2016 ESC Guidelines for the management of atrial fibrillation

European Heart Journal - doi:10.1093/eurheartj/ehw210

EUROPEAN SOCIETY OF CARDIOLOGY®

2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS

The Task Force for the management of atrial fibrillation of the European Society of Cardiology (ESC)

Developed with the special contribution of the European Heart Rhythm Association (EHRA) of the ESC

Endorsed by the European Stroke Organisation (ESO)

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Guidelines Task Force and Reviewers

17 Task Force Members nominated by ESC and its associations and working groups (especially EHRA), EACTS, and ESO

- cardiologists with varying subspecialty expertise,
- cardiac surgeons,
- a stroke neurologist, and
- a specialist nurse

33 reviewers nominated by ESC, EACTS, and ESO

49 reviewers of Class I and Class III recommendations nominated by 49 National Cardiac Societies

The Committee for Practice Guidelines of the ESC

ESC = European Society of Cardiology
EACTS = European Association of Cardio-Thoracic Surgeons
ESO = European Stroke Organization

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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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ESC Class of recommendations

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

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Recommendations in the 2016 AF guidelines

The task force decided at the kick-off meeting that all recommendations would be voted upon after a structured discussion of the reasoning behind the proposed recommendation and the data underpinning it.

- Presentation of each chapter and its recommendations by the chapter coordinators during a 2 hour teleconference (17 conference calls)
- On line vote after the teleconference on each recommendation
- Discussion of voting outcomes at the next call and revote if needed

Only recommendations that had support of at least 75% of the task force were adopted into the guidelines.

Other topics are discussed in the text without recommendation.

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Systematic reviews in the 2016 AF guidelines

The task force commissioned three external systematic reviews to inform the 2016 ESC AF guidelines.

The formal voting process for recommendations seemed sufficiently robust in areas with a large evidence base.

The task force identified three areas of uncertainty where a systematic review would help to inform recommendations.

Three questions were defined in a PICOT format:

P - patients

I - intervention

C - comparator

O - outcome

T - time scale.

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Questions to be addressed by systematic reviews commissioned for the 2016 AF guidelines

1. **What is the advantage (if any) of interventional rhythm control therapy of persistent or long-standing persistent AF (catheter ablation, surgical ablation) versus the standard of care, i.e. cardioversion and antiarrhythmic drug therapy?**
2. **What is the stroke rate and the ischemic stroke rate in patients with one CHA_2DS_2-VASc factor (CHA_2DS_2VASc = 1 for men and 2 for women) with and without oral anticoagulation?**
3. **What are the risks and benefits of concomitant AF surgery for patients undergoing cardiac surgery?**

The systematic reviews commissioned to answer these questions informed recommendations in the guidelines. The summary of the systematic reviews can be found in references 1039-1041 in the ESC AF guidelines full text (link below) and in Figures 2-3 / Table 1 in the Web Addenda.

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Cardiovascular morbidity and mortality associated with atrial fibrillation

Event	Association with AF
Death	Increased mortality, especially cardiovascular mortality due to sudden death, heart failure or stroke.
Stroke	20–30% of all strokes are due to AF. A growing number of patients with stroke are diagnosed with 'silent', paroxysmal AF.
Hospitalizations	10–40% of AF patients are hospitalized every year.
Quality of life	Quality of life is impaired in AF patients independent of other cardiovascular conditions.
Left ventricular dysfunction and heart failure	Left ventricular dysfunction is found in 20–30% of all AF patients. AF causes or aggravates LV dysfunction in many AF patients, while others have completely preserved LV function despite long-standing AF.
Cognitive decline and vascular dementia	Cognitive decline and vascular dementia can develop even in anticoagulated AF patients. Brain white matter lesions are more common in AF patients than in patients without AF.

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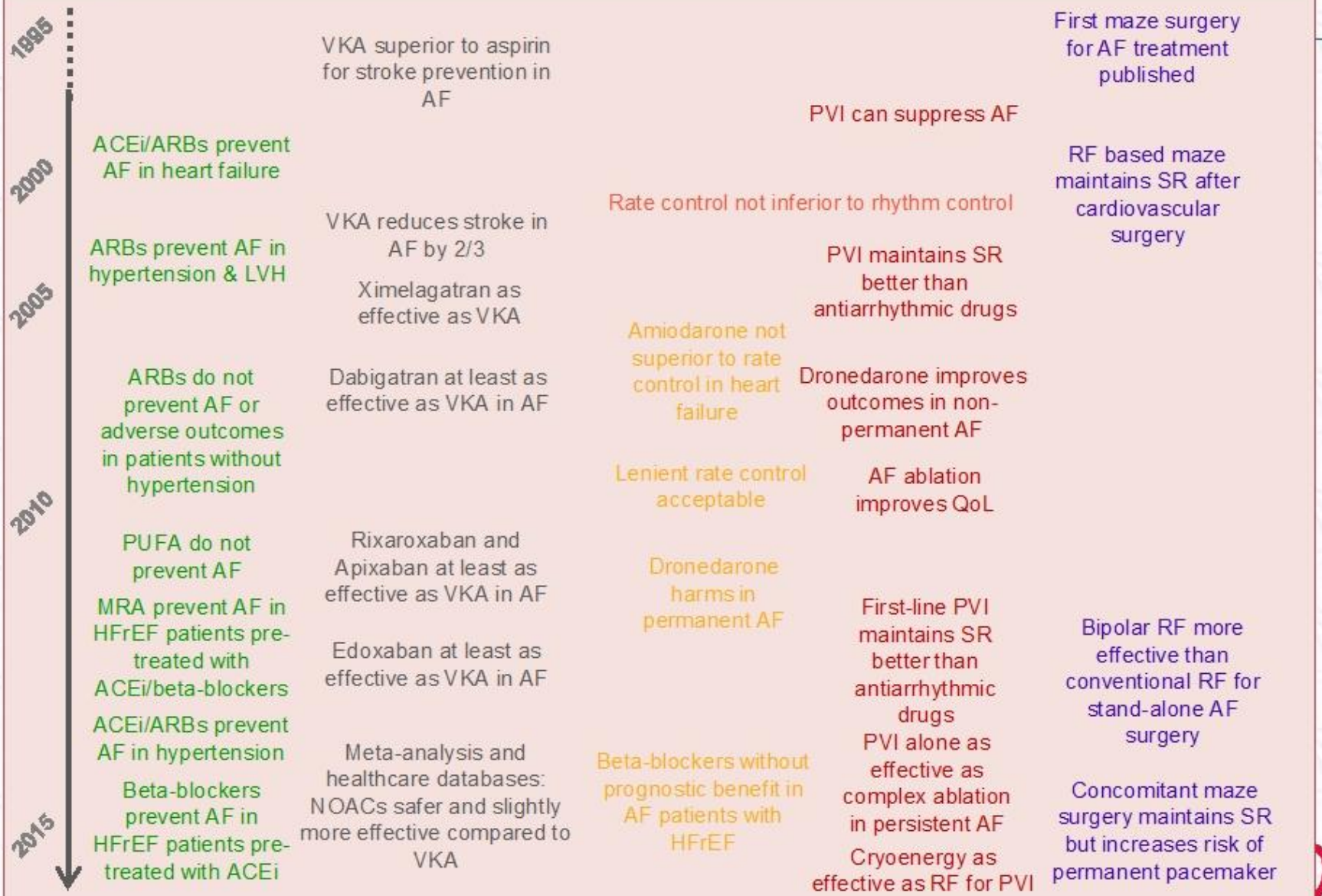
Timeline of findings from landmark trials in AF



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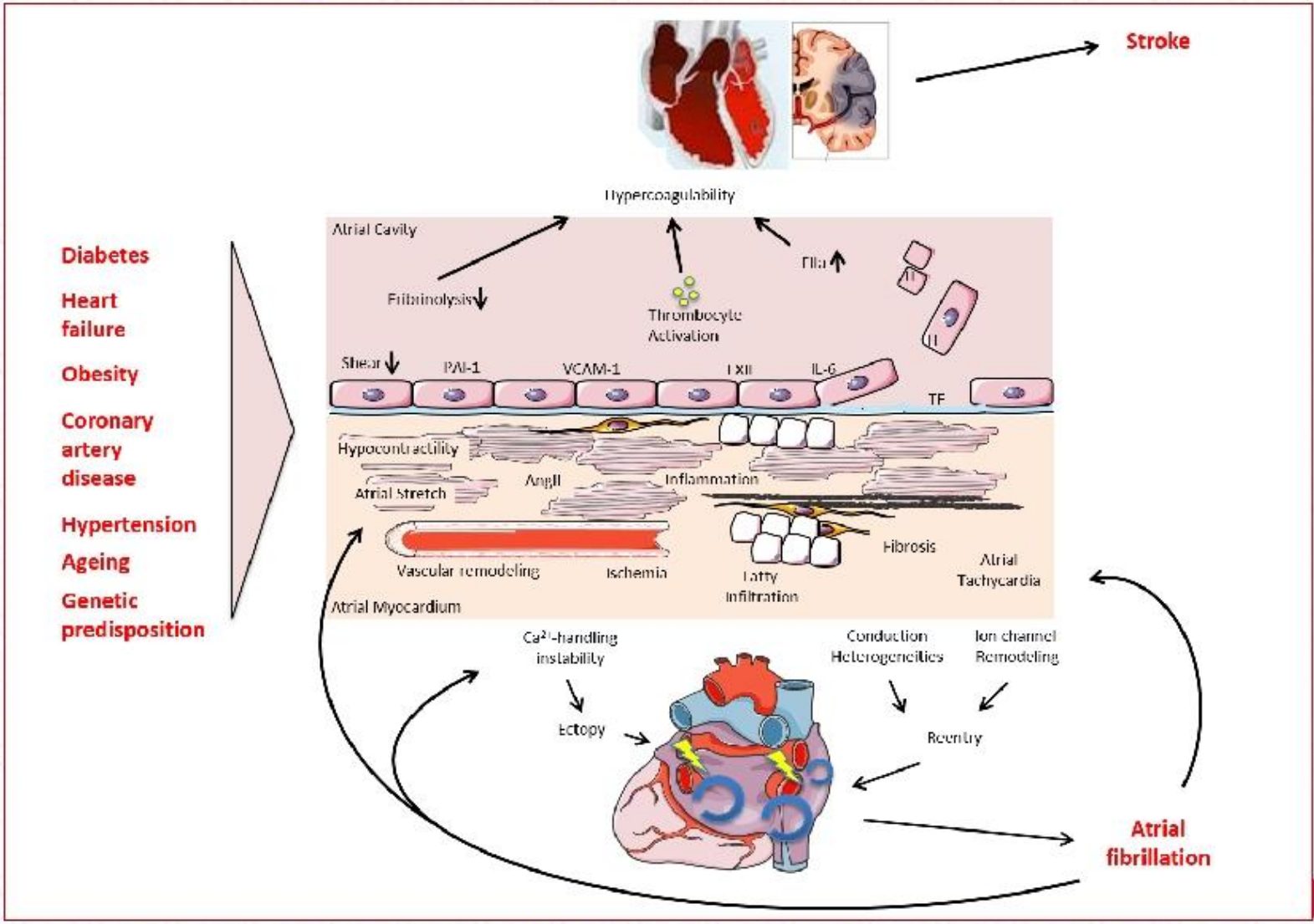
Major mechanisms causing atrial fibrillation to consider when deciding on management



AngII = angiotensin II; TF = tissue factor; FXII = factor XII; IL-6 = interleukin 6; PAI-1 = plasminogen activator inhibitor 1; VCAM-1 = vascular cell adhesion molecule 1.

