the management of antithrombotic therapy in patients with a biological heart valve or valve repair

Recommendations	Class	Level
Surgical biological heart valve without indication for oral anticoagulation		
Low-dose ASA (75–100 mg/day) or OAC using a VKA should be considered for the first 3 months after surgical implantation of an aortic BHV in patients without clear indication for OAC.	IIa	B
A VKA should be considered for the first 3 months after surgical implantation of a mitral or tricuspid BHV in patients without clear indication for OAC.	IIa	B
Lifelong low-dose ASA (75–100 mg/day) may be considered 3 months after surgical implantation of an aortic or mitral BHV in patients without clear indication for OAC.	IIb	C

Recommendations for the management of antithrombotic therapy in patients with a biological heart valve or valve repair (Continued)

Recommendations	Class	Level
Transcatheter aortic valve implantation without indication for oral anticoagulation		
Low-dose ASA (75–100 mg/day) is recommended for 12 months after TAVI in patients without indication for OAC.	I	A
Long-term (after the first 12 months) low-dose ASA (75–100 mg/day) should be considered after TAVI in patients with no clear indication for OAC.	IIa	C
DAPT is not recommended to prevent thrombosis after TAVI, unless there is a clear indication.	III	B
Routine use of OAC is not recommended after TAVI in patients without baseline indication.	III	A

Recommendations for the management of antithrombotic therapy in patients with a biological heart valve or valve repair (Continued)

Recommendations	Class	Level
Surgical repair without indication for oral anticoagulation		
OAC, with either VKAs or DOACs, should be considered during the first 3 months after surgical MV or TV repair.	IIa	B
Low-dose ASA (75–100 mg/day) should be considered for the first 3 months after surgical AV repair in patients without indication for OAC.	IIa	C
Low-dose ASA (75–100 mg/day) may be considered after surgical MV or TV repair in preference to OAC in patients without clear indication for OAC and at high bleeding risk.	IIb	B
OAC continuation is recommended in patients with a clear indication for OAC undergoing surgical BHV implantation.	I	B

Recommendations for the management of antithrombotic therapy in patients with a biological heart valve or valve repair (Continued)

Recommendations	Class	Level
Surgical repair without indication for oral anticoagulation (Continued)		
DOACs should be considered over VKAs after 3 months following surgical implantation of a BHV in patients with AF.	IIa	B
DOAC continuation may be considered after surgical BHV implantation in patients with an indication for DOAC.	IIb	B
Transcatheter biological heart valve with indication for oral anticoagulation		
OAC is recommended for TAVI patients who have other indications for OAC.	I	B
Surgical repair with indication for oral anticoagulation and/or antiplatelet therapy		
Continuation of OAC or antiplatelet therapy should be considered after surgical valve repair in patients with a clear indication for an antithrombotic therapy.	IIa	B

Criteria for the diagnosis of moderate or severe aortic and mitral haemodynamic valve deterioration

	Moderate	Severe
Aortic BHV SVD or non-structural valve dysfunction (except PVL or PPM), thrombosis, or endocarditis	Increase in mean transvalvular gradient ≥10 mmHg resulting in mean gradient ≥20 mmHg	Increase in mean transvalvular gradient ≥20 mmHg resulting in mean gradient ≥30 mmHg
	AND	**AND**
	Decrease in EOA ≥0.3 cm^2 or ≥25%, and/or decrease in DVI ≥0.1 or ≥20%, compared with echocardiographic assessment performed 1–3 months post-procedure	Decrease in EOA ≥0.6 cm^2 or ≥50%, and/or decrease in DVI ≥0.2 or ≥40%, compared with echocardiographic assessment performed 1–3 months post-procedure
	OR	***OR***
	New occurrence or increase of ≥1 grade of intraprosthetic AR resulting in ≥ moderate AR	New occurrence or increase of ≥2 grades of intraprosthetic AR resulting in ≥ moderate-to-severe AR

