2017 ESC/EACTS Guidelines for the management of valvular heart disease

EACTS
European Association For Cardio-Thoracic Surgery

ESC
European Society of Cardiology

2017 ESC/EACTS Guidelines for the management of valvular heart disease

The Task Force for the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) & the European Association for Cardio-Thoracic Surgery (EACTS)

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Classes of recommendations

Classes of recommendations	Definition	Suggested wording to use
Class I	Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective.	Is recommended/ 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.

Level 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.

What is new in the 2017 Valvular Heart Disease Guidelines?

Changes in recommendations	
2012	**2017**
Indications for intervention in symptomatic aortic stenosis	
IIb C Intervention may be considered in symptomatic patients with low-flow, low-gradient aortic stenosis and reduced ejection fraction without flow (contractile) reserve.	**IIa C** Intervention should be considered in symptomatic patients with low-flow, low-gradient aortic stenosis and reduced ejection fraction without flow (contractile) reserve, particularly when CT calcium scoring confirms severe aortic stenosis.

What is new in the 2017 Valvular Heart Disease Guidelines?

Changes in recommendations	
2012	**2017**
Choice of intervention in symptomatic aortic stenosis	
Recommendations for the use of TAVI *(Tables on "Contra-indications for TAVI" and Table on "Recommendations for the use of TAVI").*	**Replaced by recommendations for the choice of intervention.** *See Section b in Table "Indications for intervention in aortic stenosis and recommendations for the choice of intervention" (Section 5.2), and Table "Aspects to be considered by the heart team for the decision between SAVR and TAVI in patients at increased surgical risk".*

What is new in the 2017 Valvular Heart Disease Guidelines?

Changes in recommendations	
2012	**2017**
Indications for surgery in asymptomatic aortic stenosis	
IIb C Markedly elevated BNP levels.	**IIa C** Markedly elevated BNP levels (>threefold age- and sex-corrected normal range) confirmed by repeated measurements without other explanations.
IIb C Increase of mean pressure gradient with exercise by >20 mmHg.	**Taken out**
IIb C Excessive LV hypertrophy in the absence of hypertension.	**Taken out**

What is new in the 2017 Valvular Heart Disease Guidelines?

Changes in recommendations	
2012	**2017**
Indications for intervention in asymptomatic severe primary mitral regurgitation	
IIb C Surgery may be considered in asymptomatic patients with preserved LV function, high likelihood of durable repair, low surgical risk, and: • Left atrial dilatation (volume index ≥60 mL/m² BSA) and sinus rhythm.	**IIa C (modified!)** Surgery should be considered in asymptomatic patients with preserved LVEF (>60%) and LVESD 40–44 mm when a durable repair is likely, surgical risk is low, the repair is performed in heart valve centres, and the following finding is present: presence of significant LA dilatation (volume index ≥60 mL/m² BSA) in sinus rhythm.
Pulmonary hypertension on exercise (SPAP ≥60 mmHg at exercise).	**Taken out**

2017 ESC/EACTS Guidelines for the Management of Valvular Heart Disease
(European Heart Journal 2017 - doi:10.1093/eurheartj/ehx391)

What is new in the 2017 Valvular Heart Disease Guidelines?

Changes in recommendations	
2012	**2017**
Indications for mitral valve intervention in secondary mitral regurgitation	
IIa C Surgery should be considered in patients with moderate secondary mitral regurgitation undergoing CABG	**Taken out**
IIb C When revascularization is not indicated, surgery may be considered in patients with severe secondary mitral regurgitation and LVEF >30%,who remain symptomatic despite optimal medical management (including CRT if indicated).	**IIb C (modified)** When revascularization is not indicated, surgery may be considered in patients with severe secondary mitral regurgitation and LVEF >30%, who remain symptomatic despite optimal medical management (including CRT if indicated) and have a low surgical risk.

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(European Heart Journal 2017 - doi:10.1093/eurheartj/ehx391)

What is new in the 2017 Valvular Heart Disease Guidelines?

Changes in recommendations	
2012	**2017**
Indications for mitral valve intervention in secondary mitral regurgitation *(continued)*	
	IIb C (modified) *(continued)* When revascularization is not indicated and surgical risk is not low, a percutaneous edge-to-edge procedure may be considered in patients with severe secondary mitral regurgitation and LVEF >30%, who remain symptomatic despite optimal medical management (including CRT if indicated) and who have a suitable valve morphology by echocardiography, avoiding futility.

What is new in the 2017 Valvular Heart Disease Guidelines?

Changes in recommendations	
2012	**2017**
Indications for mitral valve intervention in secondary mitral regurgitation *(continued)*	
	IIb C (modified) *(continued)* In patients with severe secondary mitral regurgitation and LVEF <30% who remain symptomatic despite optimal medical management (including CRT if indicated) and who have no option for revascularization, the Heart Team may consider percutaneous edge-to-edge procedure or valve surgery after careful evaluation for ventricular assist device or heart transplant according to individual patient characteristics.

What is new in the 2017 Valvular Heart Disease Guidelines?

Changes in recommendations	
2012	**2017**
Indications for mitral valve intervention in secondary mitral regurgitation *(continued)*	
	Additional statement: The lower thresholds defining severe MR compared to primary MR are based on their association with prognosis. However, it is unclear if prognosis is independently affected by MR compared to LV dysfunction. For isolated mitral valve treatment in secondary MR, thresholds of severity of MR for intervention still need to be validated in clinical trials. So far, no survival benefit has been confirmed for reduction of secondary MR.

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What is new in the 2017 Valvular Heart Disease Guidelines?

Changes in recommendations	
2012	**2017**
Indications for antithrombotic therapy in patients with a prosthetic heart valve or valve repair	
IIa C The addition of low-dose aspirin (75–100 mg/day) to VKA should be considered in the case of concomitant atherosclerotic disease.	**IIb C** The addition of low-dose aspirin (75–100 mg/day) to VKA may be considered in the case of concomitant atherosclerotic disease.

What is new in the 2017 Valvular Heart Disease Guidelines?

2017 New recommendations
Management of CAD in patients with VHD
New IIa C recommendations: • CT angiography should be considered as an alternative to coronary angiography before valve surgery in patients with severe VHD and low probability of CAD, or in whom conventional coronary angiography is technically not feasible or associated with a high risk. • PCI should be considered in patients with a primary indication to undergo TAVI and coronary artery diameter stenosis >70% in proximal segments. • PCI should be considered in patients with a primary indication to undergo transcatheter mitral valve interventions and coronary artery diameter stenosis >70% in proximal segments.
Management of atrial fibrillation in VHD
New additional recommendations: See new Table *"Management of atrial fibrillation in patients with VHD"* Section 3.7.2.

What is new in the 2017 Valvular Heart Disease Guidelines?

2017 New recommendations
Indications for surgery in severe aortic regurgitation and aortic root disease
New I C recommendations: Heart Team discussion is recommended in selected patients in whom aortic valve repair may be a feasible alternative to valve replacement. • Aortic valve repair, using the reimplantation or remodelling with aortic annuloplasty technique, is recommended in young patients with aortic root dilation and tricuspid aortic valves, when performed by experienced surgeons.
New IIa C recommendation: Surgery should be considered in patients who have aortic root disease with maximal ascending aortic diameter: ≥45 mmin patients with a *TGFBR1* or*TGFBR2* mutation (including Loeys-Dietz syndrome)*.
* *A lower threshold of 40 mm may be considered in women with low BSA, in patients with a TGFBR2 mutation, or in patients with severe extra-aortic features.*

What is new in the 2017 Valvular Heart Disease Guidelines?

2017 New recommendations
Diagnosis of severe aortic stenosis See new recommendations for the diagnosis of severe aortic stenosis (Figure and Table).
Indications for surgery in asymptomatic aortic stenosis
New IIa C recommendation: Severe pulmonary hypertension (systolic pulmonary artery pressure at rest >60 mmHg confirmed by invasive measurement) without other explanation.
Indications for intervention in asymptomatic severe primary mitral regurgitation
New additional statement: If pulmonary hypertension (SPAP >50 mmHg at rest) is the only indication for surgery, the value should be confirmed by invasive measurement.

What is new in the 2017 Valvular Heart Disease Guidelines?

2017 New recommendations
Management after valve intervention **New recommendations:** After transcatheter as well as surgical implantation of a bioprosthetic valve, echocardiography – including the measurement of transprosthetic gradients -should be performed within 30 days (preferably around 30 days for surgery) after valve implantation (i.e. baseline imaging), at 1 year after implantation, and annually thereafter.
Indications for antithrombotic therapy in patients with a prosthetic heart valve or valve repair. **New recommendations:**
I B • INR self-management is recommended provided appropriate training and quality control are performed.

What is new in the 2017 Valvular Heart Disease Guidelines?

2017 New recommendations

IIa B

- In patients treated with coronary stent implantation, triple therapy with aspirin (75-100 mg/day), clopidogrel (75 mg/day), and VKA should be considered for 1 month, irrespective of the type of stent used and the clinical presentation (i.e. ACS or stable CAD).
- Triple therapy comprising aspirin (75-100 mg/day), clopidogrel (75 mg/day), and VKA for longer than 1 month and up to 6 months should be considered in patients with high ischaemic risk due to ACS or other anatomical/procedural characteristics that outweigh the bleeding risk.

IIa A

- Dual therapy comprising VKA and clopidogrel (75 mg/day) should be considered as an alternative to 1-month triple antithrombotic therapy in patients in whom the bleeding risk outweighs the ischaemic risk.

What is new in the 2017 Valvular Heart Disease Guidelines?

2017 New recommendations

IIa B

- In patients who have undergone PCI, discontinuation of antiplatelet treatment should be considered at 12 months.
- In patients requiring aspirin and/or clopidogrel in addition to VKA, the dose intensity of VKA should be carefully regulated with a target INR in the lower part of the recommended target range and a time in therapeutic range >65–70%.

IIa C

- Dual antiplatelet therapy should be considered for the first 3–6 months after TAVI, followed by lifelong single antiplatelet therapy in patients who do not need oral anticoagulation for other reasons.

IIb C

- Single antiplatelet therapy may be considered after TAVI in the case of high bleeding risk.

III B

- The use of NOACs is contraindicated in mechanical valves.

What is new in the 2017 Valvular Heart Disease Guidelines?

2017 New recommendations
Management of prosthetic valve dysfunction
New recommendations:
I C
Anticoagulation using a VKA and/or UFH is recommended in bioprosthetic valve thrombosis before considering reintervention.
I C
Reoperation is recommended if paravalvular leak is related to endocarditis or causes haemolysis requiring repeated blood transfusions or leading to severe symptoms.
IIb C
Transcatheter closure may be considered for paravalvular leaks with clinically significant regurgitation in surgical high-risk patients (Heart Team decision).
IIa C
Transcatheter valve-in-valve implantation in aortic position should be considered by the Heart Team depending on the risk of reoperation and the type and size of prosthesis.

What is new in the 2017 Valvular Heart Disease Guidelines?

2017 NEW/REVISED CONCEPTS
New concept • Condense guideline document linked to ESC Textbook for more background information. • Key points and gaps in evidence after each section.
Heart valve centres and heart team
New concept! • See new Table *"Recommended requirements of a heart valve centre"*, see Section 3.6

	Class I		**Class IIa**		**Class IIb**		**Class III**

Essential questions in the evaluation of patients for valvular intervention

Questions
• How severe is VHD?
• What is the aetiology of VHD?
• Does the patient have symptoms?
• Are symptoms related to valvular disease?
• Are any signs present in asymptomatic patients that indicate a worse outcome if the intervention is delayed?
• What are the patient's life expectancy and expected quality of life?

Essential questions in the evaluation of patients for valvular intervention *(continued)*

Questions *(continued)*
• Do the expected benefits of intervention (versus spontaneous outcome) outweigh its risks?
• What is the optimal treatment modality? Surgical valve replacement (mechanical or biological), surgical valve repair, or catheter intervention?
• Are local resources (local experience and outcome data for a given intervention) optimal for the planned intervention?
• What are the patient's wishes?

Echocardiographic criteria for the definition of severe valve regurgitation: an integrative approach

(Adapted from Lancellotti et al.)

	Aortic regurgitation
Qualitative	
Valve morphology	Abnormal/flail/large coaptation defect
Colour flow regurgitant jet	Large in central jets, variable ineccentric jets
CW signal of regurgitant jet	Dense
Other	Holodiastolic flow reversal in descending aorta (EDV >20 cm/s)

Echocardiographic criteria for the definition of severe valve regurgitation: an integrative approach *(continued)*

(Adapted from Lancellotti et al.)

	Aortic regurgitation
Semiquantitative	
Vena contracta width (mm)	>6
Upstream vein flow	–
Inflow	–
Other	Pressure half-time <200 ms

Echocardiographic criteria for the definition of severe valve regurgitation: an integrative approach *(continued)*

(Adapted from Lancellotti et al.)

	Aortic regurgitation
Quantitative	
EROA (mm^2)	≥30
Regurgitant volume (mL/beat)	≥60
+ enlargement of cardiac chambers/vessels	LV

Echocardiographic criteria for the definition of severe valve regurgitation: an integrative approach *(continued)*

(Adapted from Lancellotti et al.)

	Mitral regurgitation
Qualitative	
Valve morphology	Flail leaflet/ruptured papillary muscle/large coaptation defect
Colour flow regurgitant jet	Very large central jet or eccentric jet adhering, swirling, and reaching the posterior wall of the LA
CW signal of regurgitant jet	Dense/triangular
Other	Large flow convergence zone

Echocardiographic criteria for the definition of severe valve regurgitation: an integrative approach *(continued)*

(Adapted from Lancellotti et al.)

	Mitral regurgitation
Semiquantitative	
Vena contracta width (mm)	≥7 (>8 for biplane)
Upstream vein flow	Systolic pulmonary vein flow reversal
Inflow	E-wave dominant ≥1.5 m/s
Other	TVI mitral/TVI aortic >1.4

Echocardiographic criteria for the definition of severe valve regurgitation: an integrative approach *(continued)*

(Adapted from Lancellotti et al.)

	Mitral regurgitation	
Quantitative	**Primary**	**Secondary**
EROA (mm^2)	≥40	≥20
Regurgitant volume (mL/beat)	≥60	≥30
+ enlargement of cardiac chambers/vessels	LV, LA	

Echocardiographic criteria for the definition of severe valve regurgitation: an integrative approach *(continued)*

(Adapted from Lancellotti et al.)

	Tricuspid regurgitation
Qualitative	
Valve morphology	Abnormal/flail/large coaptation defect
Colour flow regurgitant jet	Very large central jet or eccentric wall impinging jet
CW signal of regurgitant jet	Dense/triangular with early peaking (peak <2 m/s in massive TR)
Other	–

Echocardiographic criteria for the definition of severe valve regurgitation: an integrative approach *(continued)*

(Adapted from Lancellotti et al.)

	Tricuspid regurgitation
Semiquantitative	
Vena contracta width (mm)	≥7
Upstream vein flow	Systolic hepatic vein flow reversal
Inflow	E-wave dominant ≥1 m/s
Other	PISA radius >9 mmg

Echocardiographic criteria for the definition of severe valve regurgitation: an integrative approach *(continued)*

(Adapted from Lancellotti et al.)