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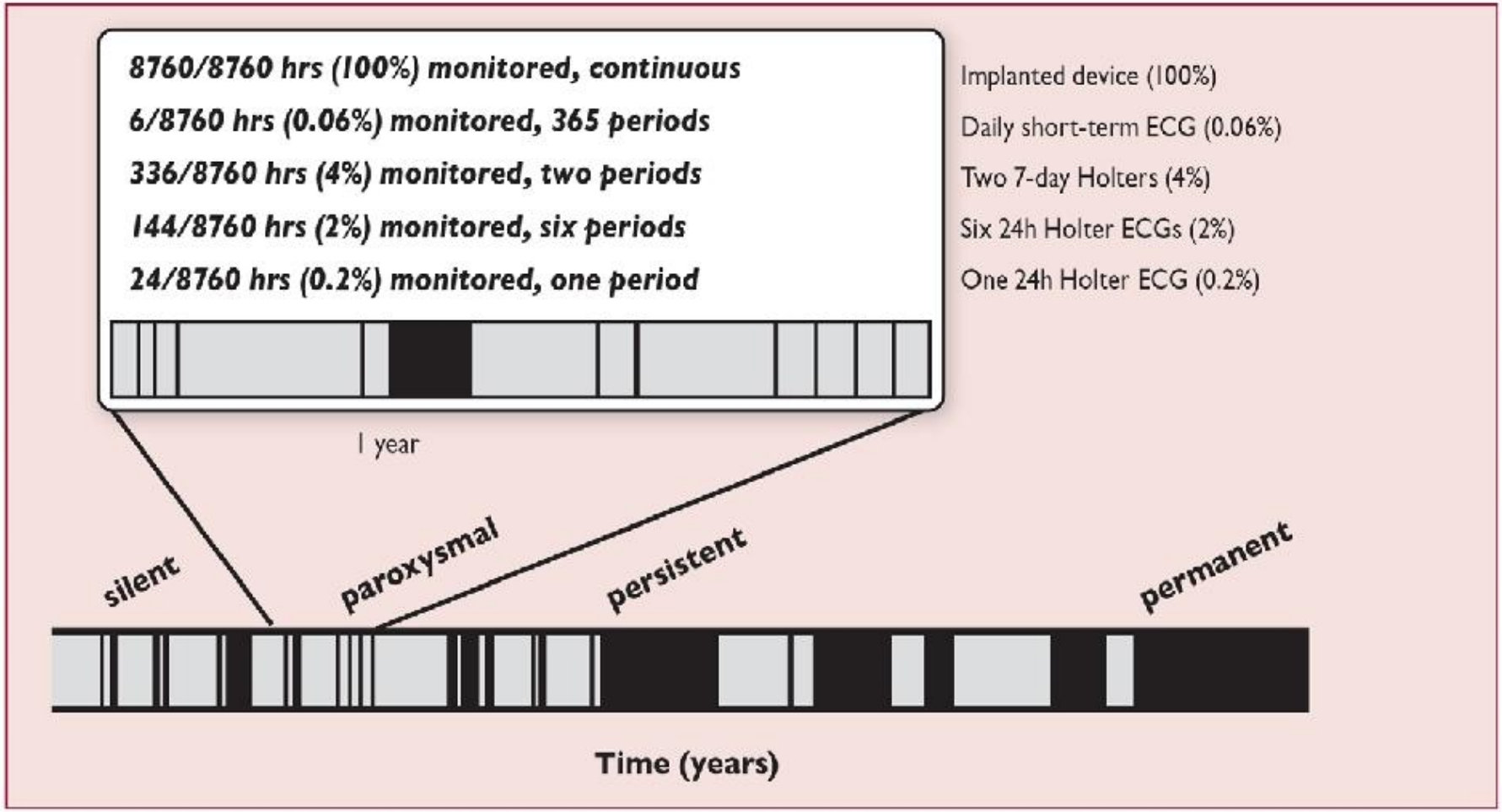
Diagnostic yield of different ECG screening techniques for paroxysmal or silent atrial fibrillation



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Screening for atrial fibrillation

Recommendations	Class	Level
Opportunistic screening for AF is recommended by pulse taking or ECG rhythm strip in patients >65 years of age.	I	B
In patients with TIA or ischaemic stroke, screening for AF is recommended by short-term ECG recording followed by continuous ECG monitoring for at least 72 hours.	I	B
It is recommended to interrogate pacemakers and ICDs on a regular basis for atrial high rate episodes (AHRE). Patients with AHRE should undergo further ECG monitoring to document AF before initiating AF therapy.	I	B
In stroke patients, additional ECG monitoring by long-term non-invasive ECG monitors or implanted loop recorders should be considered to document silent atrial fibrillation.	IIa	B
Systematic ECG screening may be considered to detect AF in patients aged >75 years, or those at high stroke risk.	IIb	B

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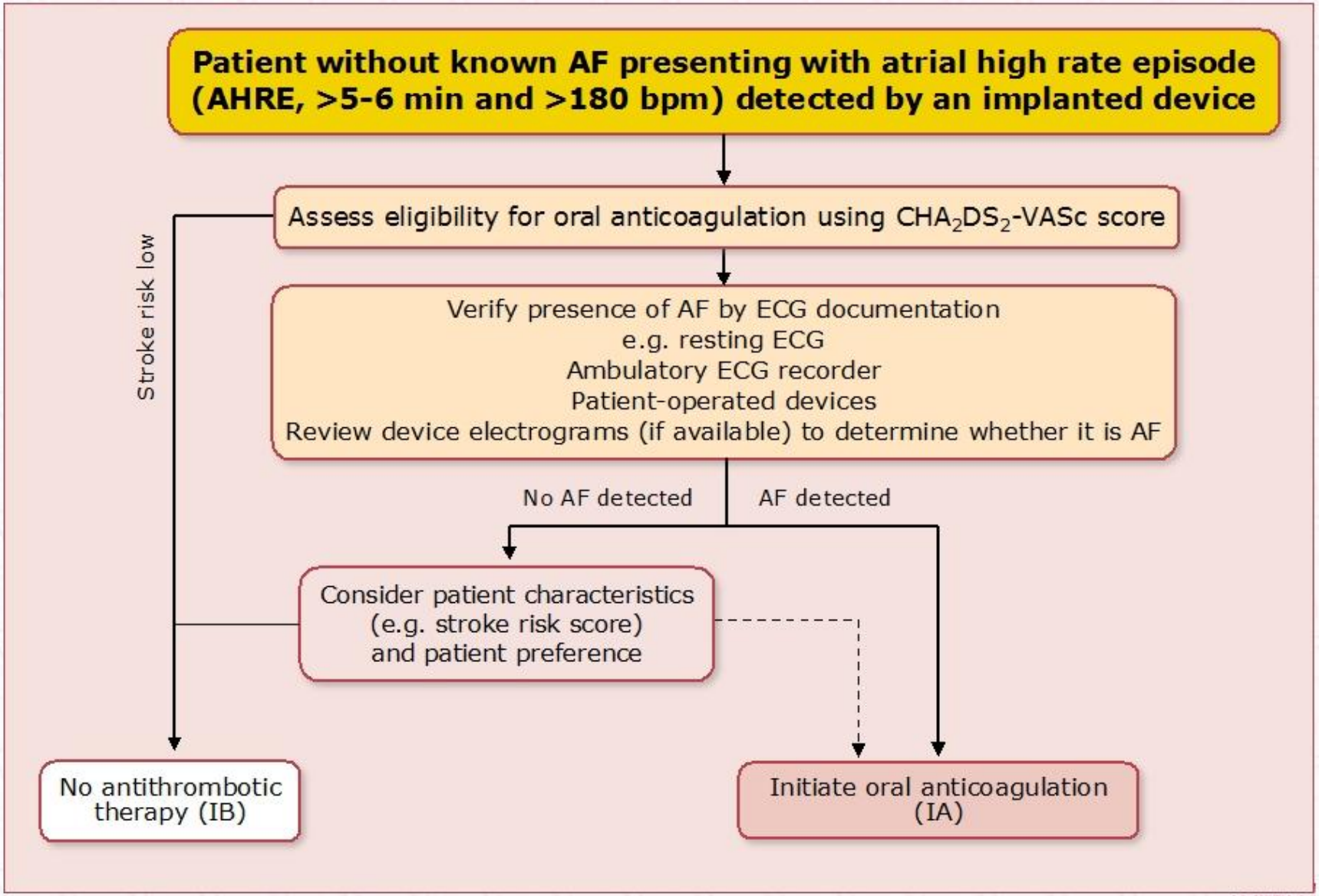
Management of atrial high rate episodes detected by an implanted device



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Patterns of atrial fibrillation

AF pattern	Definition
First diagnosed AF	AF that has not been diagnosed before, irrespective of the duration of the arrhythmia or the presence and severity of AF-related symptoms.
Paroxysmal AF	Self-terminating, in most cases within 48 hours. Some AF paroxysms may continue for up to 7 days. AF episodes that are cardioverted within 7 days should be considered paroxysmal.
Persistent AF	AF that lasts longer than 7 days, including episodes that are terminated by cardioversion, either with drugs or by direct current cardioversion, after 7 days or more.
Long-standing persistent AF	Continuous AF lasting for ≥1 year when it is decided to adopt a rhythm control strategy.
Permanent AF	AF that is accepted by the patient (and physician). Hence, rhythm control interventions are, by definition, not pursued in patients with permanent AF. Should a rhythm control strategy be adopted, the arrhythmia would be re-classified as 'long-standing persistent AF'.

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Clinical types of atrial fibrillation

AF type	Clinical presentation	Possible pathophysiology
AF secondary to structural heart disease	AF in patients with systolic/diastolic dysfunction, or structural disease.	Structural remodelling; activation of autonomic/renin-angiotensin system.
Focal AF	Patients with coarse paroxysmal AF; often highly symptomatic and younger.	Localized triggers, in most cases originating from pulmonary veins.
Polygenic AF	Common gene variants associated with early onset AF.	Currently under study.
Postoperative AF	New onset after major (typically cardiac) surgery.	Acute perioperative factors and pre-existing substrate for AF.
AF with mitral stenosis or prosthetic valves	AF in patients with mitral stenosis, mitral valve surgery and other valvular disease.	Left atrial pressure (stenosis) and volume (regurgitation) load.
AF in athletes	Usually paroxysmal, related to duration/intensity of training.	Increased vagal tone and atrial volume.
Monogenic AF	AF in inherited cardiomyopathies and channelopathies.	Arrhythmogenic mechanisms responsible for sudden death.

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Modified European Heart Rhythm Association (EHRA) symptom scale

Recommendations	Class	Level
Use of the modified EHRA symptom scale is recommended in clinical practice and research studies to quantify AF-related symptoms.	I	C

Modified EHRA score	Symptoms	Description
1	None	AF does not cause any symptoms.
2a	Mild	Normal daily activity not affected by symptoms related to AF.
2b	Moderate	Normal daily activity not affected by symptoms related to AF, but patient troubled by symptoms.
3	Severe	Normal daily activity affected by symptoms related to AF.
4	Disabling	Normal daily activity discontinued.

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Cardiovascular and other conditions independently associated with atrial fibrillation (1)

Characteristic/comorbidity	Association with AF
Genetic predisposition (based on multiple common gene variants associated with AF)	HR range 0.4–3.2
Older age 50-59 years 60-69 years 70-79 years 80-89 years	HR: 1.00 (reference) 4.98 (95% CI 3.49–7.10) 7.35 (95% CI 5.28–10.2) 9.33 (95% CI 6.68–13.0)
Hypertension (treated) vs. none	HR 1.32 (95% CI 1.08–1.60)
Heart failure vs. none	HR 1.43 (95% CI 0.85–2.40)
Valvular heart disease vs. none	RR 2.42 (95% CI 1.62–3.60)
Myocardial infarction vs. none	HR 1.46 (95% CI 1.07–1.98)
Thyroid dysfunction Hypothyroidism Subclinical hyperthyroidism Overt hyperthyroidism	(reference: euthyroid) HR 1.23 (95% CI 0.77–1.97) RR 1.31 (95% CI 1.19–1.44) RR 1.42 (95% CI 1.22–1.63)
Obesity (body mass index) None (<25 kg/m²) Overweight (25–30 kg/m²) Obese (≥31 kg/m²)	HR: 1.00 (reference) 1.13 (95% CI 0.87–1.46) 1.37 (95% CI 1.05–1.78)
Diabetes mellitus vs. none	HR 1.25 (95% CI 0.98–1.60)

HR = hazard ratio; RR = risk ratio

Continued on next slide

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Cardiovascular and other conditions independently associated with atrial fibrillation (2)

Characteristic/comorbidity	Association with AF
Chronic obstructive pulmonary disease FEV1 ≥80% FEV1 60–80% FEV1 <60%	RR: 1.00 (reference) 1.28 (95% CI 0.79–2.06) 2.53 (95% CI 1.45–4.42)
Obstructive sleep apnoea vs. none	HR 2.18 (95% CI 1.34–3.54)
Chronic kidney disease None Stage 1 or 2 Stage 3 Stage 4 or 5	OR: 1.00 (reference) 2.67 (95% CI 2.04–3.48) 1.68 (95% CI 1.26–2.24) 3.52 (95% CI 1.73–7.15)
Smoking Never Former Current	HR: 1.00 (reference) 1.32 (95% CI 1.10–1.57) 2.05 (95% CI 1.71–2.47)
Alcohol consumption None 1– 6 drinks/week 7–14 drinks/week 15–21 drinks/week >21 drinks/week	RR: 1.00 (reference) 1.01 (95% CI 0.94–1.09) 1.07 (95% CI 0.98–1.17) 1.14 (95% CI 1.01–1.28) 1.39 (95% CI 1.22–1.58)
Habitual vigorous exercise Non-exercisers <1 day/week 1–2 days/week 3–4 days/week 5–7 days/week	RR: 1.00 (reference) 0.90 (95% CI 0.68–1.20) 1.09 (95% CI 0.95–1.26) 1.04 (95% CI 0.91–1.19) 1.20 (95% CI 1.02–1.41)