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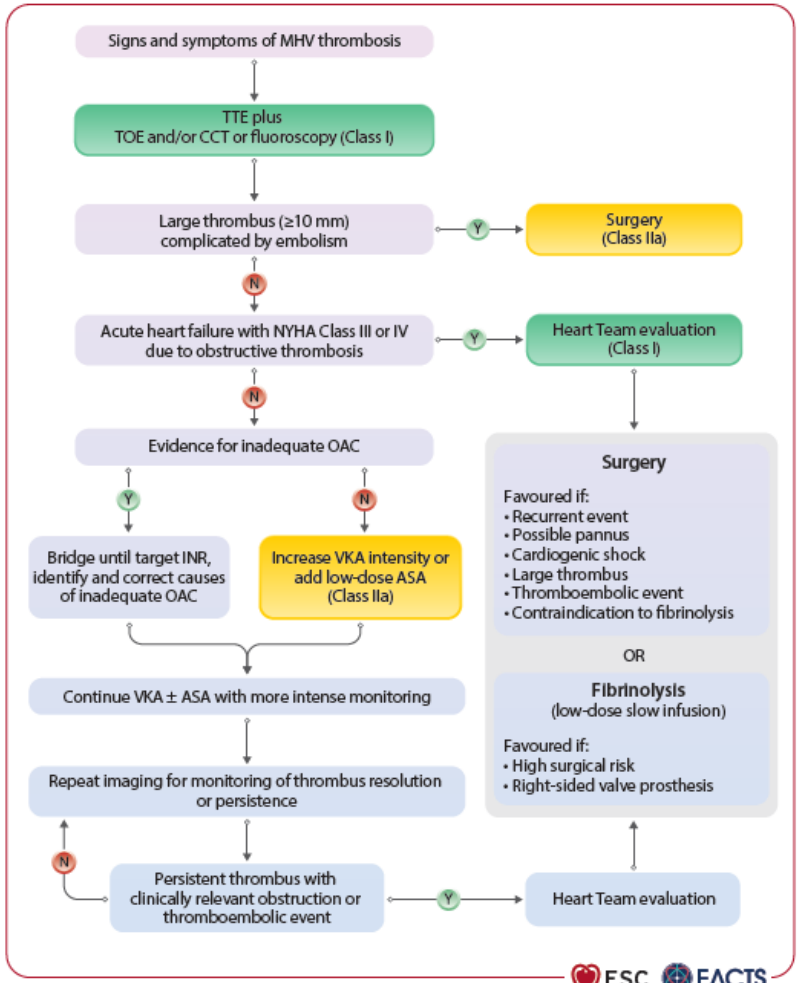
Criteria for the diagnosis of moderate or severe aortic and mitral haemodynamic valve deterioration

	Moderate	Severe
Mitral BHV SVD or non-structural valve dysfunction (except PVL or PPM), thrombosis, or endocarditis	Increase in DVI ≥0.4 or ≥20%, resulting in DVI ≥2.2, or decrease in EOA ≥0.5 cm^2 or ≥25%, resulting in EOA <1.5 cm^2, usually associated with increase of transmitral gradient ≥5 mmHg	Increase in DVI ≥0.8 or ≥40%, resulting in DVI ≥2.7, or decrease in EOA ≥1.0 cm^2 or ≥50%, resulting in EOA <1 cm^2, usually associated with increase of transmitral gradient ≥10 mmHg
	OR	***OR***
	New occurrence or increase of ≥1 grade of intraprosthetic MR resulting in ≥moderate MR	New occurrence or increase of ≥2 grades of intraprosthetic MR resulting in ≥moderate-to-severe MR

Figure 20

Management of left-sided obstructive and non-obstructive mechanical heart valve thrombosis



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Recommendations for the management of prosthetic valve dysfunction

Recommendations	Class	Level
Haemolysis and paravalvular leak		
It is recommended that the decision between transcatheter or surgical closure of clinically significant PVLs is based on Heart Team evaluation, including patient risk, leak morphology, and local expertise.	I	C
Reoperation is recommended if a PVL is related to endocarditis, or causes haemolysis requiring repeated blood transfusion or leading to HF symptoms.	I	C
Transcatheter closure should be considered for suitable PVLs with clinically significant regurgitation and/or haemolysis.	IIa	B
Mechanical heart valve failure		
Reoperation is recommended in symptomatic patients with significant valve dysfunction not attributable to valve thrombosis.	I	C

Recommendations for the management of prosthetic valve dysfunction (Continued)

Recommendations	Class	Level
Biological heart valve failure		
Reintervention is recommended in symptomatic patients with significant valve dysfunction not attributable to valve thrombosis.	I	C
Transcatheter, transfemoral valve-in-valve implantation in the aortic position should be considered in patients with significant valve dysfunction who are at intermediate or high surgical risk, and have suitable anatomical and prosthesis features, as assessed by the Heart Team.	IIa	B
Transcatheter transvenous mitral or tricuspid valve-in-valve implantation should be considered in patients with significant valve dysfunction at intermediate or high surgical risk, if the anatomy is suitable.	IIa	B
Reoperation should be considered in asymptomatic patients with significant prosthetic dysfunction, if surgical risk is low.	IIa	C