	Tricuspid regurgitation
Quantitative	**Primary**
EROA (mm^2)	≥40
Regurgitant volume (mL/beat)	≥45
+ enlargement of cardiac chambers/vessels	RV, RA, inferior *vena cava*

Management of coronary artery disease

(Adapted from Windecker et al.)

Recommendations	Class	Level
Diagnosis of coronary artery disease		
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 and postmenopausal women, • one or more cardiovascular risk factors.	I	C
Coronary angiography is recommended in the evaluation of moderate to severe secondary mitral regurgitation.	I	C
CT angiography should be considered as an alternative to coronary angiography before valve surgery in patients with severe VHD and low probability of CAD or in whom conventional coronary angiography is technically not feasible or associated with a high-risk.	IIa	C

Management of coronary artery disease *(continued)*

(Adapted from Windecker et al.)

Recommendations	Class	Level
Indications for myocardial revascularization		
CABG is recommended in patients with a primary indication for aortic/mitral valve surgery and coronary artery diameter stenosis≥70%.	I	C
CABG should be considered in patients with a primary indication for aortic/mitral valve surgery and coronary artery diameter stenosis ≥50-70%.	IIa	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 should be considered in patients with a primary indication to undergo transcatheter mitral valve interventions and coronary artery diameter stenosis >70% in proximal segments.	IIa	C

Requirements of a heart valve centre

(Modified from Chambers et al.)

Requirements
Multidisciplinary teams with competencies in valve replacement, aortic root surgery, mitral, tricuspid and aortic valve repair, as well as trans-catheter aortic and mitral valve techniques including reoperations and reinterventions. The Heart Teams must meet on a regular basis and work with standard operating procedures.
Imaging, including 3D and stress echocardiographic techniques, peri-operative TOE,cardiac CT, MRI, and positron emission tomography-CT.
Regular consultation with community, other hospitals, and extracardiac departments, and between non-invasive cardiologists and surgeons and interventional cardiologists.

Requirements of a heart valve centre *(continued)*

(Modified from Chambers et al.)

Requirements
Back-up services including other cardiologists, cardiac surgeons, intensive care and othermedical specialties.
Data review: • Robust internal audit processes including mortality and complications, repair rates, durability of repair, and reoperation rate with a minimum of 1-year follow-up. • Results available for review internally and externally. • Participation in national or European quality databases.

Management of atrial fibrillation in patients with VHD

Recommendations	Class	Level
Anticoagulation		
NOACs should be considered as an alternative to VKAs in patients with aortic stenosis, aortic regurgitation, and mitral regurgitation presenting with atrial fibrillation.	IIa	B
NOACs should be considered as alternative to VKAs after the third month of implantation in patients who have atrial fibrillation associated with a surgical or transcatheter aortic valve bioprosthesis.	IIa	C
The use of NOACs is not recommended in patients with atrial fibrillation and moderate to severe mitral stenosis.	III	C
NOACS are contra-indicated in patients with a mechanical valve.	III	B

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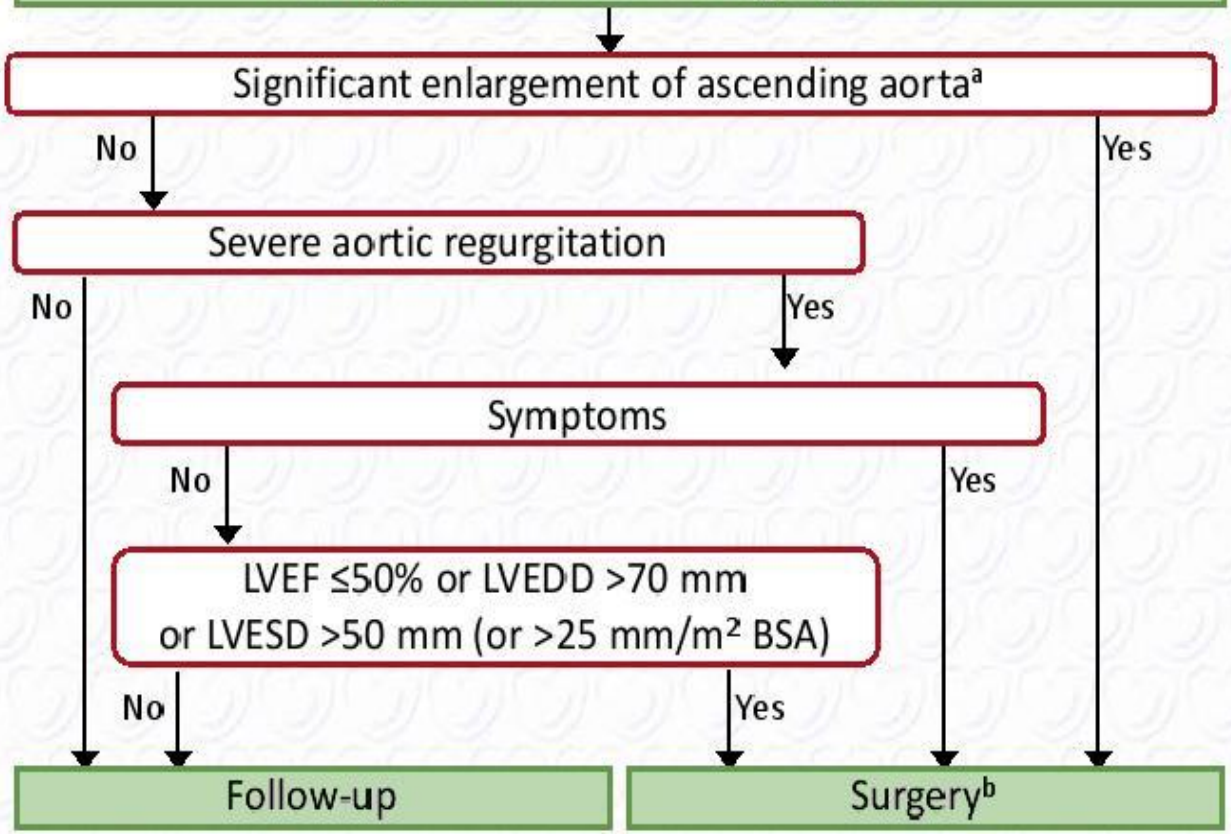
Management of atrial fibrillation in patients with VHD *(continued)*

Recommendations	Class	Level
Surgical interventions		
Surgical ablation of atrial fibrillation should be considered in patients with symptomatic atrial fibrillation who undergo valve surgery.	IIa	A
Surgical ablation of atrial fibrillation may be considered in patients with asymptomatic atrial fibrillation who undergo valve surgery, if feasible, with minimal risk.	IIb	C
Surgical excision or external clipping of the LA appendage may be considered in patients undergoing valve surgery.	IIb	B

Management of aortic regurgitation



[a] *See table of recommendations for definitions of aortic diameter*

[b] *Surgery should also be considered if significant changes in LV and aortic size occur during FU (see table)*

Indications for surgery in severe aortic regurgitation

Recommendations	Class	Level
A. Severe aortic regurgitation		
Surgery is indicated in symptomatic patients.	I	B
Surgery is indicated in asymptomatic patients with resting LVEF ≤50%.	I	B
Surgery is indicated in patients undergoing CABG or surgery of the ascending aorta or of another valve.	I	C
Heart Team discussion is recommended in selected patients* in whom aortic valve repair may be a feasible alternative to valve replacement.	I	C
Surgery should be considered in asymptomatic patients with resting ejection fraction >50% with severe LV dilatation: LVEDD >70 mm, or LVESD>50 mm (or LVESD >25 mm/m^2 BSA in patients with small body size).	IIa	B

** Patients with pliable non-calcified tricuspid or bicuspid valves who have a type I (enlargement of the aortic root with normal cusp motion) or type II (cusp prolapse) mechanism of AR.*

Indications for surgery in (A) severe aortic regurgitation and (B) aortic root disease (irrespective of aortic regurgitation severity) (continued)

Recommendations	Class	Level
B. Aortic root or tubular ascending aorta aneurysm (irrespective of the severity of aortic regurgitation)		
Aortic valve repair, using the reimplantation or remodelling with aortic annuloplasty technique, is recommended in young patients with aortic root dilation and tricuspid aortic valves, when performed by experienced surgeons.	I	C
Surgery is indicated in patients with Marfan syndrome, who have aortic root disease with a maximal ascending aortic diameter ≥50 mm.	I	C

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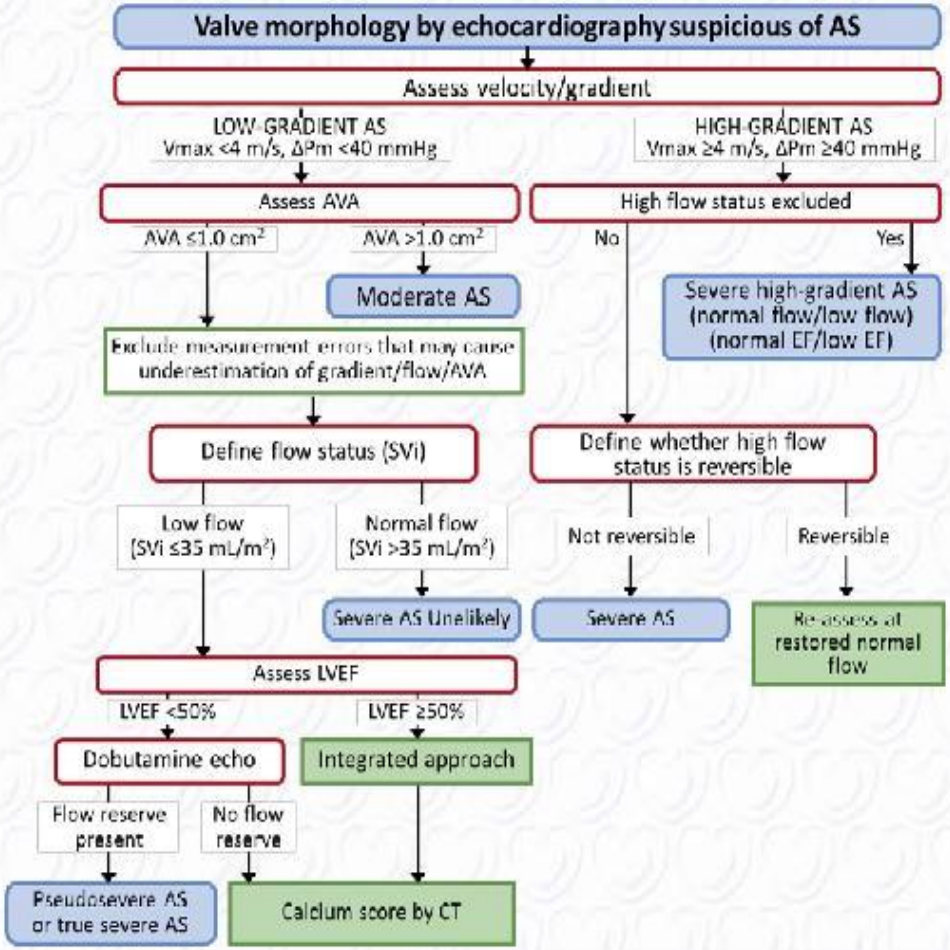
Indications for surgery in aortic root dis. *(continued)*

Recommendations	Class	Level
B. Aortic root or tubular ascending aorta aneurysm (irrespective of the severity of aortic regurgitation) *(continued)*		
Surgery should be considered in patients who have aortic root disease with maximal ascending aortic diameter: • ≥45 mm in the presence of Marfan syndrome and additional risk factors[a], or patients with a *TGFBR1* or *TGFBR2* mutation (including Loeys-Dietz syndrome)[b]. • ≥50 mm in the presence of a bicuspid valve with additional risk factors[a] or coarctation. • ≥55 mm for all other patients.	IIa	C
When surgery is primarily indicated for the aortic valve, replacement of the aortic root or tubular ascending aorta should be considered when ≥45 mm, particularly in the presence of a bicuspid valve.	IIa	C

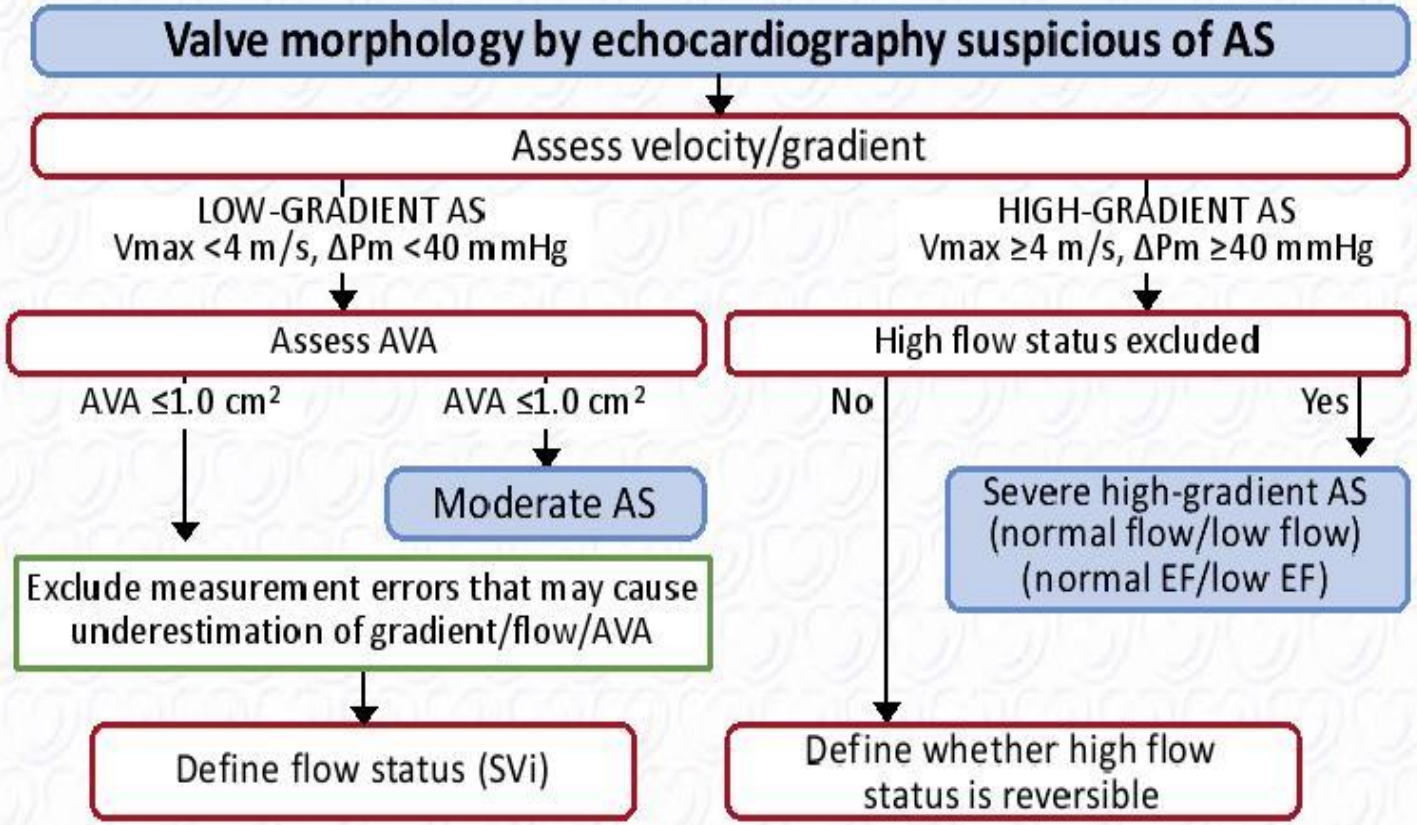
[a] *Family history of aortic dissection (or personal history of spontaneous vascular dissection), severe aortic regurgitation or mitral regurgitation, desire of pregnancy, systemic hypertension, and/or aortic size increase >3 mm/year*