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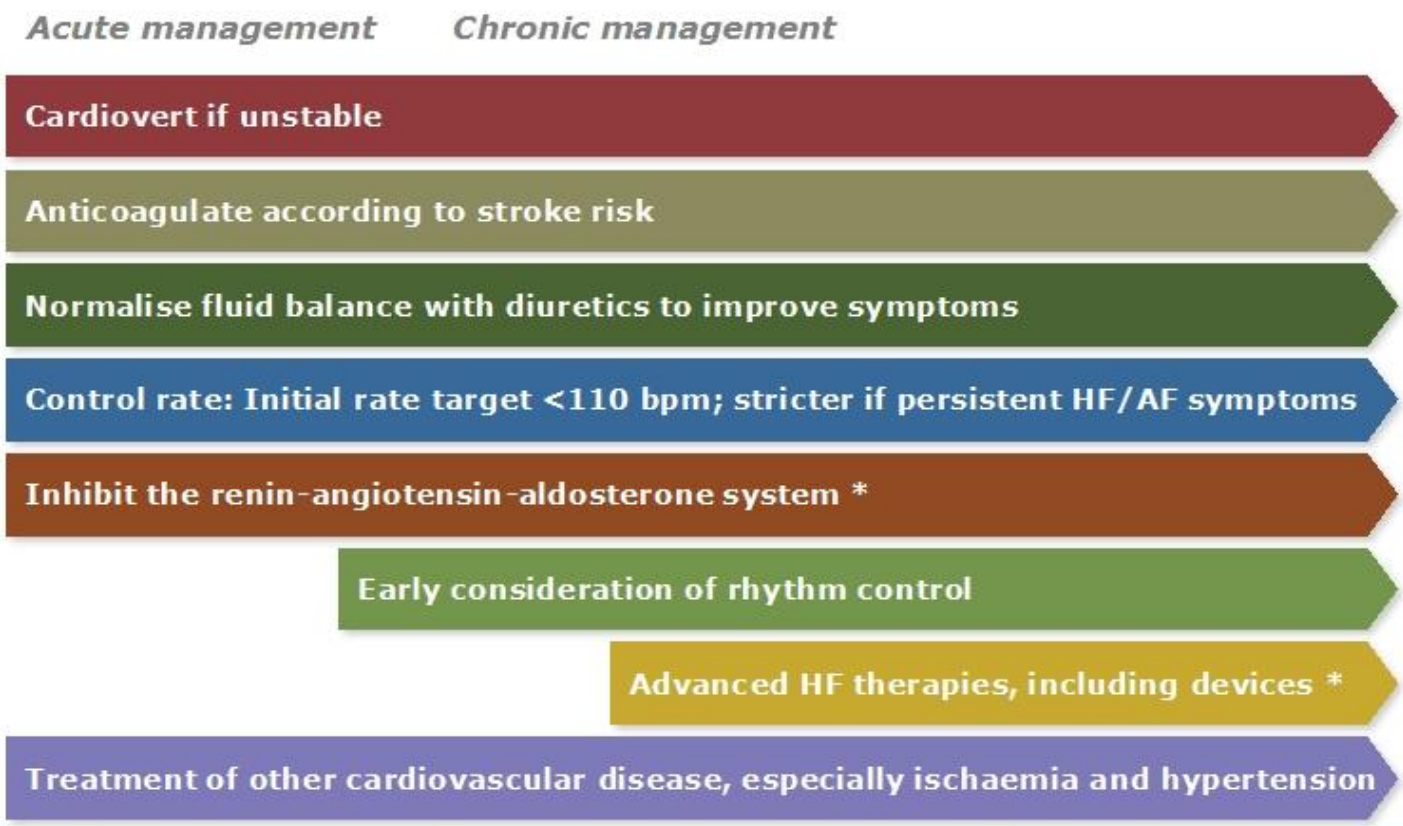
Initial management of patients presenting acutely with atrial fibrillation and heart failure



* In patients with heart failure and reduced ejection fraction.

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Atrial fibrillation triggering surgical or interventional therapy of valvular heart disease

Recommendations	Class	Level
Early mitral valve surgery should be considered in severe mitral regurgitation, preserved LV function, and new-onset AF, even in the absence of symptoms, particularly when valve repair is feasible.	IIa	C
Mitral valvulotomy should be considered for asymptomatic patients with severe mitral stenosis and suitable valve anatomy who have new-onset AF.	IIa	C

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Weight reduction in patients with atrial fibrillation

Recommendations	Class	Level
In obese patients with AF, weight loss together with management of other risk factors should be considered to reduce AF burden and symptoms.	IIa	B

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Management of respiratory diseases in patients with atrial fibrillation

Recommendations	Class	Level
Correction of hypoxaemia and acidosis should be considered as initial management for patients who develop AF during an acute pulmonary illness or exacerbation of chronic pulmonary disease.	IIa	C
Interrogation for clinical signs of obstructive sleep apnoea should be considered in all AF patients.	IIa	B
Obstructive sleep apnoea treatment should be optimized to reduce AF recurrences and improve AF treatment results.	IIa	B

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Assessment of kidney function in atrial fibrillation

Recommendations	Class	Level
The assessment of kidney function by serum creatinine or creatinine clearance is recommended in all AF patients to detect kidney disease and to support correct dosing of AF therapy.	I	A
All AF patients treated with oral anticoagulation should be considered for at least yearly renal function evaluation to detect chronic kidney disease.	IIa	B

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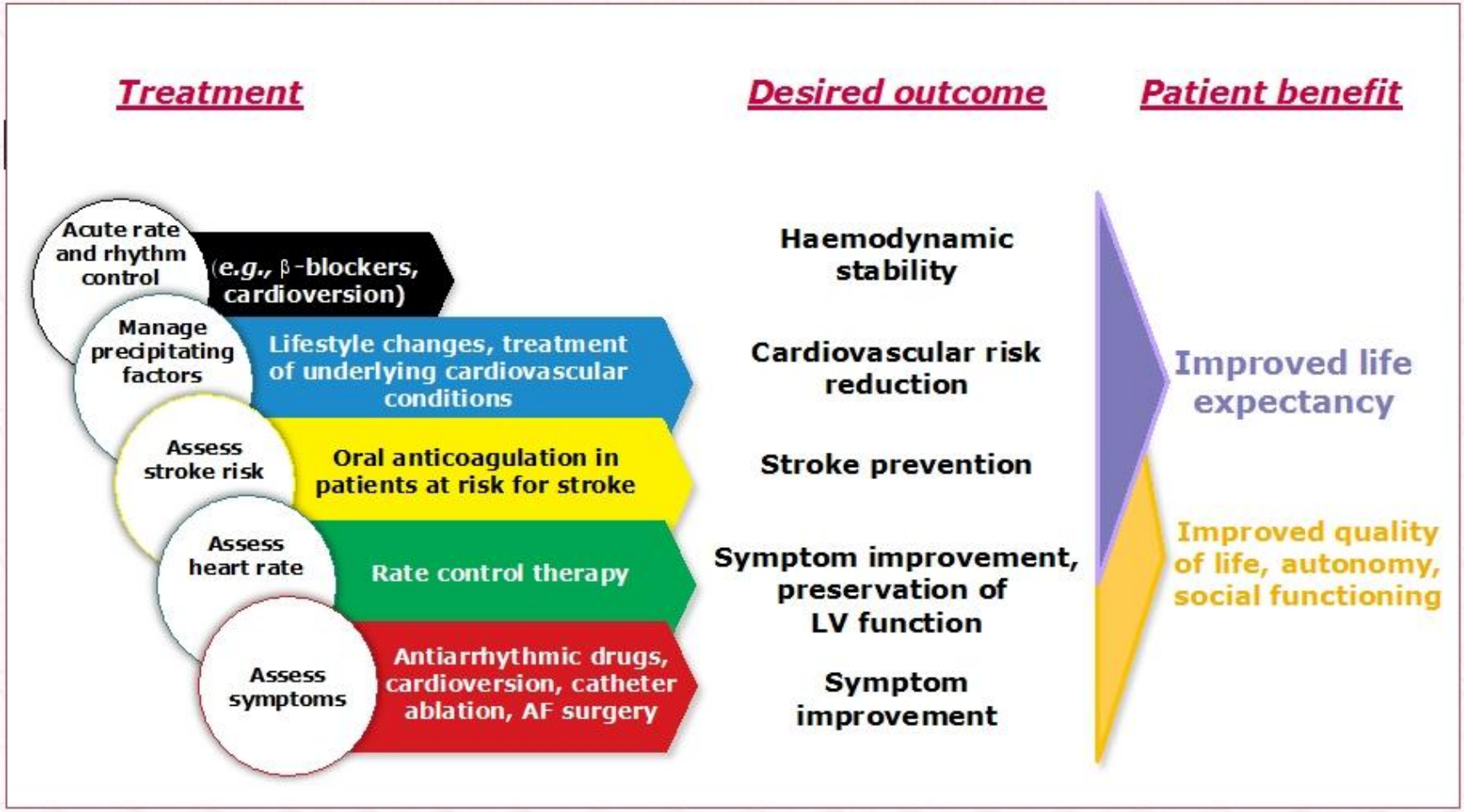
The Five Domains of Integrated AF Management



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Clinical signs calling for urgent involvement of a specialized Atrial Fibrillation service

Clinical conditions
Haemodynamic instability.
Uncontrollable heart rate.
Symptomatic bradycardia not amenable to reduction of rate control agents.
Severe angina or worsening left ventricular function.
Transient ischaemic attack or stroke.

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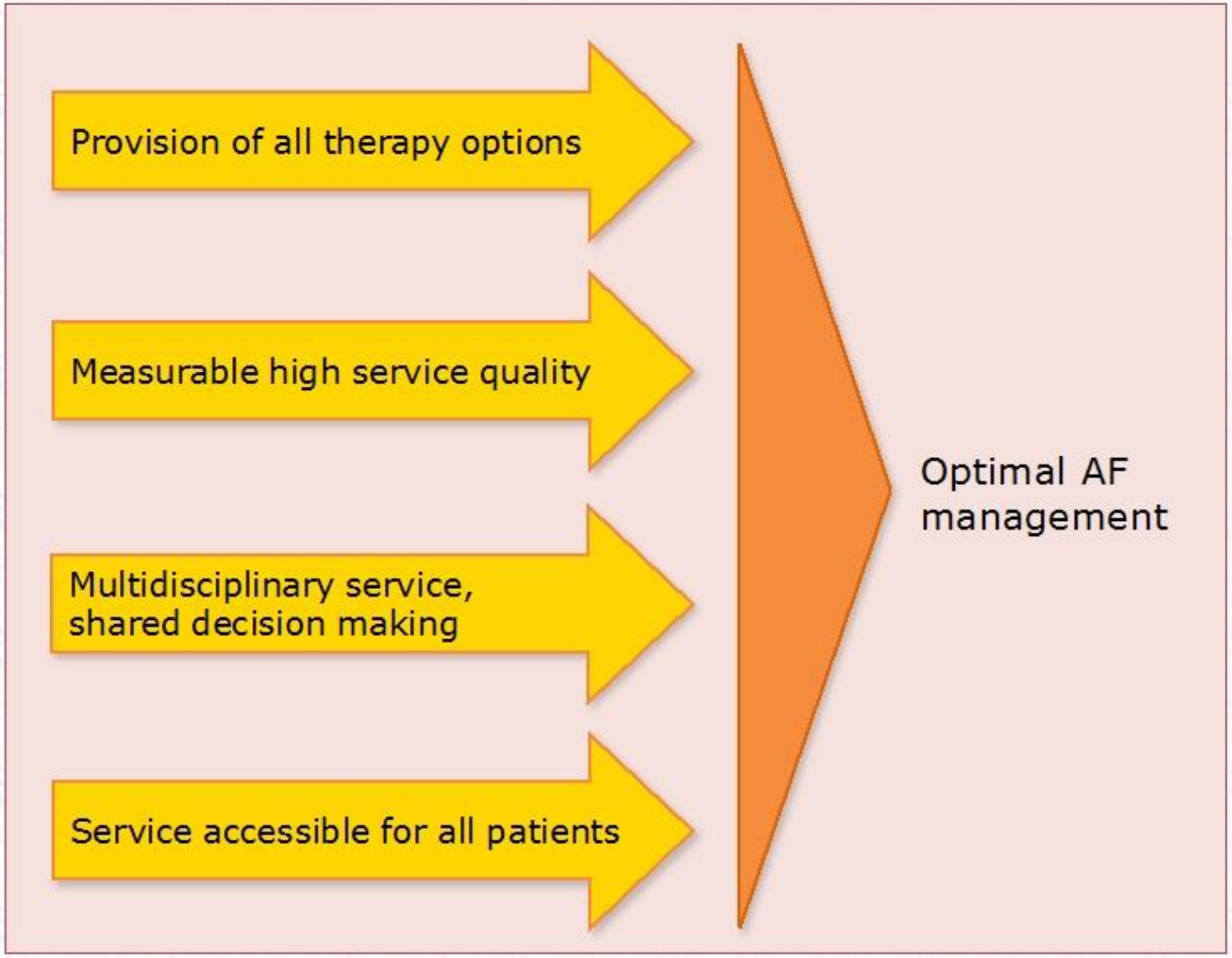
Achieving optimal management of atrial fibrillation patients



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Providing integrated care for AF patients

Integrated AF management			
Patient involvement	**Multidisciplinary teams**	**Technology tools**	**Access to all treatment options for AF**
• Central role in care process. • Patient education. • Encouragement and empowerment for self-management. • Advice and education on lifestyle and risk factor management. • Shared decision making. • ***Informed, involved, empowered patient.***	• Physicians (general physicians, cardiology and stroke AF specialists, surgeons) and allied health professionals work in a collaborative practice model. • Efficient mix of communication skills, education, and experience. • ***Working together in a multi-disciplinary chronic AF care team.***	• Information on AF. • Clinical decision support. • Checklist and communication tools • Used by healthcare professionals and patients. • Monitoring of therapy adherence and effectiveness. • ***Navigation system to support decision making in treatment team.***	• Structured support for lifestyle changes. • Anticoagulation. • Rate control. • Antiarrhythmic drugs. • Catheter and surgical interventions (ablation, LAA occluder, AF surgery, etc.). • ***Complex management decisions underpinned by an AF Heart Team***

To support integrated AF care, the ESC Guidelines task force and the CATCH ME consortium (www.catch-me.info) have developed state-of-the-art interactive tools underpinning integrated AF management. A first version including an overall treatment manager is integrated into the AF section of the ESC pocket guidelines app. Further CATCH ME tools for healthcare professionals and an associated app for AF patients will be released in late 2016 / early 2017.