Recommendations for the management of prosthetic valve dysfunction (Continued)

Recommendations	Class	Level
Valve thrombosis		
TOE and/or 4D-CT are recommended in patients with suspected valve thrombosis to confirm the diagnosis.	I	C
Mechanical heart valve thrombosis		
Heart Team evaluation is recommended in patients with acute HF (NYHA class III or IV) due to obstructive MHV thrombosis to determine appropriate management (repeat valve replacement or low-dose slow infusion fibrinolysis).	I	B
Surgery should be considered for large (>10 mm) prosthetic thrombus complicated by embolism.	IIa	C

Recommendations on the management of prosthetic valve dysfunction (Continued)

Recommendations	Class	Level
Biological heart valve thrombosis		
OAC using VKA is recommended in BHV thrombosis before considering reintervention.	I	B
OAC should be considered in patients with leaflets thickening and reduced leaflet motion leading to elevated gradients at least until resolution.	IIa	B

Figure 21

Management of non-cardiac surgery in patients with severe aortic stenosis

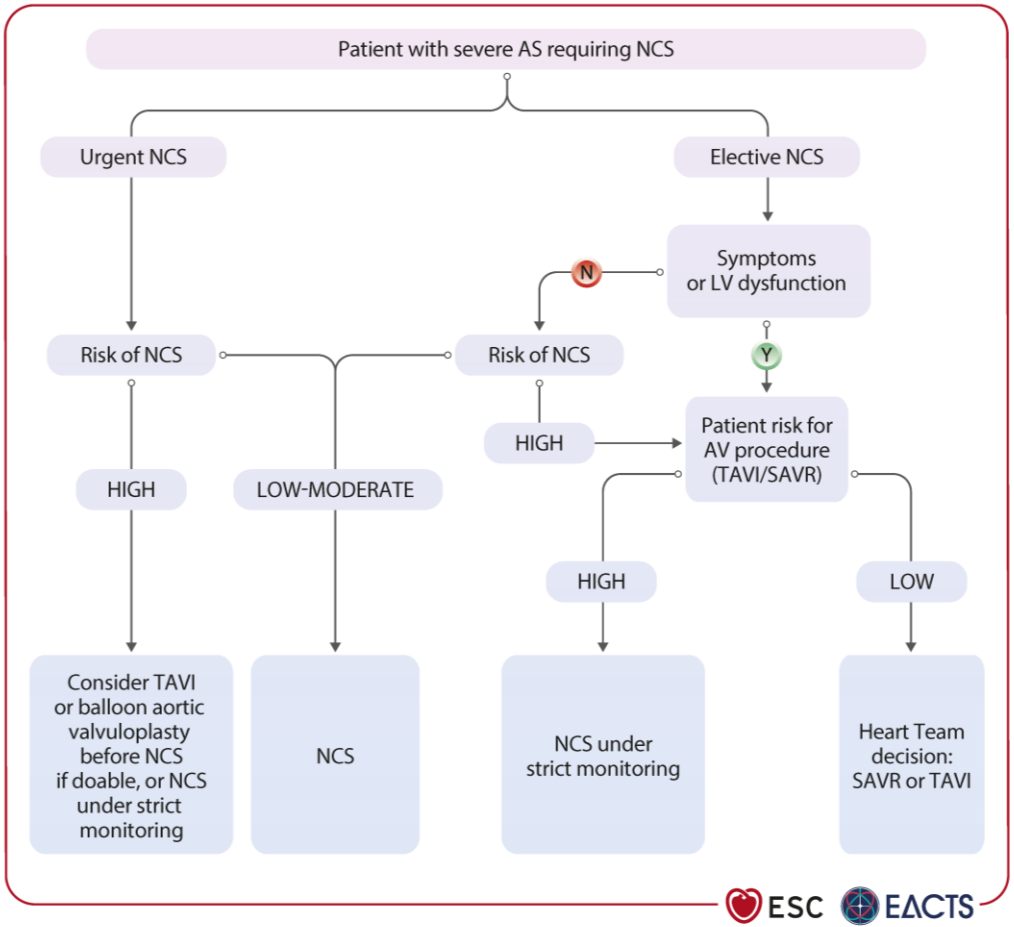

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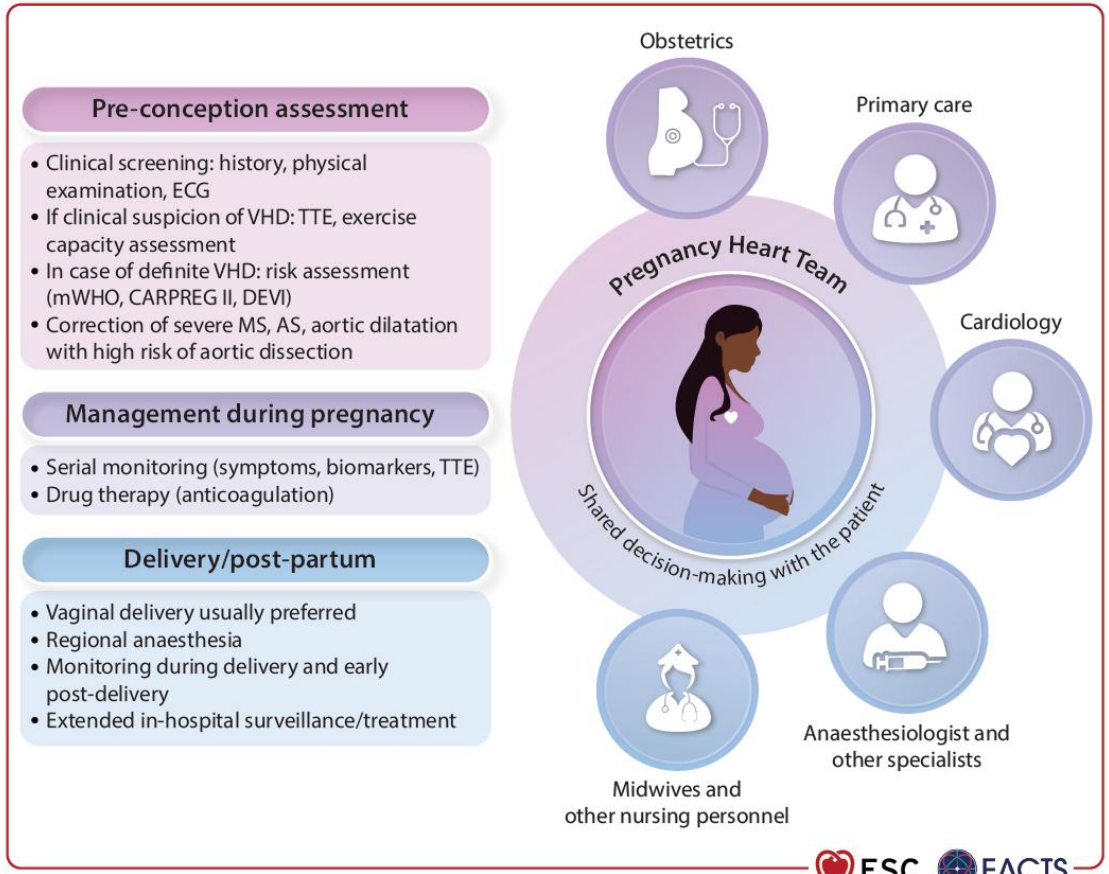
Figure 22

The Pregnancy Heart Team model of care



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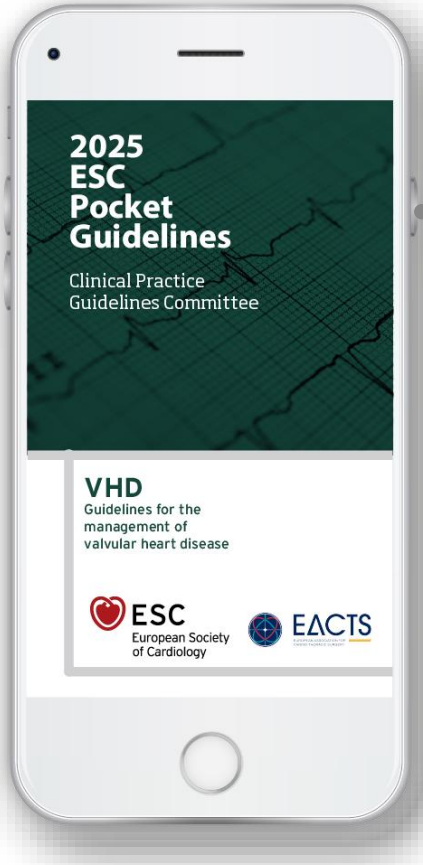

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