[b] *A lower threshold of 40 mm may be considered in women with low BSA, in patients with a TGFBR2 mutation, or in patients with severe extra-aortic features*

Stepwise integrated approach for the assessment of aortic stenosis severity *(Modified from Baumgartner et al.)*



Stepwise integrated approach for the assessment of aortic stenosis severity *(Modified from Baumgartner et al.)*



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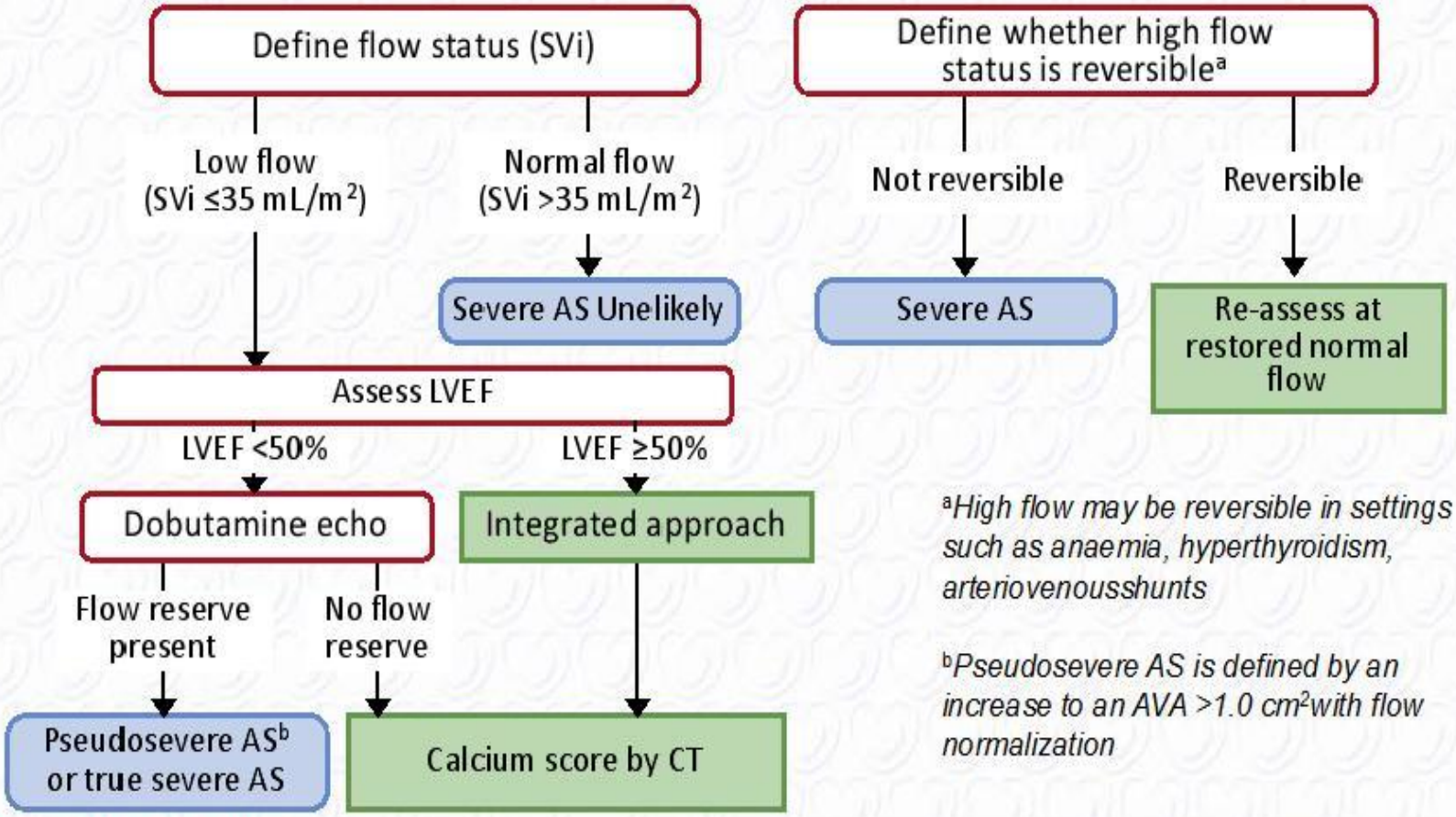
Stepwise integrated approach for the assessment of aortic stenosis severity (continued) - *(Modified from Baumgartner et al.)*



[a]*High flow may be reversible in settings such as anaemia, hyperthyroidism, arteriovenousshunts*

[b]*Pseudosevere AS is defined by an increase to an AVA >1.0 cm²with flow normalization*

Criteria that increase the likelihood of severe AS in pts. with AVA <1.0 cm², mean gradient < 40 mmHg and preserved EF

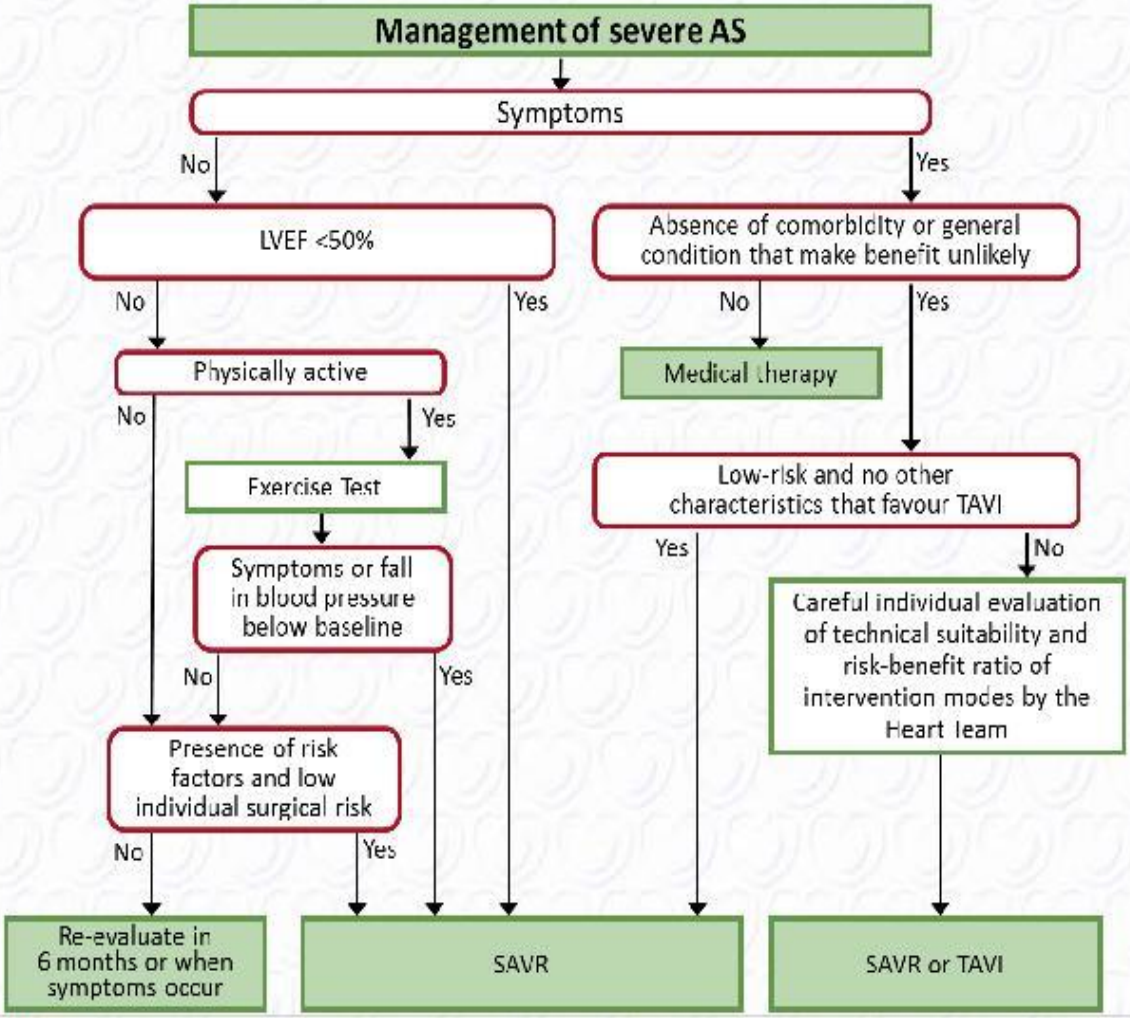
(Baumgartner et al)

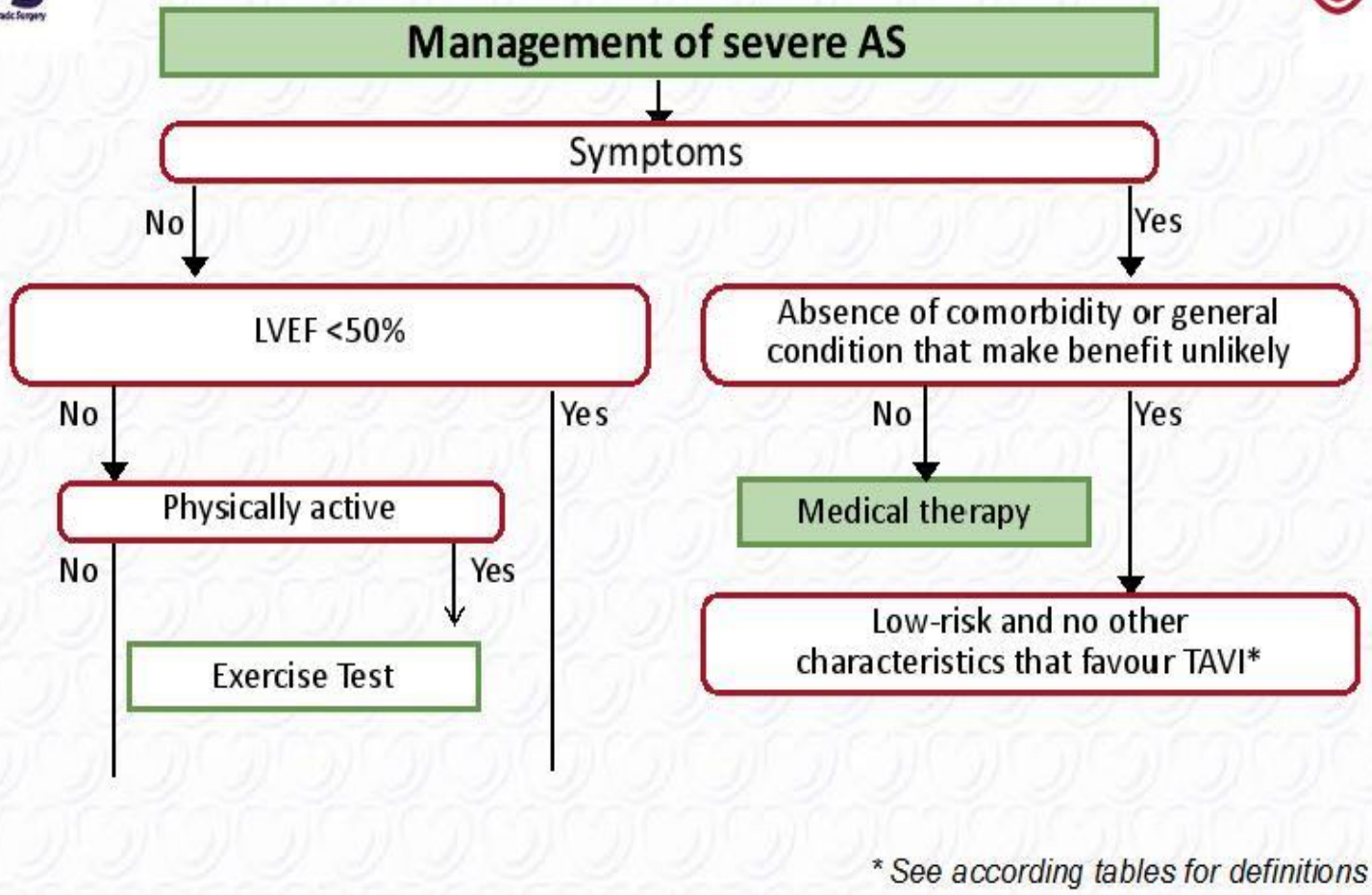
Criteria	
Clinical criteria	• Typical symptoms without other explanation. • Elderly patient (>70 years).
Qualitative imaging data	• LV hypertrophy (additional history of hypertension to be considered). • Reduced LV longitudinal function without other explanation.
Quantitative imaging data	• Mean gradient 30–40 mmHg.
	• AVA ≤0.8 cm².