CATCH ME is supported by the European Union grant agreement No 633196 [CATCH ME].

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Providing integrated care for AF patients

Recommendations	Class	Level
An integrated approach with structured organization of care and follow-up should be considered in all patients with AF, aiming to improve guideline adherence and to reduce hospitalizations and mortality.	IIa	B
Placing patients in a central role in decision-making should be considered in order to tailor management to patient preferences and improve adherence to long-term therapy.	IIa	C

To support integrated AF care, the ESC Guidelines task force and the CATCH ME consortium (www.catch-me.info) have developed state-of-the-art interactive tools underpinning integrated AF management. A first version including an overall treatment manager is integrated into the AF section of the ESC pocket guidelines app. Further CATCH ME tools for healthcare professionals and an associated app for AF patients will be released in late 2016 / early 2017.
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Diagnostic workup of atrial fibrillation patients

Recommendations	Class	Level
ECG documentation is required to establish the diagnosis of AF.	I	B
A full cardiovascular evaluation, including an accurate history, careful clinical examination, and assessment of concomitant conditions, is recommended in all AF patients.	I	C
Transthoracic echocardiography is recommended in all AF patients to guide management.	I	C
Long-term ECG monitoring should be considered in selected patients to assess the adequacy of rate control in symptomatic patients and to relate symptoms with AF episodes.	IIa	C

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Goal-based follow-up

Category	Intervention	Follow-up aspects	Performance indicator (examples)
Prognostic	Comorbidity control (relevant examples given)	Obesity Arterial hypertension Heart failure Coronary artery disease Diabetes Valvular heart disease	Weight loss Blood pressure control Heart failure therapy and hospitalizations Statin and antiplatelet therapy; revascularization Glycaemic control Valve repair or replacement
Prognostic	Anticoagulation	Indication (risk profile; timing, e.g. post-cardioversion). Adherence (NOAC or VKA) and INR (if VKA). NOAC dosing (co-medications; age; weight; renal function).	Stroke Bleeding Mortality
Mainly symptomatic Partly prognostic	Rate control	Symptoms Average resting heart rate <110 bpm	Modified EHRA score Heart failure status LV function Exercise capacity Hospitalization Therapy complications
Symptomatic at present	Rhythm control	Symptoms vs. side effects Exclusion of pro-arrhythmia (PR; QRS; QTc interval)	
Relevant for implementation of therapy and adherence	Patient education and self-care capabilities	Knowledge (about disease; about treatment; about management goals) Capabilities (what to do if…)	Adherence to therapy Directed evaluation, preferably based on systematic checklists
Relevant for chronic care management	Caregiver involvement	Who? (spouse; GP; home nurse; pharmacist) Clearly spelling out participation roles Knowledge and capabilities	Directed evaluation of task performance (e.g. via patient card) Dispensed medication Log of follow-up visits

Prediction of stroke and bleeding risk

Recommendations	Class	Level
The CHA_2DS_2-VASc score is recommended for stroke risk prediction in patients with AF.	I	A
Bleeding risk scores should be considered in AF patients on oral anticoagulation to identify modifiable risk factors for major bleeding.	IIa	B
Biomarkers such as high-sensitivity troponin and natriuretic peptide may be considered to further refine stroke and bleeding risk in AF patients.	IIb	B

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Clinical risk factors for stroke, transient ischaemic attack, and systemic embolism

CHA_2DS_2-VASc risk factor	Points
Congestive heart failure Signs/symptoms of heart failure or objective evidence of reduced left-ventricular ejection fraction	1
Hypertension Resting blood pressure >140/90 mmHg on at least two occasions or current antihypertensive treatment	1
Age 75 years or older	2
Diabetes mellitus Fasting glucose >125 mg/dL (7 mmol/L) or treatment with oral hypoglycaemic agent and/or insulin	1
Previous stroke, transient ischaemic attack, or thromboembolism	2
Vascular disease Previous myocardial infarction, peripheral artery disease, or aortic plaque	1
Age 65–74 years	1
Sex category (female)	1

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Modifiable risk factors for bleeding in anticoagulated patients with atrial fibrillation

Modifiable bleeding risk factors:
Hypertension (especially when systolic blood pressure is >160 mmHg)
Labile INR or time in therapeutic range <60% in patients on vitamin K antagonists
Medication predisposing to bleeding, such as antiplatelet drugs and non-steroidal anti-inflammatory drugs
Excess alcohol (≥8 drinks/week)

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Modifiable and non-modifiable risk factors for bleeding in anticoagulated patients with AF

Modifiable bleeding risk factors:
Hypertension (especially when systolic blood pressure is >160 mmHg)
Labile INR or time in therapeutic range <60% in patients on vitamin K antagonists
Medication predisposing to bleeding, such as antiplatelet drugs and non-steroidal anti-inflammatory drugs
Excess alcohol (≥8 drinks/week)
Potentially modifiable bleeding risk factors:
Anaemia
Impaired renal function
Impaired liver function
Reduced platelet count or function

Non-modifiable bleeding risk factors:
Age (>65 years) (≥75 years)
History of major bleeding
Previous stroke
Dialysis-dependent kidney disease or renal transplant
Cirrhotic liver disease
Malignancy
Genetic factors
Biomarker-based bleeding risk factors:
High-sensitivity troponin
Growth differentiation factor-15
Serum creatinine/estimated CrCl

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Stroke prevention in patients with atrial fibrillation (1)

Recommendations	Class	Level
Oral anticoagulation therapy to prevent thromboembolism is recommended for all male AF patients with a CHA_2DS_2-VASc score of 2 or more.	I	A
Oral anticoagulation therapy to prevent thromboembolism is recommended in all female AF patients with a CHA_2DS_2-VASc score of 3 or more.	I	A
Oral anticoagulation therapy to prevent thromboembolism should be considered in male AF patients with a CHA_2DS_2-VASc score of 1, considering individual characteristics and patient preferences.	IIa	B
Oral anticoagulation therapy to prevent thromboembolism should be considered in female AF patients with a CHA_2DS_2-VASc score of 2, considering individual characteristics and patient preferences.	IIa	B
Vitamin K antagonist therapy (INR 2.0–3.0 or higher) is recommended for stroke prevention in AF patients with moderate-to-severe mitral stenosis or mechanical heart valves.	I	B
When oral anticoagulation is initiated in a patient with AF who is eligible for a NOAC (apixaban, dabigatran, edoxaban, or rivaroxaban), a NOAC is recommended in preference to a Vitamin K antagonist.	I	A

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Stroke prevention in patients with atrial fibrillation (2)

Recommendations	Class	Level
When patients are treated with a vitamin K antagonist, time in therapeutic range (TTR) should be kept as high as possible and closely monitored.	I	A
AF patients already on treatment with a vitamin K antagonist may be considered for NOAC treatment if TTR is not well controlled despite good adherence, or if patient preference without contra-indications to NOAC (e.g. prosthetic valve).	IIb	A
Combinations of oral anticoagulants and platelet inhibitors increase bleeding risk and should be avoided in AF patients without another indication for platelet inhibition.	III (harm)	B
In male or female AF patients without additional stroke risk factors, anticoagulant or antiplatelet therapy is not recommended for stroke prevention.	III (harm)	B
Antiplatelet monotherapy is not recommended for stroke prevention in AF patients, regardless of stroke risk.	III (harm)	A
NOACs (apixaban, dabigatran, edoxaban, and rivaroxaban) are not recommended in patients with mechanical heart valves (Level of evidence B) or moderate-to-severe mitral stenosis (Level of evidence C).	III (harm)	B C

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Variable, often low stroke rates in AF patients with CHA_2DS_2-VASc scores of 1 for men and 2 for women

Study	Population	CHA_2DS_2-VASc score	No of events / No of subjects or patients-years (PY)	Outcome	Event rate per year (%) or incidence rate per 100 person-years (95% CI)	
					Without anticoagulation	On anticoagulation
Lip 2010[4]	European patients seen admitted to hospital	1 (men and women)	1/162	Ischaemic stroke, peripheral embolism, or pulmonary embolism	0.6 (0–3.4)	
Lip 2010[5]	Anticoagulated AF clinical trial cohort (SPORTIF III and V)	1 (men and women)	3/422	Thromboembolic events		0.5 (0.1-1.3)
Poli 2011[6]	AF patients enrolled in Italian clinics	1 (men and women)	1/35	Thromboembolic events		0.8
Olesen 2011[7]	Danish population admitted to hospital	1 (men and women)	265/15866 PY	Hospital admission or death due to ischaemic stroke, peripheral artery embolism, or TIA	1.6 (1.4–1.9)	1.3 (1.0–1.6)
Olesen 2011[8]	Danish population admitted to hospital	1 (men and women)	[a]/8203	Hospital admission or death due to ischaemic stroke, peripheral artery embolism, and pulmonary embolism	2.0 (1.7–2.4)	
Friberg 2012[9]	Swedish population admitted to hospital	1 (men and women)	[a]/6770	Stroke, TIA, or peripheral emboli	0.9	
Guo 2013[10]	Chinese AF patients admitted to hospital	1 (men and women)	[a]/114	Ischaemic stroke, pulmonary embolism, or peripheral embolism	0.9	
Coppens 2013[11]	AVERROES and ACTIVE trial antiplatelet patients	1 (men and women)	27/1224	Ischaemic or unspecified stroke, or systemic embolus	0.9 (0.6–1.3)	
Forslund 2014[12]	AF patients in the Stockholm region	1 (men and women)	-	Ischaemic stroke	0.5	0.3
Chao 2015[13]	Hospital or outpatient Taiwanese AF patients	1 men	1858/67673 PY	Ischaemic stroke	2.8 (2.6–2.9)	
		2 women	1174/46058 PY	Ischaemic stroke	2.6 (2.4–2.7)	
Lip 2015[14]	Danish population admitted to hospital	0 men, 1 women	65/13370 PY and 27/3078 PY	Ischaemic stroke or systemic embolus	0.5	0.9
		1 men, 2 women	133/8571 PY and 55/5172 PY	Ischaemic stroke or systemic embolus	1.6	1.1
Friberg 2015[15]	Swedish nationwide health registry	1 men	[a]/12298[b]	Ischaemic stroke	0.5–0.7	
		1 women	[a]/12298[b]	Ischaemic stroke	0.1–0.2	
van den Ham 2015[16]	Linked data from UK primary care	1 (men and women)	130/16800 PY	Ischaemic stroke	0.8	
		2 (men and women)	412/21500 PY	Ischaemic stroke	1.9	
Allen 2016[17]	Linked data from UK primary care	1 men	137/20422	Ischaemic or unclassified stroke	0.8 (0.6–0.9)	0.5 (0.3–0.7)
		2 women	72/10872	Ischaemic or unclassified stroke	0.7 (0.6–0.9)	0.5 (0.3–0.9)

ACTIVE = Atrial fibrillation Clopidogrel Trial with Irbesartan for prevention of Vascular Events; AF = atrial fibrillation; AVERROES = Apixaban VERsus acetylsalicylic acid to pRevent strOkES; CHA_2DS_2-VASc = Congestive Heart failure, hypertension, Age ≥75 (doubled), Diabetes, Stroke (doubled), Vascular disease, Age 65–74, and Sex (female); ESC = European Society of Cardiology; PY = person-years; SPORTIF = Stroke Prevention using ORal Thrombin Inhibitor in atrial Fibrillation; TIA = transient ischaemic attack; UK = United Kingdom.