Criteria that increase the likelihood of severe AS in pts. with AVA < 1.0 cm^2, mean gradient < 40 mmHg and preserved EF

(Baumgartner et al)

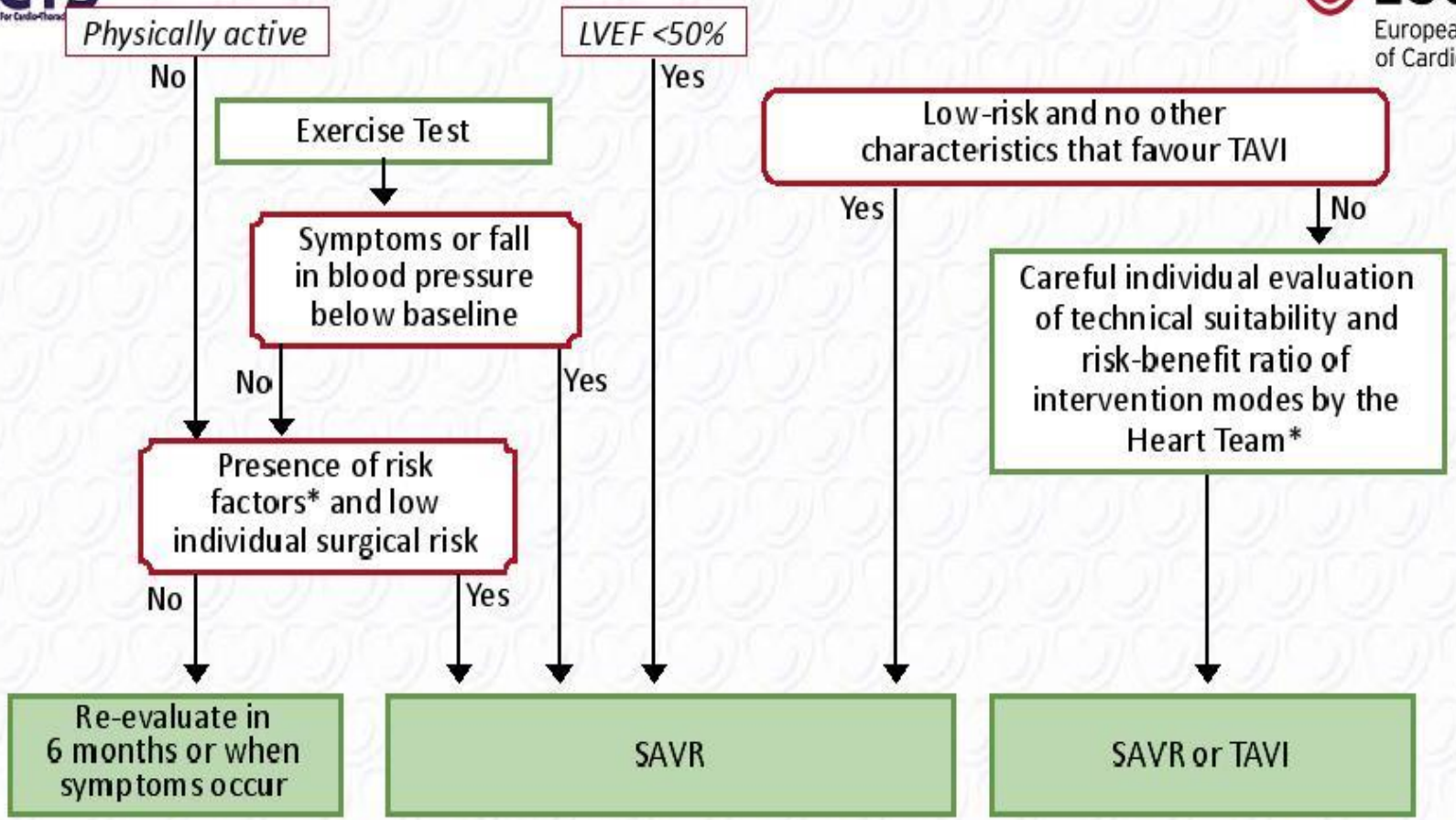
Criteria *(continued)*	
Quantitative imaging data *(continued)*	• Low flow (SVi <35 mL/m^2) confirmed by techniques other than standard Doppler technique (LVOT measurement by 3D TOE or MSCT; CMR, invasive data).
	• Calcium score by MSCT: – Severe aortic stenosis very likely: men ≥3000; women ≥1600, – Severe aortic stenosis likely: men ≥2000; women ≥1200, – Severe aortic stenosis unlikely: men <1600; women<800.


Management of severe AS
Symptoms
No
Yes
LVEF <50%
Absence of comorbidity or general condition that make benefit unlikely
No
Yes
No
Yes
Physically active
Medical therapy
No
Yes
Exercise Test
Low-risk and no other characteristics that favour TAVI
Symptoms or fall in blood pressure below baseline
Yes
No
Careful individual evaluation of technical suitability and risk-benefit ratio of intervention modes by the Heart Team
No
Yes
Presence of risk factors and low individual surgical risk
No
Yes
Re-evaluate in 6 months or when symptoms occur
SAVR
SAVR or TAVI



** See according tables for definitions*

Management of severe aortic stenosis *(continued)*



** See according tables for indications of surgery in asymptomatic patients and for decision between TAVI and SAVR*

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Indications for intervention in aortic stenosis and recommendations for the choice of intervention mode

Recommendations	Class	Level
a) Symptomatic aortic stenosis		
Intervention is indicated in symptomatic patients with severe, high-gradient aortic stenosis (mean gradient ≥40 mmHg or peak velocity ≥4.0 m/s).	I	B
Intervention is indicated in symptomatic patients with severe low-flow, low-gradient (<40 mmHg) aortic stenosis with reduced ejection fraction, and evidence of flow (contractile) reserve excluding pseudo-severe aortic stenosis.	I	C
Intervention should be considered in symptomatic patients with low flow, low-gradient (<40 mmHg) aortic stenosis with normal ejection fraction after careful confirmation of severe aortic stenosis.	IIa	C

Indications for intervention in aortic stenosis and recommendations for the choice of intervention mode *(continued)*

Recommendations	Class	Level
Intervention should be considered in symptomatic patients with low-flow, low-gradient aortic stenosis and reduced ejection fraction without flow (contractile) reserve, particularly when CT calcium scoring confirms severe aortic stenosis.	IIa	C
Intervention should not be performed in patients with severe comorbidities when the intervention is unlikely to improve quality of life or survival.	III	C
b) Choice of intervention in symptomatic aortic stenosis		
Aortic valve interventions should only be performed in centres with both departments of cardiology and cardiac surgery on-site, and with structured collaboration between the two, including a Heart Team (heart valve centres).	I	C

Indications for intervention in aortic stenosis and recommendations for the choice of intervention mode *(continued)*

Recommendations	Class	Level
The choice for intervention must be based on careful individual evaluation of technical suitability and weighing of risks and benefits of each modality (aspects to be considered are listed in the according table). In addition, the local expertise and outcomes data for the given intervention must be taken into account.	I	C
SAVR is recommended in patients at low surgical risk (STS or EuroSCORE II <4% or logistic EuroSCORE I <10% and no other risk factors not included in these scores, such as frailty, porcelain aorta, sequelae of chest radiation).	I	B
TAVI is recommended in patients who are not suitable for SAVR as assessed by the Heart Team.	I	B

Indications for intervention in aortic stenosis and recommendations for the choice of intervention mode *(continued)*

Recommendations	Class	Level
In patients who are at increased surgical risk (STS or EuroSCORE II ≥4% or logistic EuroSCORE I ≥10% or other risk factors not included in these scores such as frailty, porcelain aorta, sequelae of chest radiation), the decision between SAVR and TAVI should be made by the Heart Team according to the individual patient characteristics (see according table), with TAVI being favoured in elderly patients suitable for transfemoral access.	I	B
Balloon aortic valvotomy may be considered as a bridge to SAVR or TAVI in haemodynamically unstable patients or in patients with symptomatic severe aortic stenosis who require urgent major non-cardiac surgery.	IIb	C

Indications for intervention in aortic stenosis and recommendations for the choice of intervention mode *(continued)*

Recommendations	Class	Level
Balloon aortic valvotomy may be considered as a diagnostic means in patients with severe aortic stenosis and other potential cause for symptoms (i.e. lung disease) and in patients with severe myocardial dysfunction, pre-renal insufficiency or other organ dysfunction that maybe reversible with balloon aortic valvotomy when performed in centres that can escalate to TAVI.	IIb	C
c) Asymptomatic patients with severe aortic stenosis (refers only to patients eligible for surgical valve replacement)		
SAVR is indicated in asymptomatic patients with severe aortic stenosis and systolic LV dysfunction (LVEF <50%) not due to another cause.	I	C
SAVR is indicated in asymptomatic patients with severe aortic stenosis and abnormal exercise test showing symptoms on exercise clearly related to aortic stenosis.	I	C

Indications for intervention in aortic stenosis and recommendations for the choice of intervention mode *(continued)*

Recommendations	Class	Level
SAVR should be considered in asymptomatic patients with severe aortic stenosis and abnormal exercise test showing fall in blood pressure below baseline.	IIa	C
SAVR should be considered in asymptomatic patients with normal ejection fraction and none of the above-mentioned exercise test abnormalities if the surgical risk is low and one of the following findings is present: – very severe aortic stenosis defined by a V_{max}>5.5 m/s, – severe valve calcification and a rate of V_{max} progression ≥0.3m/s/year, – markedly elevated BNP levels (>threefold age- and sex-corrected normalrange) confirmed by repeated measurements without other explanations, – severe pulmonary hypertension (systolic pulmonary artery pressure at rest >60 mmHg confirmed by invasive measurement) without other explanation.	IIa	C

Indications for intervention in aortic stenosis and recommendations for the choice of intervention mode *(continued)*

Recommendations	Class	Level
d) Concomitant aortic valve surgery at the time of other cardiac/ascending aorta surgery		
SAVR is indicated in patients with severe aortic stenosis undergoing CABG, or surgery of the ascending aorta or of another valve.	I	C
SAVR should be considered in patients with moderate aortic stenosis* undergoing CABG, or surgery of the ascending aorta or of another valve after Heart Team decision.	IIa	C

** Moderate aortic stenosis is defined by a valve area of 1.0-1.5 cm^2 or a mean gradient of 25-40 mmHg in the presence of normal flow conditions. However, clinical judgement is required.*

Aspects to be considered by the Heart Team for the decision between SAVR and TAVI in patients at increased surgical risk

	Favours TAVI	Favours SAVR
Clinical characteristics		
STS/EuroSCORE II <4% (logistic EuroSCORE I<10%)		+
STS/EuroSCORE II ≥4% (logistic EuroSCORE I ≥10%)	+	
Presence of severe comorbidity (not adequately reflected by scores)	+	
Age <75 years		+
Age ≥75 years	+	
Previous cardiac surgery	+	

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Aspects to be considered by the Heart Team for the decision between SAVR and TAVI in patients at increased surgical risk *(continued)*

	Favours TAVI	Favours SAVR
Clinical characteristics *(continued)*		
Frailty	+	
Restricted mobility and conditions that may affect the rehabilitation process after the procedure	+	
Suspicion of endocarditis		+
Anatomical and technical aspects		
Favourable access for transfemoral TAVI	+	
Unfavourable access (any) for TAVI		+

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Aspects to be considered by the Heart Team for the decision between SAVR and TAVI in patients at increased surgical risk *(continued)*

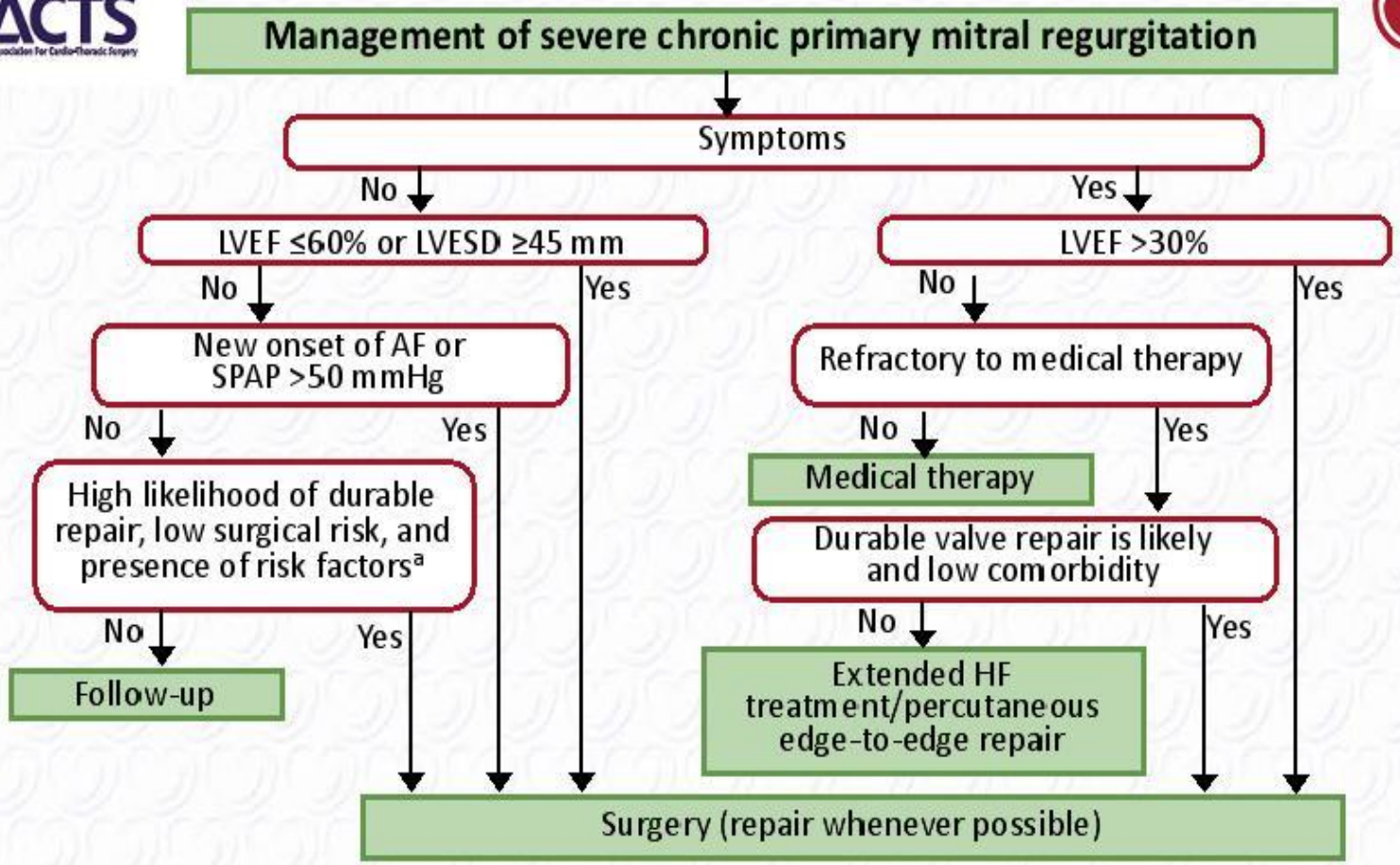
	Favours TAVI	Favours SAVR
Anatomical and technical aspects *(continued)*		
Sequelae of chest radiation	+	
Porcelain aorta	+	
Presence of intact coronary bypass grafts at risk when sternotomy is performed	+	
Expected patient–prosthesis mismatch	+	
Severe chest deformation or scoliosis	+	
Short distance between coronary ostia and aortic valve annulus		+

Aspects to be considered by the Heart Team for the decision between SAVR & TAVI in patients at increased surgical risk *(continued)*

	Favours TAVI	Favours SAVR
Anatomical and technical aspects *(continued)*		
Size of aortic valve annulus out of range for TAVI		+
Aortic root morphology unfavourable for TAVI		+
Valve morphology (bicuspid, degree of calcification, calcification pattern) unfavourable for TAVI		+
Presence of thrombi in aorta or LV		+
Cardiac conditions in addition to aortic stenosis that require consideration for concomitant intervention		
Severe CAD requiring revascularization by CABG		+

Aspects to be considered by the Heart Team for the decision between SAVR and TAVI in patients at increased surgical risk *(continued)*

	Favours TAVI	Favours SAVR
Cardiac conditions in addition to aortic stenosis that require consideration for concomitant intervention *(continued)*		
Severe primary mitral valve disease, which could be treated surgically		+
Severe tricuspid valve disease		+
Aneurysm of the ascending aorta		+
Septal hypertrophy requiring myectomy		+



[a] *LVESD ≥40 mm and one of the following present: flail leaflet or LA volume ≥60 mL/m² BSA at sinus rhythm*

Indications for intervention in severe primary mitral regurgitation

Recommendations	Class	Level
Mitral valve repair should be the preferred technique when the results are expected to be durable.	I	C
Surgery is indicated in symptomatic patients with LVEF >30%.	I	B
Surgery is indicated in asymptomatic patients with LV dysfunction (LVESD ≥45 mm* and/or LVEF ≤60%).	I	B
Surgery should be considered in asymptomatic patients with preserved LV function (LVESD <45 mm and LVEF >60%) and atrial fibrillation secondary to mitral regurgitation or pulmonary hypertension (systolic pulmonary pressure at rest >50 mmHg**).	IIa	B

** Cut-offs refer to average-size adults and may require adaptation in patients with unusually small or large stature*
*** If an elevated SPAP is the only indication for surgery, the value should be confirmed by invasive measurement*

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Indications for intervention in severe primary mitral regurgitation *(continued)*

Recommendations	Class	Level
Surgery should be considered in asymptomatic patients with preserved LVEF (>60%) and LVESD 40–44 mm* when a durable repair is likely, surgical risk is low, the repair is performed in heart valve centres, and at least one of the following findings is present: - flail leaflet or, - presence of significant LA dilatation (volume index ≥60 mL/m² BSA) in sinus rhythm.	IIa	C
Mitral valve repair should be considered in symptomatic patients with severe LV dysfunction (LVEF <30% and/or LVESD >55 mm) refractory to medical therapy when likelihood of successful repair is high and comorbidity low.	IIa	C

** Cut-offs refer to average-size adults and may require adaptation in patients with unusually small or large stature*

Indications for intervention in severe primary mitral regurgitation *(continued)*

Recommendations	Class	Level
Mitral valve replacement may be considered in symptomatic patients with severe LV dysfunction (LVEF <30% and/or LVESD >55 mm) refractory to medical therapy when likelihood of successful repair is low and comorbidity low.	IIb	C
Percutaneous edge-to-edge procedure may be considered in patients with symptomatic severe primary mitral regurgitation who fulfil the echocardiographic criteria of eligibility and are judged inoperable or at high surgical risk by the Heart Team, avoiding futility.	IIb	C

Indications for mitral valve intervention in chronic secondary mitral regurgitation

Recommendations	Class	Level
Surgery is indicated in patients with severe secondary mitral regurgitation undergoing CABG and LVEF >30%.	I	C
Surgery should be considered in symptomatic patients with severe secondary mitral regurgitation, LVEF <30% but with an option for revascularization, and evidence of myocardial viability.	IIa	C
When revascularization is not indicated, surgery may be considered in patients with severe secondary mitral regurgitation and LVEF >30%, who remain symptomatic despite optimal medical management (including CRT if indicated) and have a low surgical risk.	IIb	C

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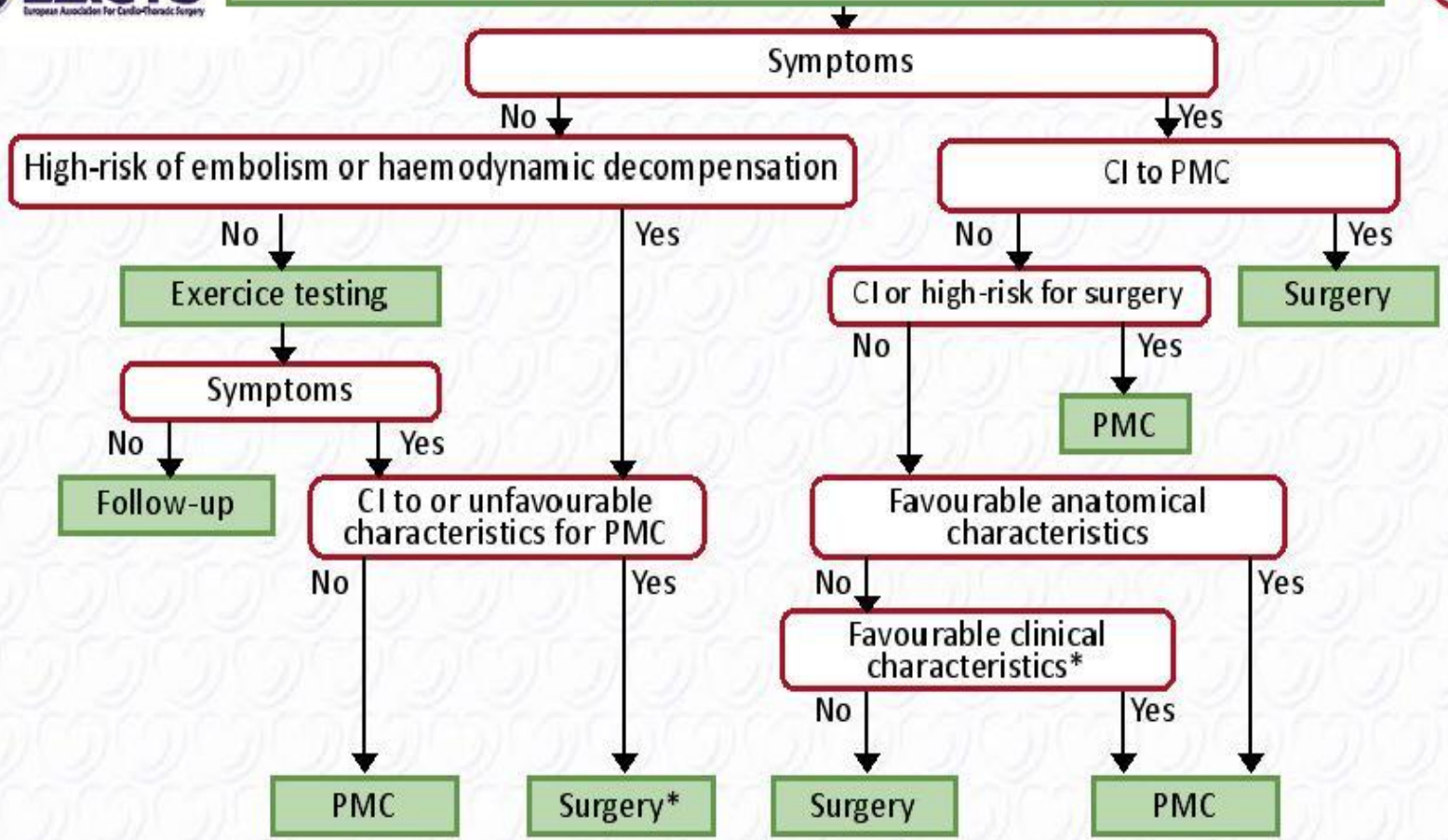
Indications for mitral valve intervention in chronic secondary mitral regurgitation *(continued)*

Recommendations	Class	Level
When revascularization is not indicated, surgery may be considered in patients with severe secondary mitral regurgitation and LVEF >30%, who remain symptomatic despite optimal medical management (including CRT if indicated) and have a low surgical risk.	IIb	C
In patients with severe secondary mitral regurgitation and LVEF <30% who remain symptomatic despite optimal medical management (including CRT if indicated) and who have no option for revascularization, the Heart Team may consider percutaneous edge-to-edge procedure or valve surgery after careful evaluation for ventricular assist device or heart transplant according to individual patient characteristics.	IIb	C

Management of clinically significant mitral stenosis (MVA <1.5 cm²)



See table of recommendations **If symptoms occur for a low level of exercise and operative risk is low*

Indications for PMC and mitral valve Surgery in clinically significant mitral stenosis (≤1.5cm^2)

Recommendations	Class	Level
PMC is indicated in symptomatic patients without unfavourable characteristics for PMC.	I	B
PMC is indicated in any symptomatic patients with a contra-indication or a high-risk for surgery.	I	C
Mitral valve surgery is indicated 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

* *Several of the following: old age, history of commissurotomy, NYHA class IV, Afib., pulm. hypertension*

Indications for PMC and mitral valve surgery *(continued)*

Recommendations	Class	Level
PMC should be considered in asymptomatic patients without unfavourable clinical and anatomical characteristics for PMC and • high thromboembolic risk (history of systemic embolism, dense spontaneous contrast in the LA, new-onset or paroxysmal atrial fibrillation); and/or • high-risk of haemodynamic decompensation (systolic pulmonary pressure >50 mmHg at rest, need for major non-cardiac surgery, desire for pregnancy).	IIa	C

Contra-indications for percutaneous mitral commissurotomy (PMC)

Contra-indications
Mitral valve area >1.5 cm^2 *
Left atrial thrombus
More than mild mitral regurgitation
Severe or bi-commissural calcification
Absence of commissural fusion
Severe concomitant aortic valve disease, or severe combined tricuspid stenosis and regurgitation requiring surgery
Concomitant CAD requiring bypass surgery

**PMC may be considered in patients with valve area >1.5 cm^2 with symptoms that cannot be explained by another cause and if the anatomy is favourable.*

Echo scores: Wilkins score, Cormier score, and Echo Score "Revisited" for immediate outcome prediction

Assessment of mitral valve anatomy according to the Wilkins score		
Grade	**Mobility**	**Thickening**
1	Highly mobile valve with only leaflet tips restricted	Leaflets near normal in thickness (4–5 mm)
2	Leaflet mid and base portions have normal mobility	Mid leaflets normal, considerable thickening of margins (5–8 mm)
3	Valve continues to move forward in diastole, mainly from the base	Thickening extending through the entire leaflet (5–8 mm)
4	No or minimal forward movement of the leaflets in diastole	Considerable thickening of all leaflet tissue (>8–10 mm)
The total score is the sum of the four items and ranges between 4 and 16		

Echo scores: Wilkins score, Cormier score and Echo Score "Revisited" for immediate outcome prediction *(continued)*

Assessment of mitral valve anatomy according to the Wilkins score		
Grade	**Calcification**	**Subvalvular thickening**
1	A single area of increased echobrightness	Minimal thickening just below the mitral leaflets
2	Scattered areas of brightness confined to leaflet margins	Thickening of chordal structures extending to one third of the chordal length
3	Brightness extending into the mid portions of the leaflets	Thickening extended to distal third of the chords
4	Extensive brightness throughout much of the leaflet tissue	Extensive thickening and shortening of all chordal structures extending down to the papillary muscles

Unfavourable anatomy: score >8

Echo scores: Wilkins score, Cormier score, and Echo Score "Revisited" for immediate outcome prediction *(continued)*

Assessment of mitral valve anatomy according to the Cormier score	
Echocardiographic group	**Mitral valve anatomy**
Group1	Pliable non-calcified anterior mitral leaflet and mild subvalvular disease (i.e., thin chordae ≥10 mm long)
Group 2	Pliable non-calcified anterior mitral leaflet and severe subvalvular disease (i.e., thickened chordae <10 mm long)
Group 3	Calcification of mitral valve of any extent, as assessed by fluoroscopy, whatever the state of subvalvular apparatus

Echo scores: Wilkins score, Cormier score and Echo Score "Revisited" for immediate outcome prediction *(continued)*

Echo Score "Revisited" for immediate outcome prediction	
Echocardiographic variables	**Points for score (0 to 11)**
Mitral valve area ≤1cm²	2
Maximum leaflet displacement ≤12 mm	3
Commissural area ratio ≥1.25	3
Subvalvular involvement	3

Risk groups: low (score 0 – 3), intermediate (score 4 – 5), high (score 6 – 11)

Indications for tricuspid valve surgery

Recommendations	Class	Level
Tricuspid stenosis		
Surgery is indicated in symptomatic patients with severe tricuspid stenosis.	I	C
Surgery is indicated in patients with severe tricuspid stenosis undergoing left-sided valve intervention.	I	C
Primary tricuspid regurgitation		
Surgery is indicated in patients with severe primary tricuspid regurgitation undergoing left-sided valve surgery.	I	C
Surgery is indicated in symptomatic patients with severe isolated primary tricuspid regurgitation without severe right-ventricular dysfunction.	I	C

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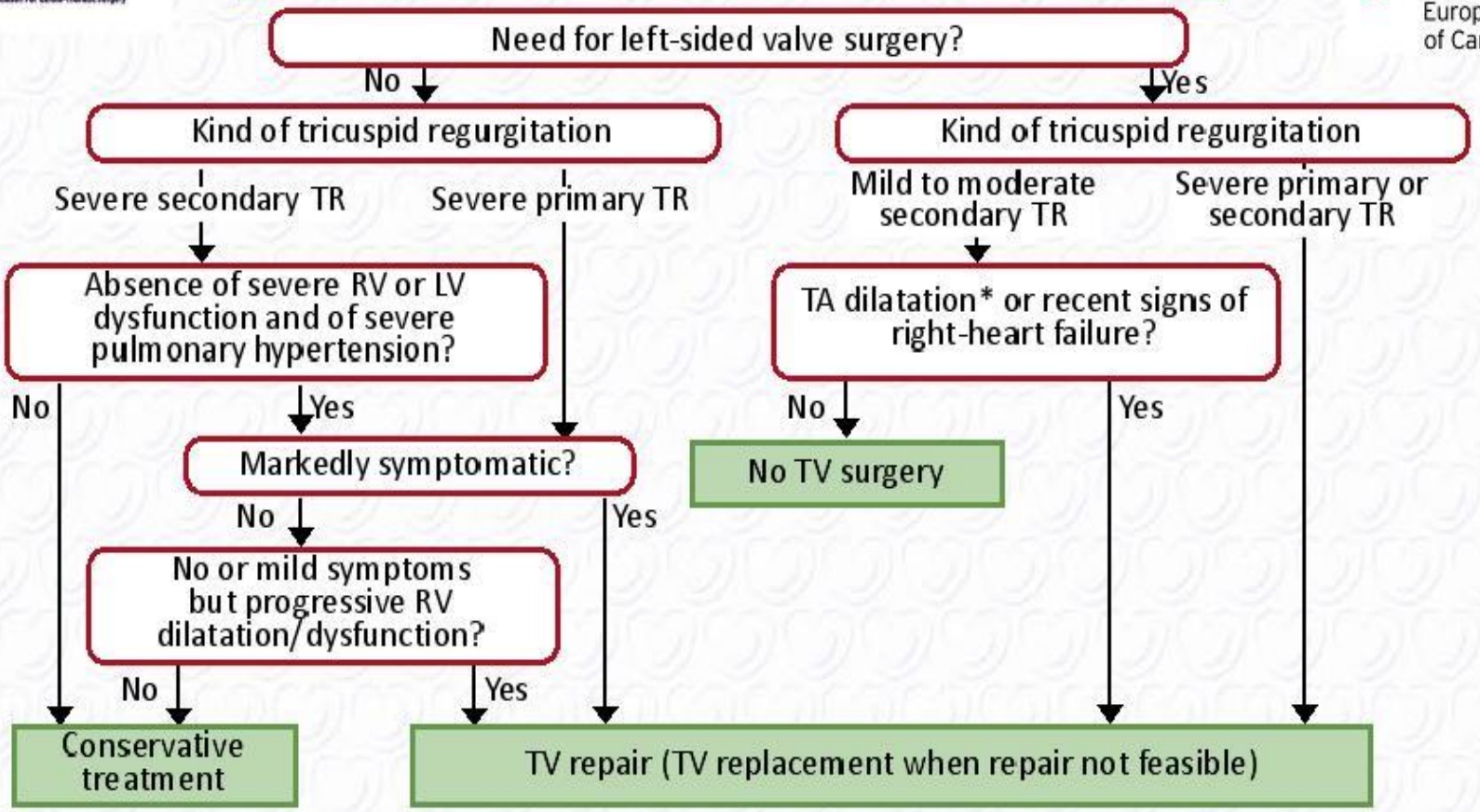
Indications for tricuspid valve surgery *(continued)*