[a]Data not reported separately. [b]Total sample size for women and men combined.

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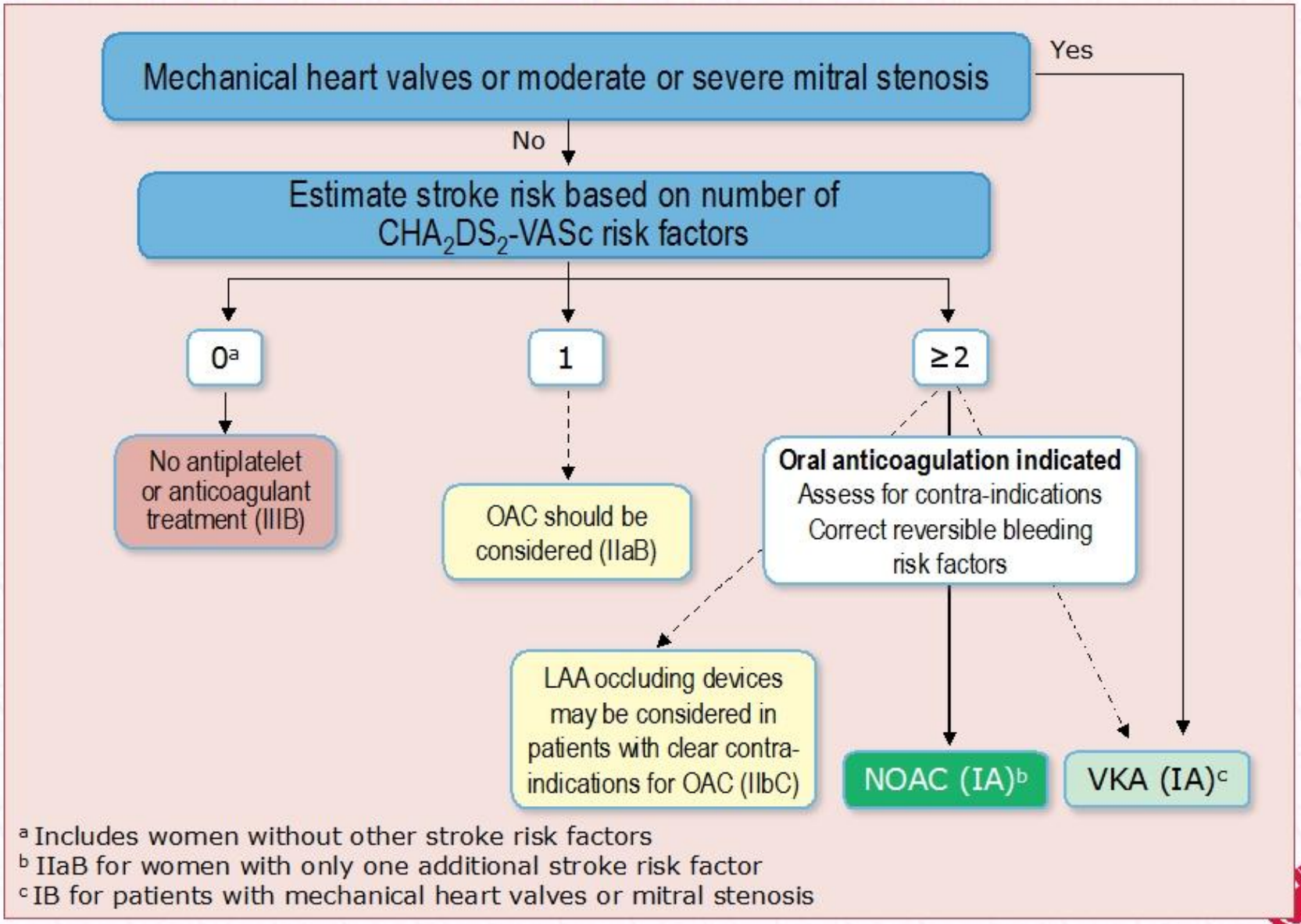
Stroke prevention in atrial fibrillation



[a] Includes women without other stroke risk factors
[b] IIaB for women with only one additional stroke risk factor
[c] IB for patients with mechanical heart valves or mitral stenosis

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Relevant clinical characteristics and dose adjustment in the four phase III NOAC trials in patients with atrial fibrillation

	Dabigatran (RE-LY)	Rivaroxaban (ROCKET-AF)	Apixaban (ARISTOTLE)	Edoxaban (ENGAGE AF-TIMI 48)
Renal clearance	80%	35%	25%	50%
Number of patients	18 113	14 264	18 201	21 105
Dose	150 mg or 110 mg twice daily	20 mg once daily	5 mg twice daily	60 mg (or 30 mg) once daily
Exclusion criteria for CKD	CrCl <30 ml/min	CrCl <30 mL/min	Serum creatinine >2.5 mg/dL or CrCl <25 mL/min	CrCl <30 mL/min
Dose adjustment with CKD	None	Rivaroxaban 15 mg once daily if CrCl 30–49 mL/min	Apixaban 2.5 mg twice daily if at least two of age ≥80 years, weight ≤60 kg, or serum creatinine ≥1.5 mg/dL (133 µmol/L)	Edoxaban 30 mg (or 15 mg) once daily if CrCl <50 mL/min
Percentage of patients with CKD	20% with CrCl 30-49 mL/min	21% with CrCl 30-49 mL/min	15% with CrCl 30-50 mL/dL	19% with CrCl <50 mL/min
Reduction of stroke and systemic embolism	No interaction with CKD status	No interaction with CKD status	No interaction with CKD status	NA
Reduction in major haemorrhages compared to warfarin	Reduction in major haemorrhage with dabigatran was greater in patients with eGFR >80 mL/min with either dose	Major haemorrhage similar	Reduction in major haemorrhage with apixaban	NA

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Main characteristics and outcomes in the PROTECT-AF trial comparing LAAO and warfarin

Study characteristics		
Study design	Randomized, unblinded (2:1)	
Number of patients	707	
Follow-up period, years	2.3	
Randomized treatments	Dose-adjusted warfarin or Watchman® left atrial appendage occlusion device (LAAO)	
Baseline patient characteristics		
Age, years (mean ± SD)	Warfarin: 73 ± 9; LAAO: 72 ± 8 years	
Male sex, %	Warfarin: 70 ; LAAO: 70	
$CHADS_2$ (mean)	Warfarin: 2.3; LAAO: 2.2	
Outcomes		
Events per 100 patient-years (rate ratio and 95% credible interval)	Warfarin (n = 244)	LAAO device (n = 463)
All stroke	2.7 (1.5–4.1)	2.0 (1.3–3.1)
Ischaemic stroke	1.4 (0.6–2.4)	1.9 (1.1–2.9)
Haemorrhagic stroke	1.2 (0.5–2.3)	0.3 (0.1–0.7)
Mortality	4.5 (2.8–6.2)	3.2 (2.3–4.5)

$CHADS_2$ = congestive heart failure, hypertension, age ≥75, diabetes, prior stroke/ transient ischaemic attack [2 points]; LAAO = left atrial appendage occlusion device; PROTECT-AF = System for Embolic PROTECTion in patients with Atrial Fibrillation; SD = standard deviation.

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Occlusion or exclusion of the left atrial appendage

Recommendations	Class	Level
After surgical occlusion or exclusion of the LAA, it is recommended to continue anticoagulation in at-risk patients with AF for stroke prevention.	I	B
LAA occlusion may be considered for stroke prevention in patients with AF and contra-indications for long-term anticoagulant treatment (e.g. those with a previous life-threatening bleed without a reversible cause).	IIb	B
Surgical occlusion or exclusion of the LAA may be considered for stroke prevention in patients with AF undergoing cardiac surgery.	IIb	B
Surgical occlusion or exclusion of the LAA may be considered for stroke prevention in patients undergoing thoracoscopic AF surgery.	IIb	B

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Secondary stroke prevention

Recommendations	Class	Level
Anticoagulation with heparin or LMWH immediately after an ischaemic stroke is not recommended in AF patients.	III (harm)	A
In patients who suffer a TIA or stroke while on anticoagulation, adherence to therapy should be assessed and optimized.	IIa	C
In patients who suffer a moderate-to-severe ischaemic stroke while on anticoagulation, anticoagulation should be interrupted for 3-12 days based on a multidisciplinary assessment of acute stroke and bleeding risk.	IIa	C
In AF patients who suffer a stroke, aspirin should be considered for prevention of secondary stroke until the initiation or resumption of oral anticoagulation.	IIa	B
Systemic thrombolysis with rtPA is not recommended if the INR is above 1.7 (or, for patients on dabigatran, if aPTT is outside normal range).	III (harm)	C
NOACs are recommended in preference to VKAs or aspirin in AF patients with a previous stroke.	I	B
After TIA or stroke, combination therapy of OAC and an antiplatelet is not recommended.	III (harm)	B
After intracranial haemorrhage, oral anticoagulation in patients with AF may be reinitiated after 4–8 weeks provided the cause of bleeding or the relevant risk factor has been treated or controlled.	IIb	B

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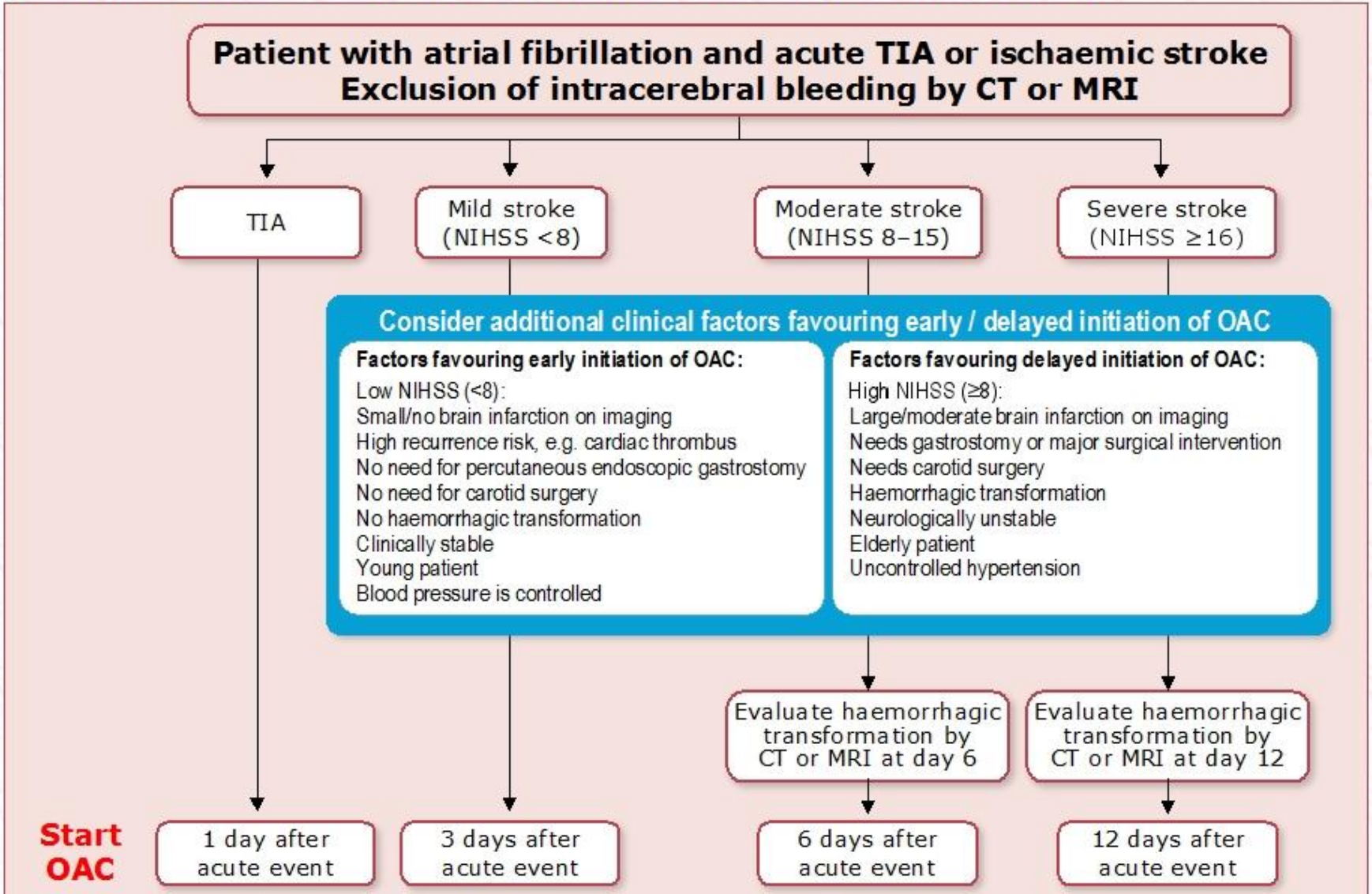
Initiation or continuation of anticoagulation in atrial fibrillation patients after a stroke or transient ischaemic attack