Recommendations	Class	Level
Surgery should be considered in patients with moderate primary tricuspid regurgitation undergoing left-sided valve surgery.	IIa	C
Surgery should be considered in asymptomatic or mildly symptomatic patients with severe isolated primary tricuspid regurgitation and progressive right-ventricular dilatation or deterioration of right ventricular function.	IIa	C
Secondary tricuspid regurgitation		
Surgery is indicated in patients with severe secondary tricuspid regurgitation undergoing left-sided valve surgery.	I	C
Surgery should be considered in patients with mild or moderate secondary tricuspid regurgitation with dilated annulus (≥40 mm or >21 mm/m^2 by 2D echocardiography) undergoing left-sided valve surgery.	IIa	C

Indications for tricuspid valve surgery *(continued)*

Recommendations	Class	Level
Surgery may be considered in patients undergoing left-sided valve surgery with mild or moderate secondary tricuspid regurgitation even in the absence of annular dilatation when previous recent right heart failure has been documented.	IIb	C
After previous left-sided valve surgery and in the absence of recurrent left-sided valve dysfunction, surgery should be considered in patients with severe tricuspid regurgitation who are symptomatic or have progressive right-ventricular dilatation/dysfunction, in the absence of severe right or LV dysfunction, and severe pulmonary vascular disease/hypertension.	IIa	C

Management of tricuspid regurgitation (TR)



** Tricuspid annulus ≥ 40 mm or 21 mm/m²*

Choice of the aortic/mitral prosthesis in favour of a mechanical prosthesis

Recommendations	Class	Level
A mechanical prosthesis is recommended according to the desire of the informed patient and if there are no contra-indications to long term anticoagulation*.	I	C
A mechanical prosthesis is recommended in patients at risk of accelerated structural valve deterioration**.	I	C
A mechanical prosthesis should be considered in patients already on anticoagulation because of a mechanical prosthesis in another valve position.	IIa	C

** Increased bleeding risk because of comorbidities, compliance concerns or geographic, lifestyle or occupational conditions*

*** Young age (<40 years), hyperparathyroidism*

Choice of the aortic/mitral prosthesis in favour of a mechanical prosthesis *(continued)*

Recommendations	Class	Level
A mechanical prosthesis should be considered in patients aged <60 years for prostheses in the aortic position and <65 years for prostheses in the mitral position*.	IIa	C
A mechanical prosthesis should be considered in patients with a reasonable life expectancy, for whom future redo valve surgery would be at high-risk.	IIa	C
A mechanical prosthesis may be considered in patients already on long-term anticoagulation due to high-risk for thrombo-embolism.	IIb	C

** Between 60 and 65 (aortic prosthesis) / 65 and 70 years (mitral prosthesis), both valves are acceptable and the choice requires careful analysis of factors other than age*

Choice of the aortic/mitral prosthesis in favour of a bioprosthesis

Recommendations	Class	Level
A bioprosthesis is recommended according to the desire of the informed patient.	I	C
A bioprosthesis is recommended when good-quality anticoagulation is unlikely (compliance problems, not readily available) or contra-indicated because of high bleeding risk (previous major bleed, comorbidities, unwillingness, compliance problems, lifestyle, occupation).	I	C
A bioprosthesis is recommended for reoperation for mechanical valve thrombosis despite good long-term anti-coagulant control.	I	C

Choice of the aortic/mitral prosthesis in favour of a bioprosthesis *(continued)*

Recommendations	Class	Level
A bioprosthesis should be considered in patients for whom there is alow likelihood and/or a low operative risk of future redo valve surgery.	IIa	C
A bioprosthesis should be considered in young women contemplating pregnancy.	IIa	C
A bioprosthesis should be considered in patients aged >65 years for a prosthesis in the aortic position, or age >70 years in a mitral position*, or those with life expectancy lower than the presumed durability of the bioprosthesis.	IIa	C

** Between 60 and 65 (aortic prosthesis) / 65 and 70 years (mitral prosthesis), both valves are acceptable and the choice requires careful analysis of factors other than age*

Indications for antithrombotic therapy for mechanical prostheses

Recommendations	Class	Level
Mechanical prosthesis		
Oral anticoagulation using a VKA is recommended lifelong for all patients.	I	B
Bridging using therapeutic doses of UFH or LMWH is recommended when VKA treatment should be interrupted.	I	C
The addition of low-dose aspirin (75-100 mg/day) to VKA should be considered after thromboembolism despite an adequate INR.	IIa	C
The addition of low-dose aspirin (75-100 mg/day) to VKA may be considered in the case of concomitant atherosclerotic disease.	IIb	C
INR self-management is recommended provided appropriate training and quality control are performed.	I	B

Indications for antithrombotic therapy for mechanical prostheses *(continued)*

Recommendations	Class	Level
Mechanical prosthesis		
In patients treated with coronary stent implantation, triple therapy with aspirin (75-100 mg/day), clopidogrel (75 mg/day), and VKA shouldbe considered for 1 month, irrespective of the type of stent used and the clinical presentation (i.e. ACS or stable CAD).	IIa	B
Triple therapy comprising aspirin (75-100 mg/day), clopidogrel (75 mg/day), and VKA for longer than 1 month and up to 6 months should be considered in patients with high ischaemic risk due to ACS or other anatomical/procedural characteristics that outweigh the bleeding risk.	IIa	B

Indications for antithrombotic therapy for mechanical prostheses *(continued)*

Recommendations	Class	Level
Mechanical prosthesis *(continued)*		
Dual therapy comprising VKA and clopidogrel (75 mg/day) should be considered as an alternative to 1-month triple antithrombotic therapy in patients in whom the bleeding risk outweighs the ischaemic risk.	IIa	A
In patients who have undergone PCI, discontinuation of antiplatelet treatment should be considered at 12 months.	IIa	B
In patients requiring aspirin and/or clopidogrel in addition to VKA, the dose intensity of VKA should be carefully regulated with a target INR in the lower part of the recommended target range and a time in therapeutic range >65-70%.	IIa	B
The use of NOACs is contra-indicated.	III	B

Indications for antithrombotic therapy for bioprostheses *(continued)*

Recommendations	Class	Level
Bioprostheses		
Oral anticoagulation is recommended lifelong for patients with surgical or transcatheter implanted bioprostheses who have other indications for anticoagulation.	I	C
Oral anticoagulation using a VKA should be considered for the first 3 months after surgical implantation of a mitral or tricuspid bioprosthesis.	IIa	C
Oral anticoagulation using a VKA should be considered for the first 3 months after surgical mitral or tricuspid valve repair.	IIa	C
Low-dose aspirin (75-100 mg/day) should be considered for the first 3 months after surgical implantation of an aortic bioprosthesis or valve sparing aortic surgery.	IIa	C

Indications for antithrombotic therapy for bioprostheses *(continued)*

Recommendations	Class	Level
Bioprostheses *(continued)*		
Dual antiplatelet therapy should be considered for the first 3-6 months after TAVI, followed by lifelong single antiplatelet therapy in patients who do not need oral anticoagulation for other reasons.	IIa	C
Single antiplatelet therapy may be considered after TAVI in the case of high bleeding risk.	IIb	C
Oral anticoagulation may be considered for the first 3 months after surgical implantation of an aortic bioprosthesis.	IIb	C

Target INR for mechanical prostheses

Prosthesis thrombogenicity	Patient-related risk factors[a]	
	None	≥1 risk factor
Low[b]	2.5	3.0
Medium[c]	3.0	3.5
High[d]	3.5	4.0

[a] *Mitral or tricuspid valve replacement, previous thromboembolism, atrial fibrillation, mitral stenosis of any degree, LVEF <35%*

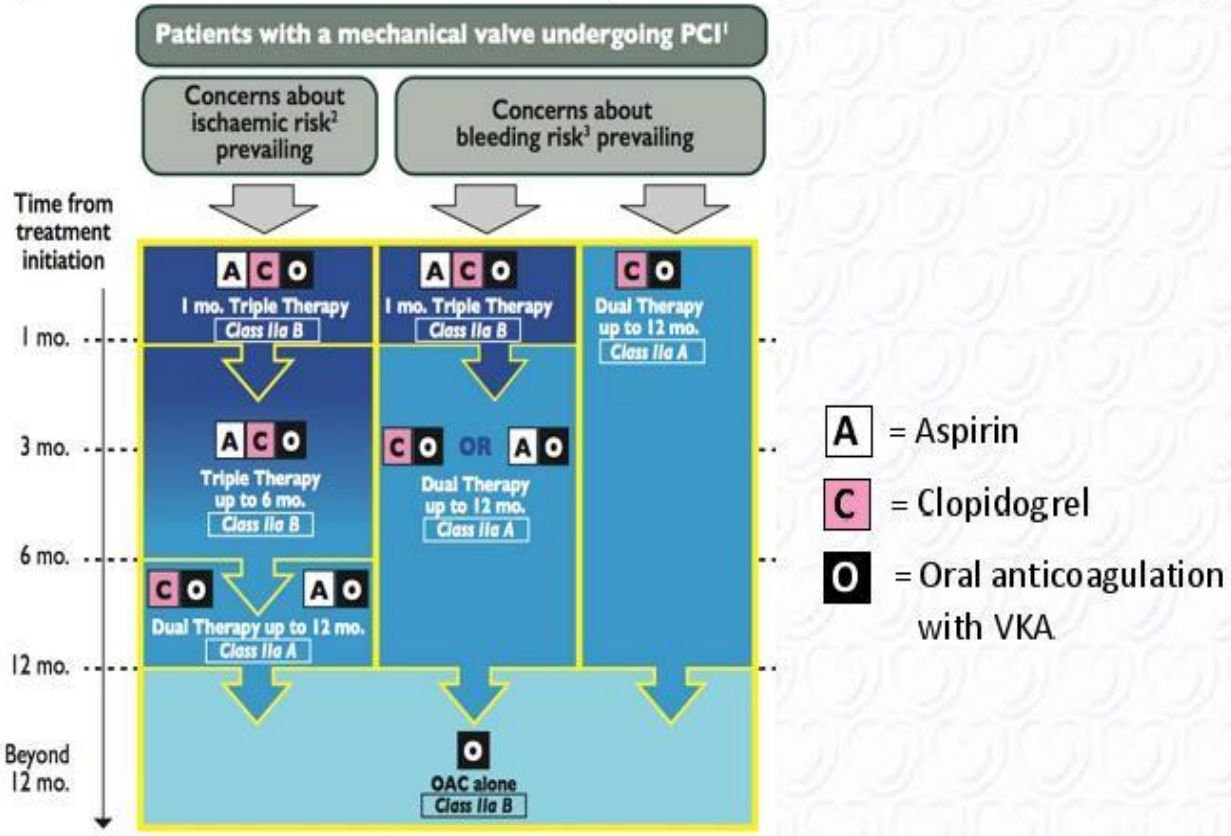
[b] *Carbomedics, Medtronic Hall, ATS, Medtronic Open-Pivot, St. Jude Medical, On-X, Sorin Bicarbon*

[c] *Other bileaflet valves with insufficient data*

[d] *Lillehei-Kaster, Omniscience, Starr-Edwards (ball-cage), Björk-Shiley and other tilting-disc valves*

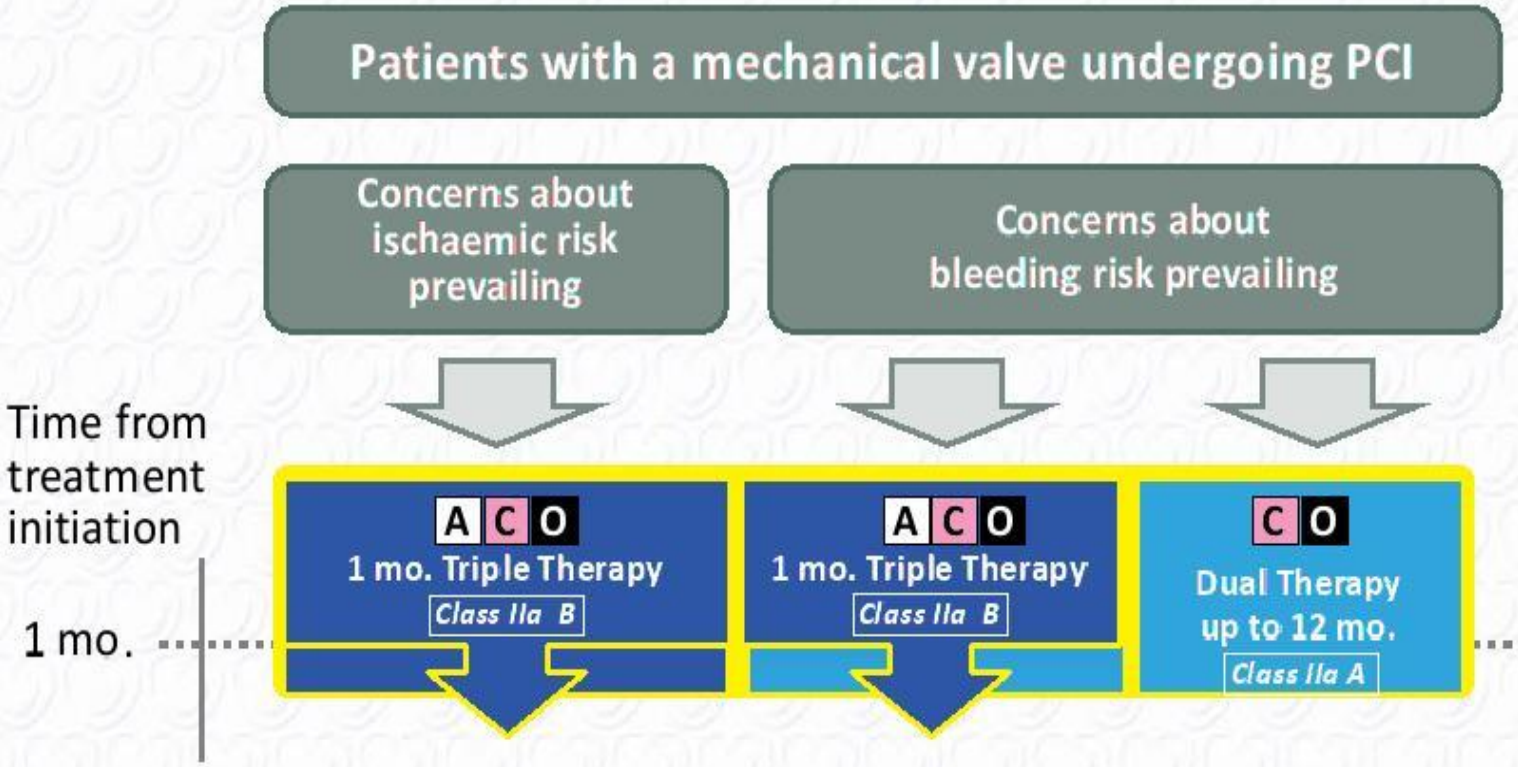
Antithrombotic therapy in patients with mechanical valve prosthesis after undergoing PCI