This approach is based on consensus within the Task Force, not on evidence.
NIHSS = National Institutes of Health Stroke Scale

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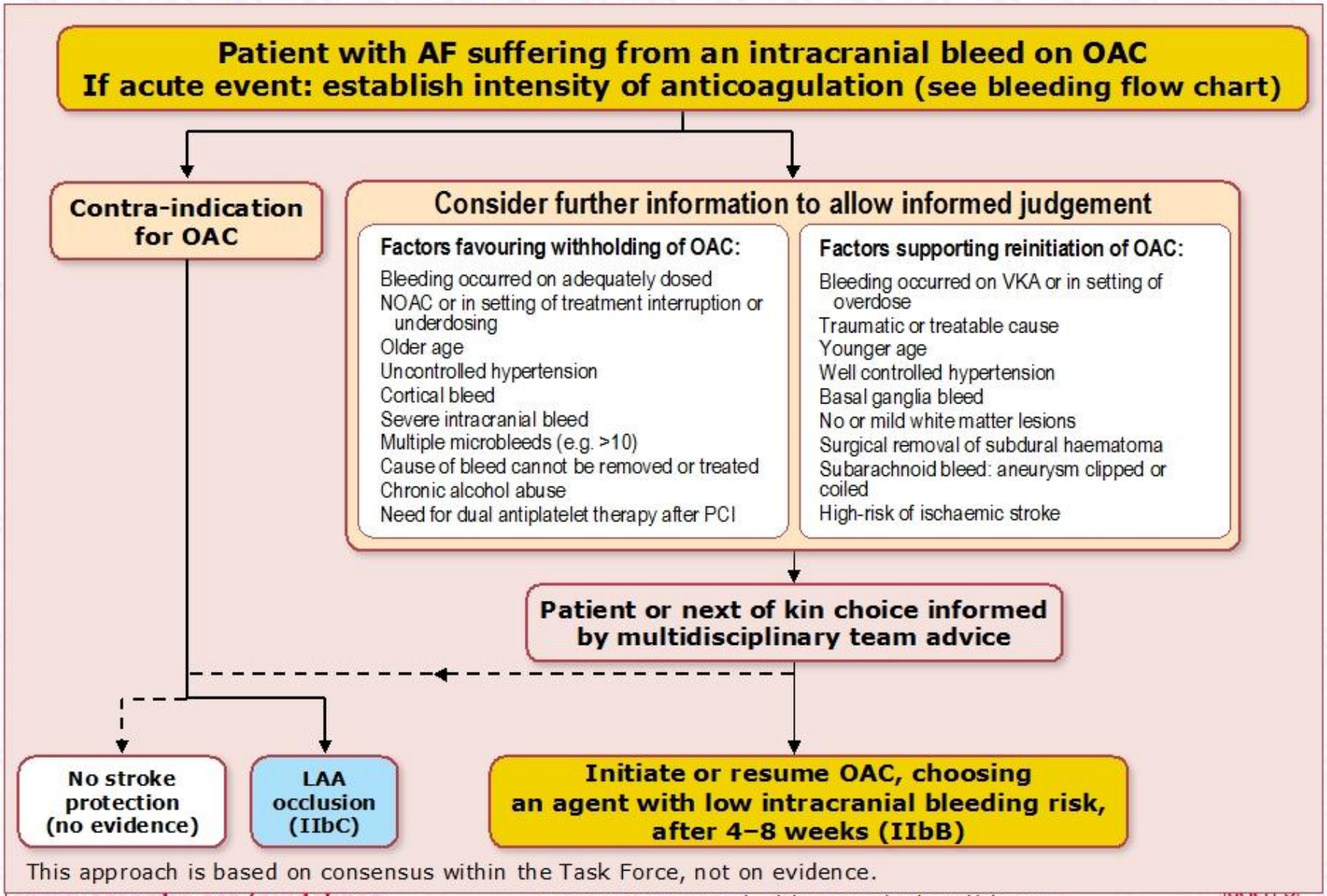
Initiation or resumption of anticoagulation in atrial fibrillation patients after an intracranial bleed



This approach is based on consensus within the Task Force, not on evidence.

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Management of bleeding

Recommendations	Class	Level
Blood pressure control in anticoagulated patients with hypertension should be considered to reduce the risk of bleeding.	IIa	B
When dabigatran is used, a reduced dose (110 mg twice daily) may be considered in patients >75 years to reduce the risk of bleeding.	IIb	B
In patients at high-risk of gastrointestinal bleeding, a VKA or another NOAC preparation should be preferred over dabigatran 150 mg twice daily, rivaroxaban 20 mg once daily, or edoxaban 60 mg once daily.	IIa	B
Advice and treatment to avoid alcohol excess should be considered in all AF patients considered for OAC.	IIa	C
Genetic testing before the initiation of VKA therapy is not recommended.	III (no benefit)	B
Reinitiation of OAC after a bleeding event should be considered in all eligible patients by a multidisciplinary AF team, considering different anticoagulants and stroke prevention interventions, improved management of factors that contributed to bleeding, and stroke risk.	IIa	B
In AF patients with severe active bleeding events, it is recommended to interrupt OAC therapy until the cause of bleeding is resolved.	I	C

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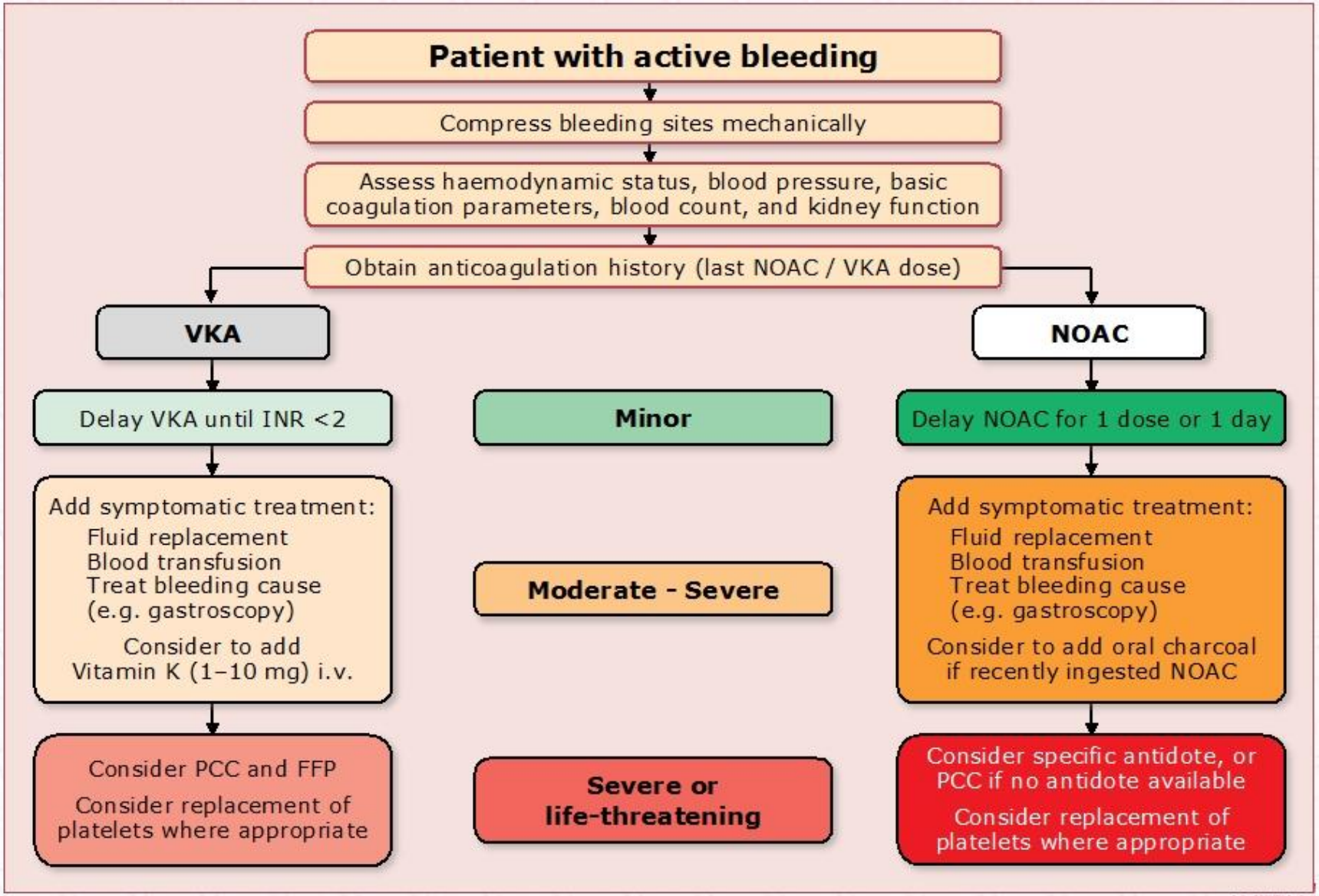
Management of bleeding in anticoagulated AF patients



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Combination therapy with oral anticoagulants and antiplatelets

Recommendations	Class	Level
After elective coronary stenting for stable coronary artery disease in AF patients at risk of stroke, combination triple therapy with aspirin, clopidogrel and an oral anticoagulant should be considered for 1 month to prevent recurrent coronary and cerebral ischaemic events.	IIa	B
After an ACS with stent implantation in AF patients at risk of stroke, combination triple therapy with aspirin, clopidogrel and an oral anticoagulant should be considered for 1–6 months to prevent recurrent coronary and cerebral ischaemic events.	IIa	C
After an ACS without stent implantation in AF patients at risk of stroke, dual treatment with an oral anticoagulant and aspirin or clopidogrel should be considered for up to 12 months to prevent recurrent coronary and cerebral ischaemic events.	IIa	C
The duration of combination antithrombotic therapy, especially triple therapy, should be kept to a limited period, balancing the estimated risk of recurrent coronary events and bleeding.	IIa	B
Dual therapy with any oral anticoagulant plus clopidogrel 75 mg/day may be considered as an alternative to initial triple therapy in selected patients.	IIb	C

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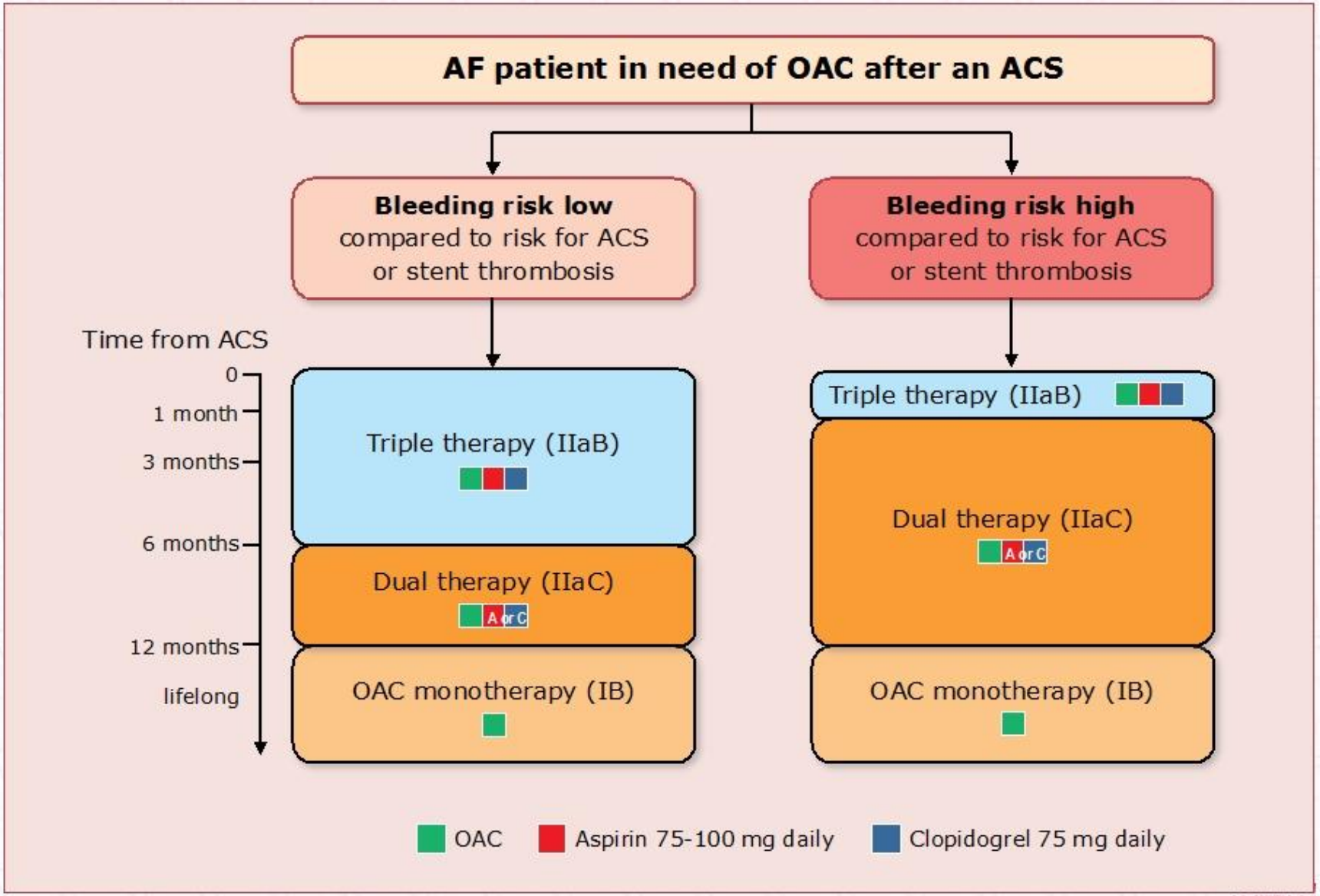
Antithrombotic therapy after an acute coronary syndrome in atrial fibrillation patients requiring anticoagulation



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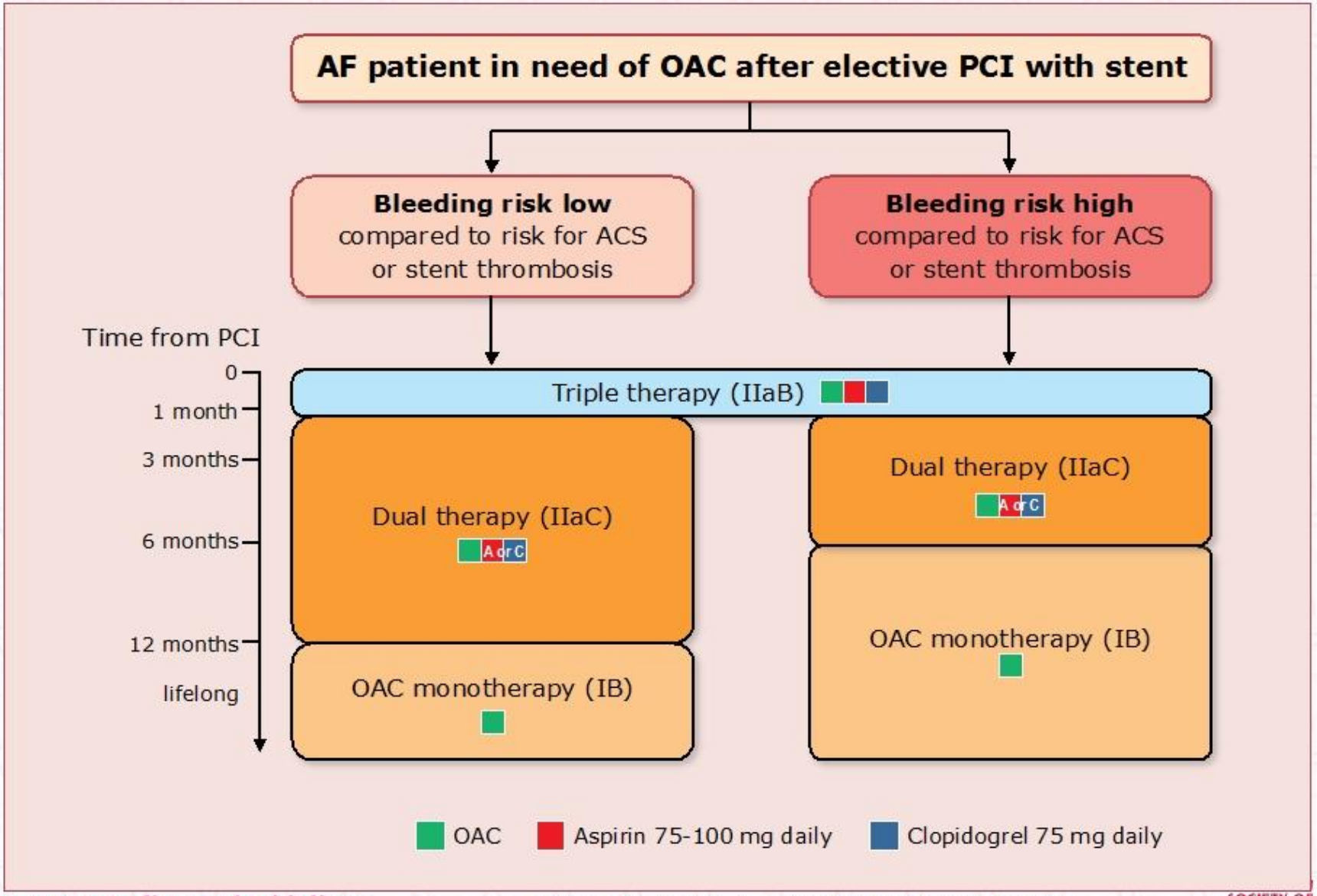
Antithrombotic therapy after elective percutaneous intervention in atrial fibrillation patients requiring anticoagulation



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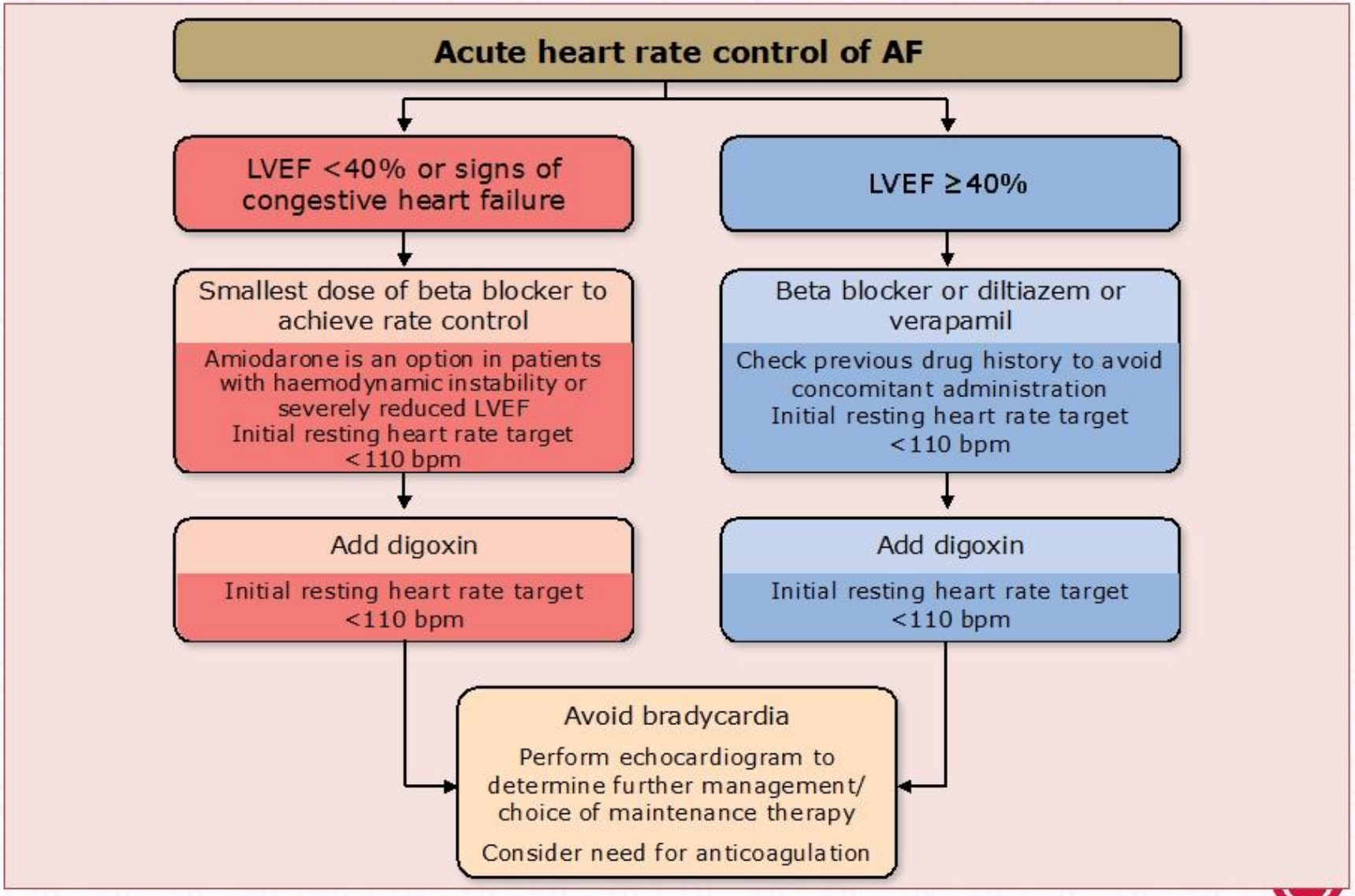
Heart rate control in atrial fibrillation

Recommendations	Class	Level
Beta-blockers, digoxin, diltiazem, or verapamil are recommended to control heart rate in AF patients with LVEF ≥40%.	I	B
Beta-blockers and/or digoxin are recommended to control heart rate in AF patients with LVEF <40%.	I	B
Combination therapy comprising different rate controlling agents should be considered if a single agent does not achieve the necessary heart rate target.	IIa	C
In patients with haemodynamic instability or severely depressed LVEF, amiodarone may be considered for acute control of heart rate.	IIb	B
In patients with permanent AF (i.e. where no attempt to restore sinus rhythm is planned), antiarrhythmic drugs should not routinely be used for rate control.	III (harm)	A
A resting heart rate of <110 bpm (i.e. lenient rate control) should be considered as the initial heart rate target for rate control therapy.	IIa	B
Rhythm rather than rate control strategies should be considered as the preferred management in pre-excited AF and AF during pregnancy.	IIa	C
Atrioventricular node ablation should be considered to control heart rate in patients unresponsive or intolerant to intensive rate and rhythm control therapy, accepting that these patients will become pacemaker dependent.	IIa	B

Acute heart rate control in atrial fibrillation



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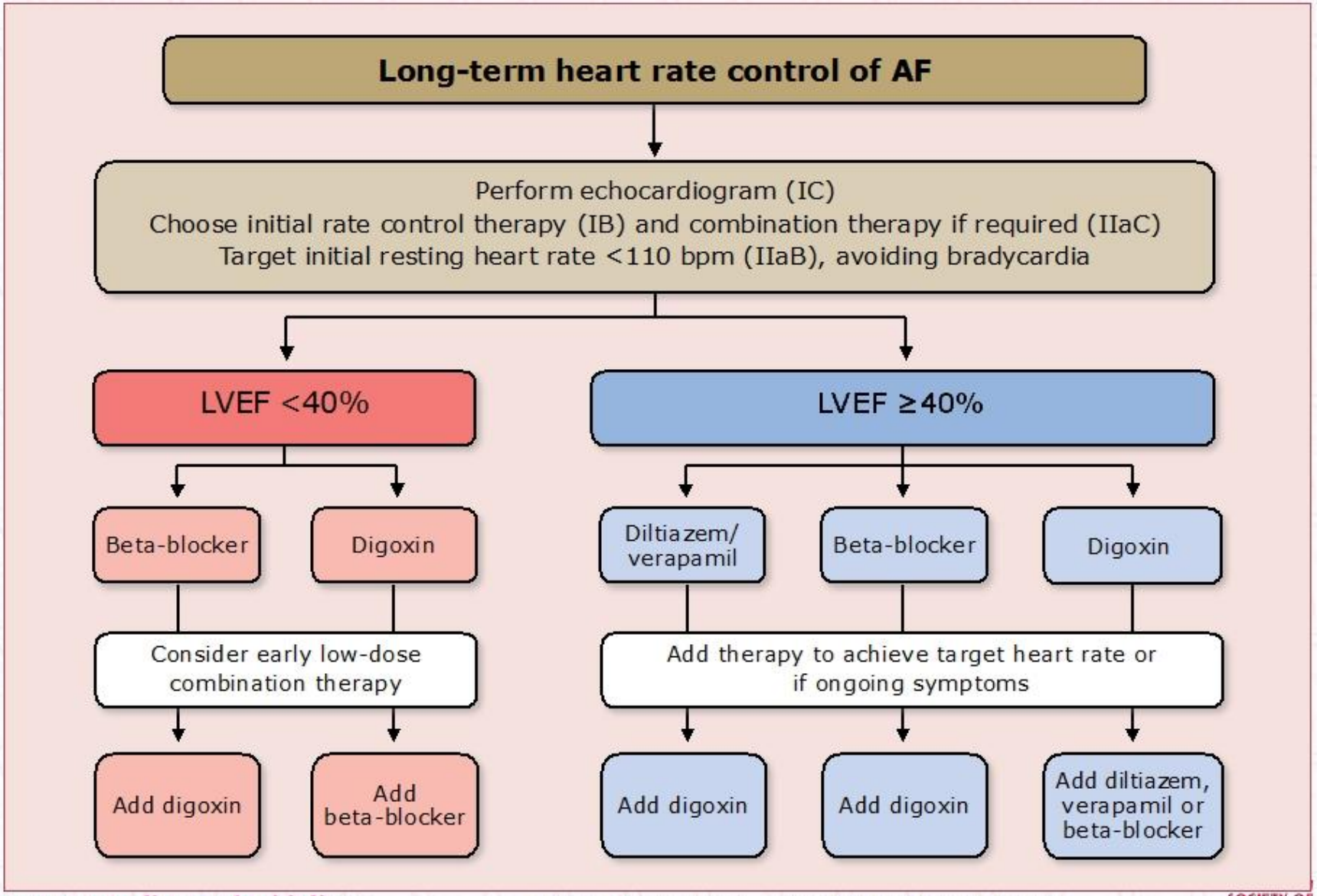
Long-term heart rate control in patients with atrial fibrillation