(Adapted from the 2017 ESC Focused Update on Dual Antiplatelet Therapy)



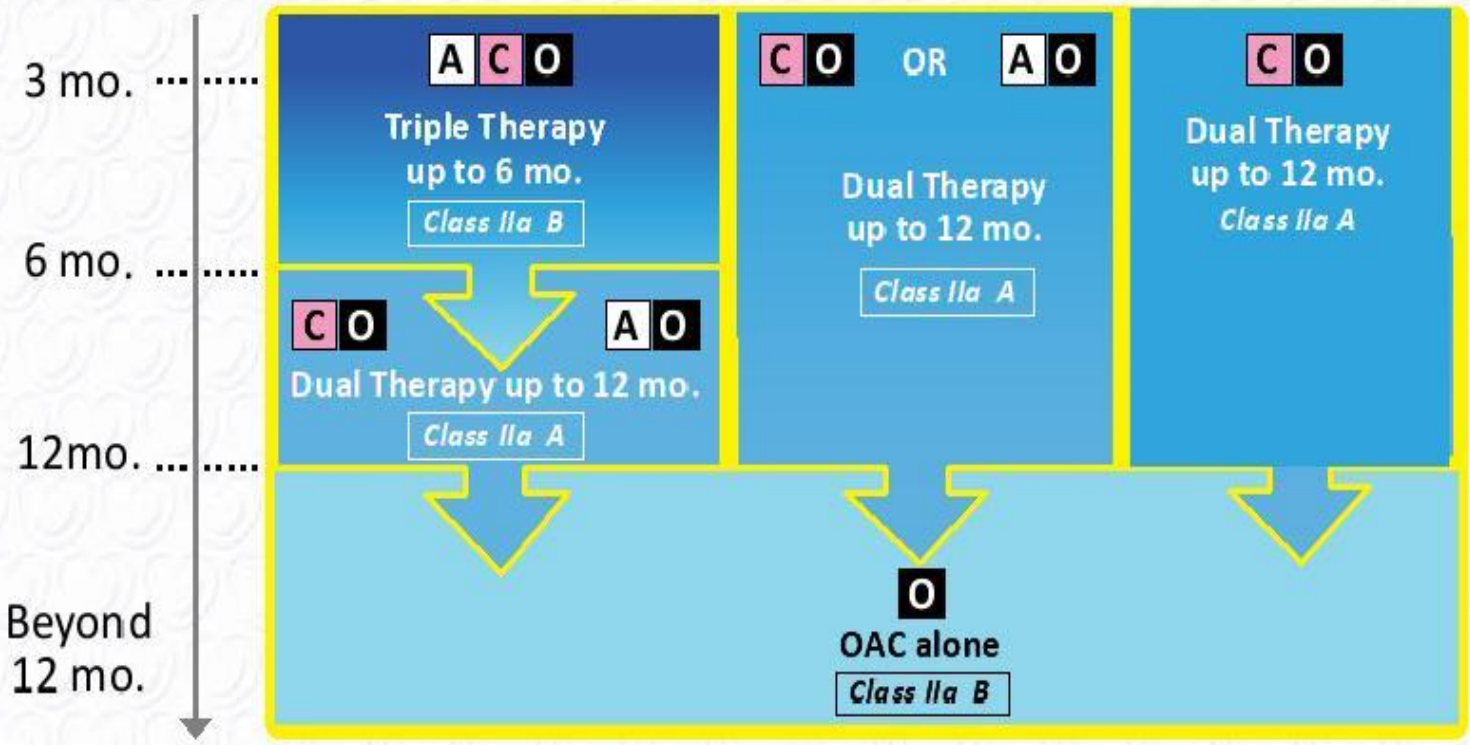
Antithrombotic therapy in patients with mechanical valve prosthesis after undergoing PCI

(Adapted from the 2017 ESC Focused Update on Dual Antiplatelet Therapy)



Antithrombotic therapy in patients with mechanical valve prosthesis after undergoing PCI *(continued)*

(Adapted from the 2017 ESC Focused Update on Dual Antiplatelet Therapy)



A = Aspirin C = Clopidogrel O = Oral anticoagulation with VKA

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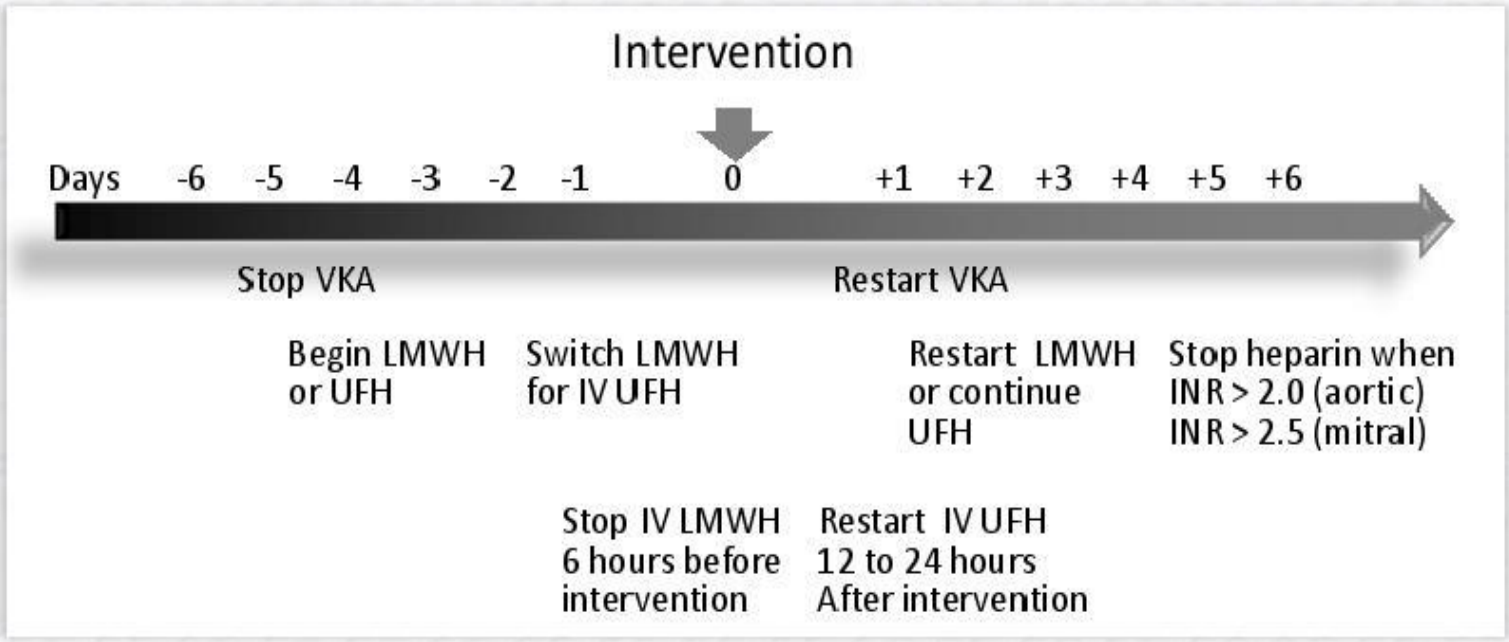
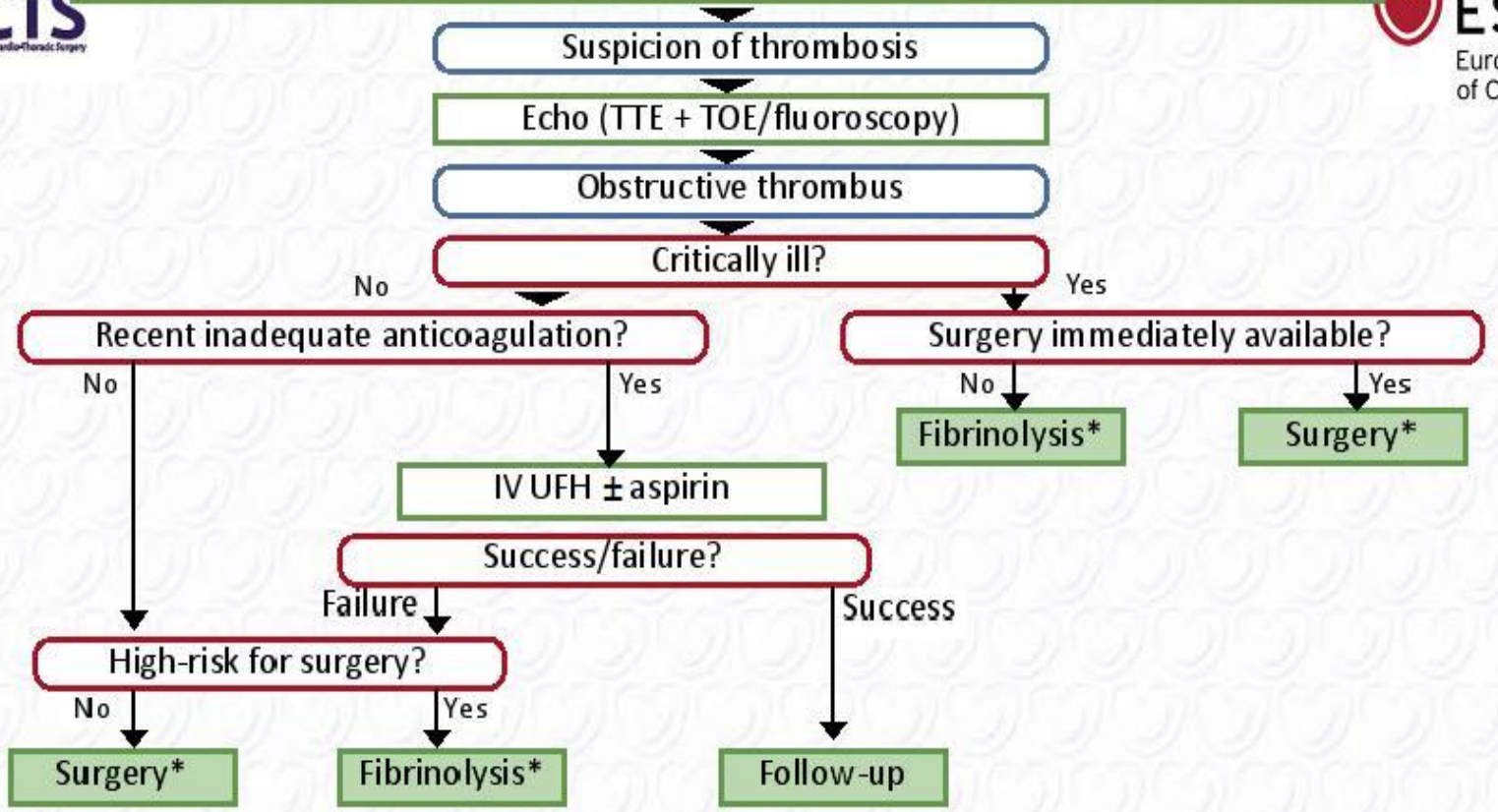
Main bridging steps for an intervention requiring interruption of oral anticoagulation in a patient with a mechanical prosthesis

(Reproduced with permission from Iung and Rodes-Cabau)



Timing should be individualized according to patient characteristics, actual INR, and the type of intervention

Management of left-sided obstructive mechanical prosthetic thrombosis



** Risk and benefits of both treatments should be individualized. The presence of a first-generation prosthesis is an incentive to surgery.*

Management of prosthetic valve dysfunction

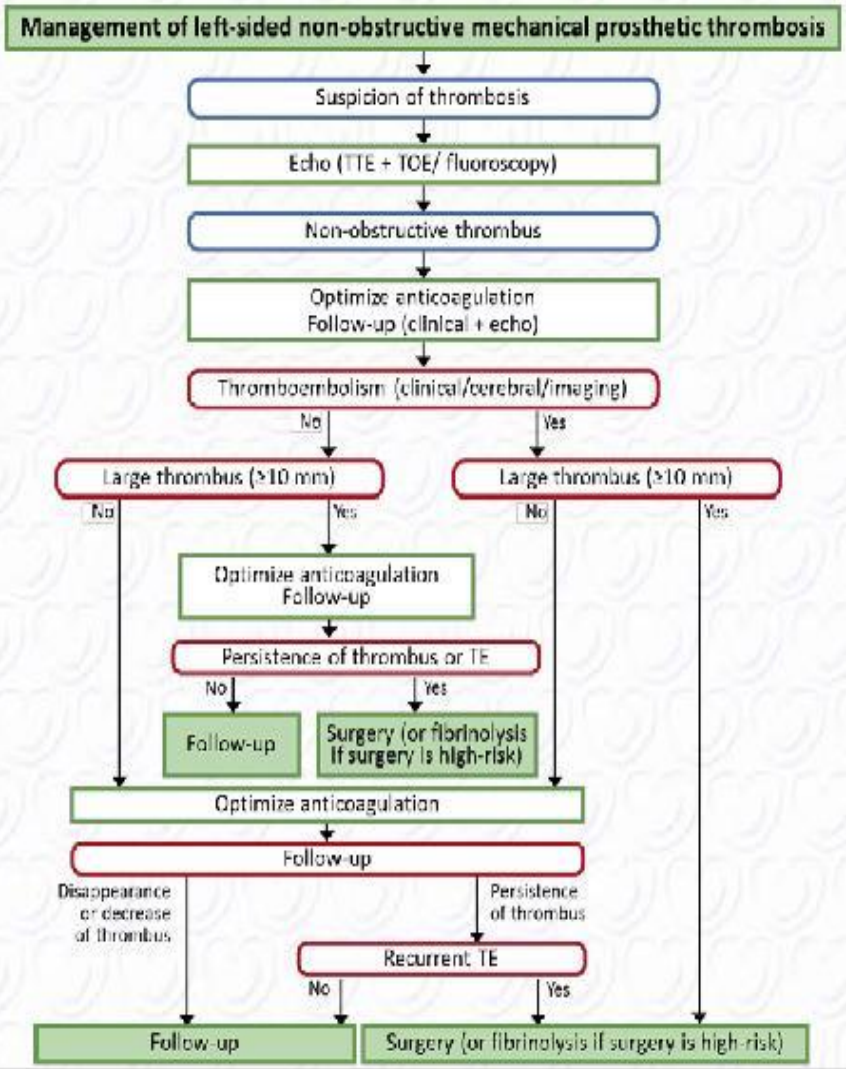
Recommendations	Class	Level
Mechanical prosthetic thrombosis		
Urgent or emergency valve replacement is recommended for obstructive thrombosis in critically ill patients without serious comorbidity.	I	C
Fibrinolysis (using recombinant tissue plasminogen activator 10 mg bolus + 90 mg in 90 minutes with UFH, or streptokinase 1,500,000 U in 60 minutes without UFH) should be considered when surgery is not available or is very high-risk, or for thrombosis of right-sided prostheses.	IIa	C
Surgery should be considered for large (>10 mm) non-obstructive prosthetic thrombus complicated by embolism.	IIa	C

Management of prosthetic valve dysfunction *(continued)*

Recommendations	Class	Level
Bioprosthetic thrombosis		
Anticoagulation using a VKA and/or UFH is recommended in bioprosthetic valve thrombosis before considering reintervention.	I	C
Haemolysis and paravalvular leak		
Reoperation is recommended if paravalvular leak is related to endocarditis or causes haemolysis requiring repeated blood transfusions or leading to severe symptoms.	I	C
Transcatheter closure may be considered for paravalvular leaks with clinically significant regurgitation in surgical high-risk patients (Heart Team decision).	IIb	C

Management of prosthetic valve dysfunction *(continued)*

Recommendations	Class	Level
Bioprosthetic failure		
Reoperation is recommended in symptomatic patients with a significant increase in transprosthetic gradient (after exclusion of valve thrombosis) or severe regurgitation.	I	C
Reoperation should be considered in asymptomatic patients with significant prosthetic dysfunction, if reoperation is at low-risk.	IIa	C
Transcatheter valve-in-valve implantation in aortic position should be considered by the Heart Team depending on the risk of reoperation and the type and size of prosthesis.	IIa	C



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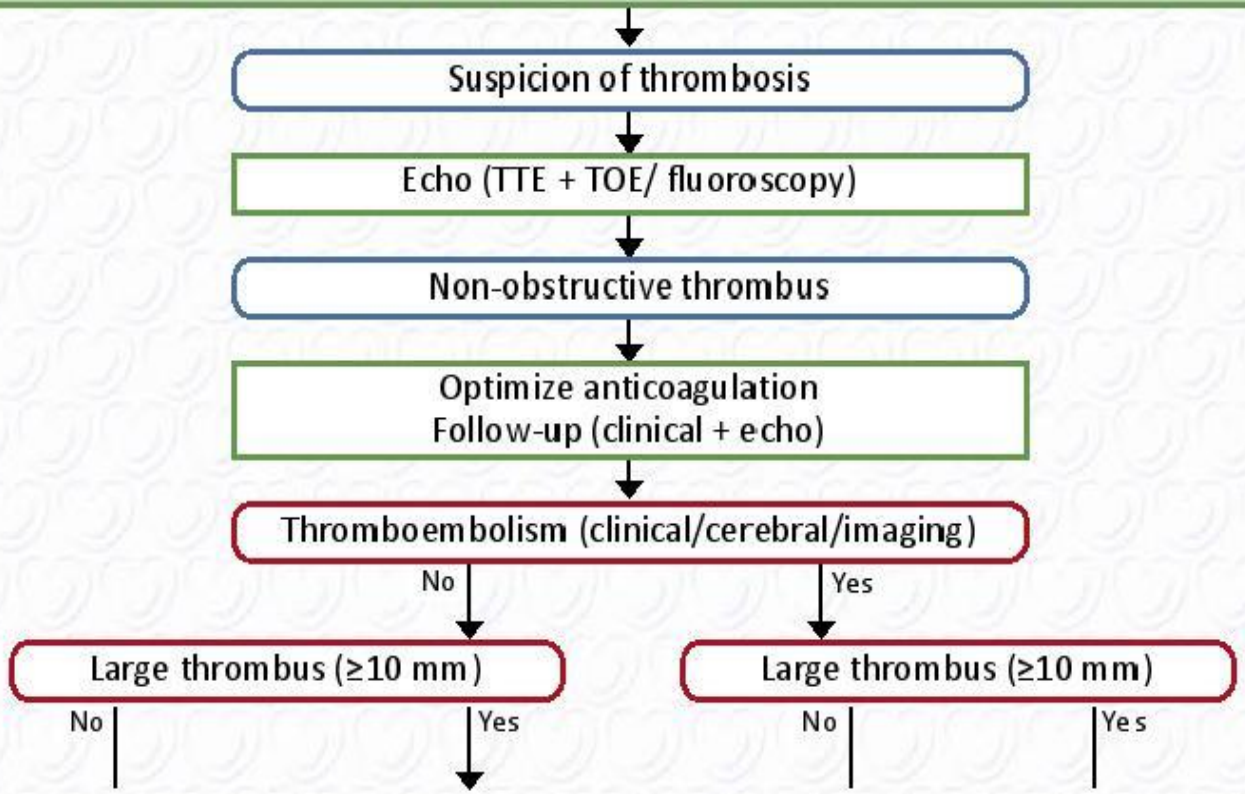
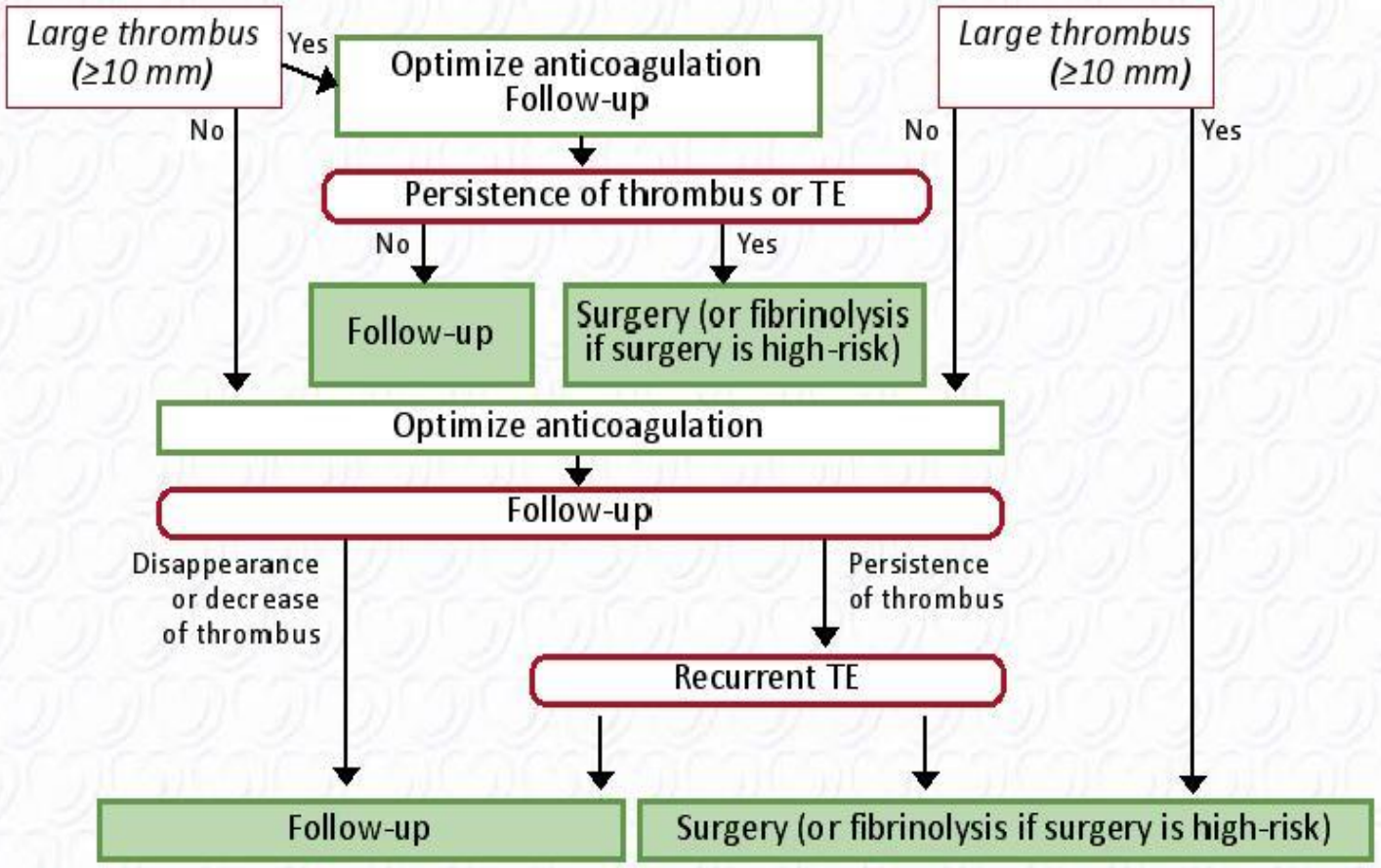
(European Heart Journal 2017 - doi:10.1093/eurheartj/ehx391)

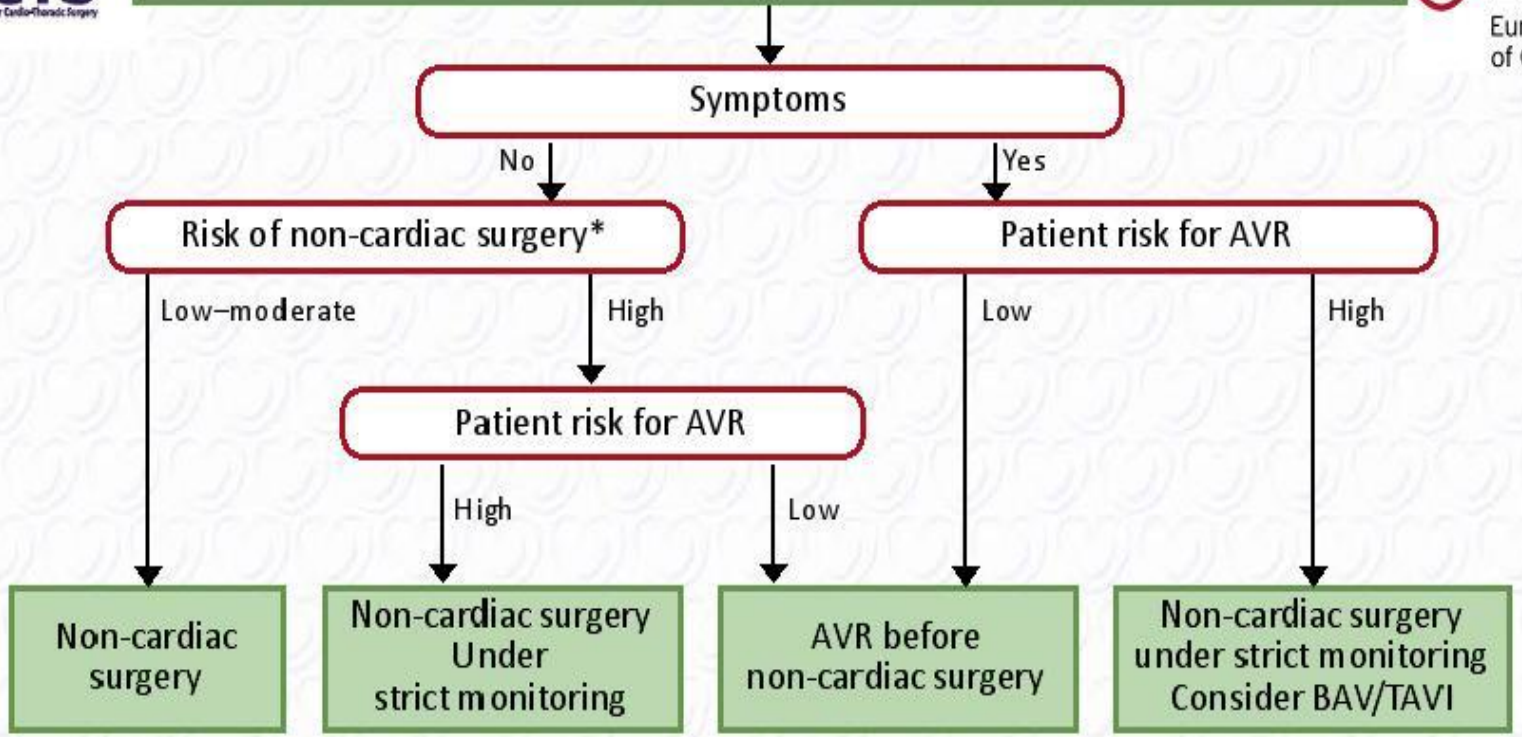
Management of left-sided non-obstructive mechanical prosthetic thrombosis



Management of left-sided non-obstructive mechanical prosthetic thrombosis *(continued)*



Management of severe AS and need for elective non-cardiac surgery



** Classification into the three groups according to the risk of cardiac complications (30-day death and myocardial infarction) for non-cardiac surgery: high-risk > 5%; intermediate-risk 1–5%; low-risk < 1%*

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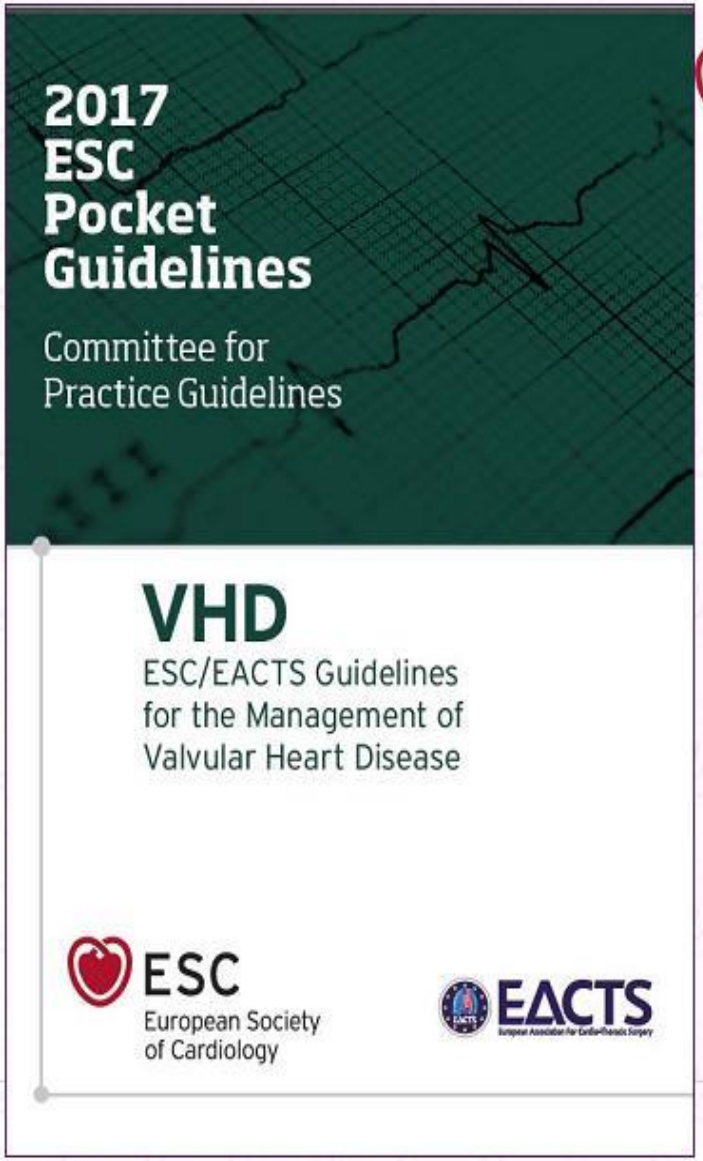

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