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Rhythm control therapy (1) – Cardioversion of AF

Recommendations	Class	Level
General recommendations		
Rhythm control therapy is indicated for symptom improvement in patients with AF.	I	B
Management of cardiovascular risk factors and avoidance of AF triggers should be pursued in patients on rhythm control therapy to facilitate maintenance of sinus rhythm.	IIa	B
With the exception of AF associated with haemodynamic instability, the choice between electrical and pharmacological cardioversion should be guided by patient and physician preferences.	IIa	C
Cardioversion of AF		
Electrical cardioversion of AF is recommended in patients with acute haemodynamic instability to restore cardiac output.	I	B
Cardioversion of AF (either electrical or pharmacological) is recommended in symptomatic patients with persistent or long-standing persistent AF as part of rhythm control therapy.	I	B
Pre-treatment with amiodarone, flecainide, ibutilide, or propafenone should be considered to enhance success of electrical cardioversion and prevent recurrent AF.	IIa	B

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Rhythm control therapy (2) – Cardioversion of AF

Recommendations	Class	Level
Cardioversion of AF *(cont'd)*		
In patients with no history of ischaemic or structural heart disease, flecainide, propafenone, or vernakalant are recommended for pharmacological cardioversion of new-onset AF.	I	A
In patients with no history of ischaemic or structural heart disease, ibutilide should be considered for pharmacological conversion of AF.	IIa	B
In selected patients with recent-onset AF and no significant structural or ischaemic heart disease, a single oral dose of flecainide or propafenone (the 'pill in the pocket' approach) should be considered for patient-led cardioversion, following safety assessment.	IIa	B
In patients with ischaemic and/or structural heart disease, amiodarone is recommended for cardioversion of AF.	I	A
Vernakalant may be considered as an alternative to amiodarone for pharmacological conversion of AF in patients without hypotension, severe heart failure or severe structural heart disease (especially aortic stenosis).	IIb	B

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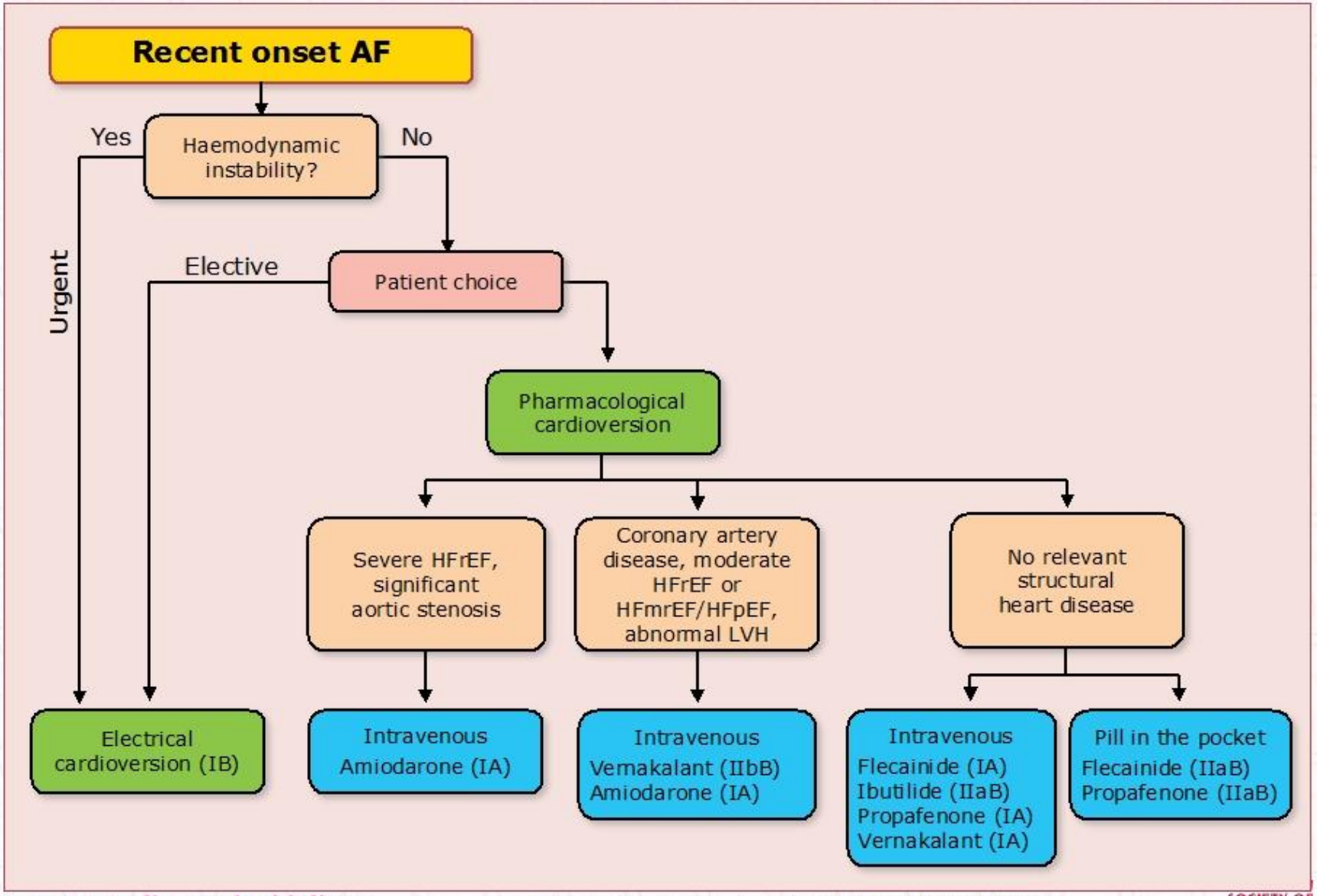
Cardioversion of recent onset of atrial fibrillation



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Rhythm control therapy (3) – Stroke prevention

Recommendations	Class	Level
Stroke prevention in patients designated for cardioversion of AF		
Anticoagulation with heparin or a NOAC should be initiated as soon as possible before every cardioversion of AF or atrial flutter.	IIa	B
For cardioversion of AF/atrial flutter, effective anticoagulation is recommended for a minimum of 3 weeks before cardioversion.	I	B
Transoesophageal echocardiography (TOE) is recommended to exclude cardiac thrombus as an alternative to preprocedural anticoagulation when early cardioversion is planned.	I	B
Early cardioversion can be performed without TOE in patients with a definite duration of AF <48 hours.	IIa	B
In patients at risk for stroke, anticoagulant therapy should be continued long-term after cardioversion according to the long-term anticoagulation recommendations, irrespective of the method of cardioversion or the apparent maintenance of sinus rhythm. In patients without stroke risk factors, anticoagulation is recommended for 4 weeks after cardioversion.	I	B
In patients where thrombus is identified on TOE, effective anticoagulation is recommended for at least 3 weeks.	I	C
A repeat TOE to ensure thrombus resolution should be considered before cardioversion.	IIa	C

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Rhythm control therapy (4) – Antiarrhythmic drugs (AAD)

Recommendations	Class	Level
AAD for the long-term maintenance of sinus rhythm/prevention of recurrent AF		
The choice of AAD needs to be carefully evaluated, taking into account the presence of comorbidities, cardiovascular risk and potential for serious proarrhythmia, extracardiac toxic effects, patient preferences, and symptom burden.	I	A
Dronedarone, flecainide, propafenone, or sotalol are recommended for prevention of recurrent symptomatic AF in patients with normal left ventricular function and without pathological left ventricular hypertrophy.	I	A
Dronedarone is recommended for prevention of recurrent symptomatic AF in patients with stable coronary artery disease, and without heart failure.	I	A
Amiodarone is recommended for prevention of recurrent symptomatic AF in patients with heart failure.	I	B
Amiodarone is more effective in preventing AF recurrences than other AAD, but extracardiac toxic effects are common and increase with time. For this reason, other AAD should be considered first.	IIa	C

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Rhythm control therapy (5) - Antiarrhythmic drugs (AAD)

Recommendations	Class	Level
AAD for the long-term maintenance of sinus rhythm/prevention of recurrent AF *(cont'd)*		
Patients on AAD therapy should be periodically evaluated to confirm their eligibility for treatment.	**IIa**	**C**
ECG recording during the initiation of AAD therapy should be considered to monitor heart rate, detect QRS and QT interval prolongation, and the occurrence of AV block.	**IIa**	**B**
AAD therapy is not recommended in patients with prolonged QT interval (>0.5 s) or those with significant sinoatrial node disease or AV node dysfunction who do not have a functioning permanent pacemaker.	**III (harm)**	**C**
Adding atrial-based bradycardia pacing to drug treatment that induces or exacerbates sinus node dysfunction should be considered to allow continuation of AAD therapy in patients in whom AF ablation is declined or not indicated.	**IIa**	**B**
Continuation of AAD therapy beyond the blanking period after AF ablation should be considered to maintain sinus rhythm when recurrences seem likely.	**IIa**	**B**

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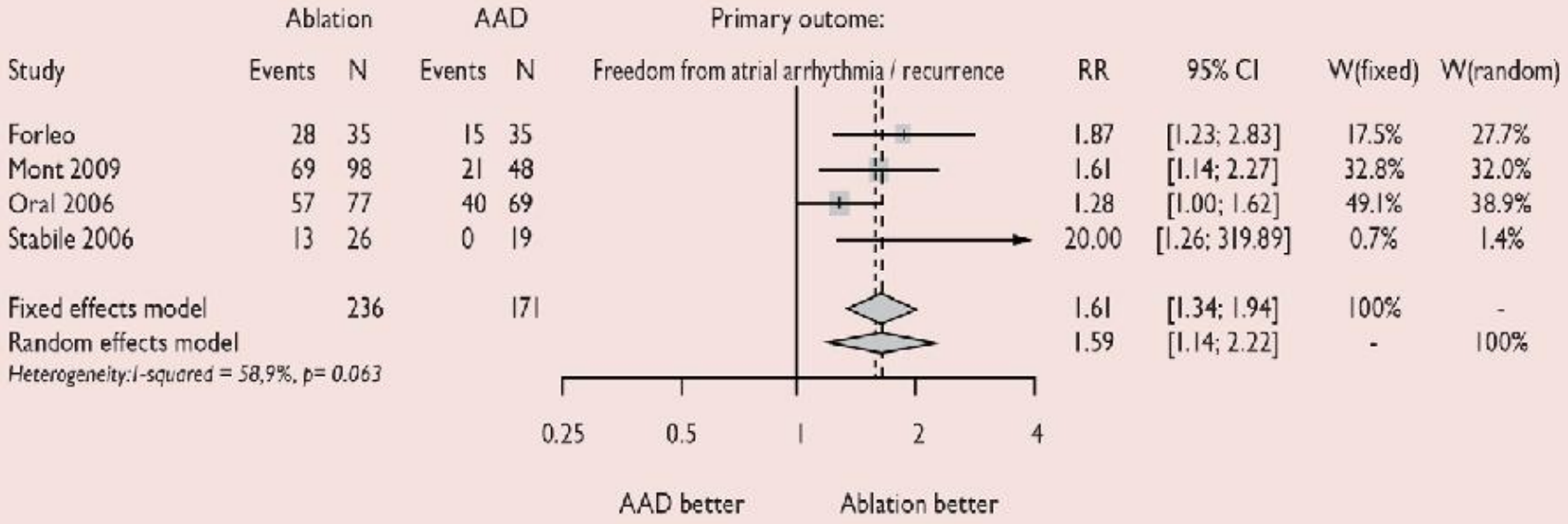
Rhythm outcome after catheter ablation compared to cardioversion and AAD in patients with persistent or long-standing persistent atrial fibrillation

Freedom from recurrence of atrial fibrillation or atrial arrhythmias, comparing catheter ablation with antiarrhythmic drug therapy in patients with persistent or long-standing persistent atrial fibrillation



AAD = antiarrhythmic drug therapy; CI = confidence interval; N = number of patients; RR = risk ratio; W = study weighting.

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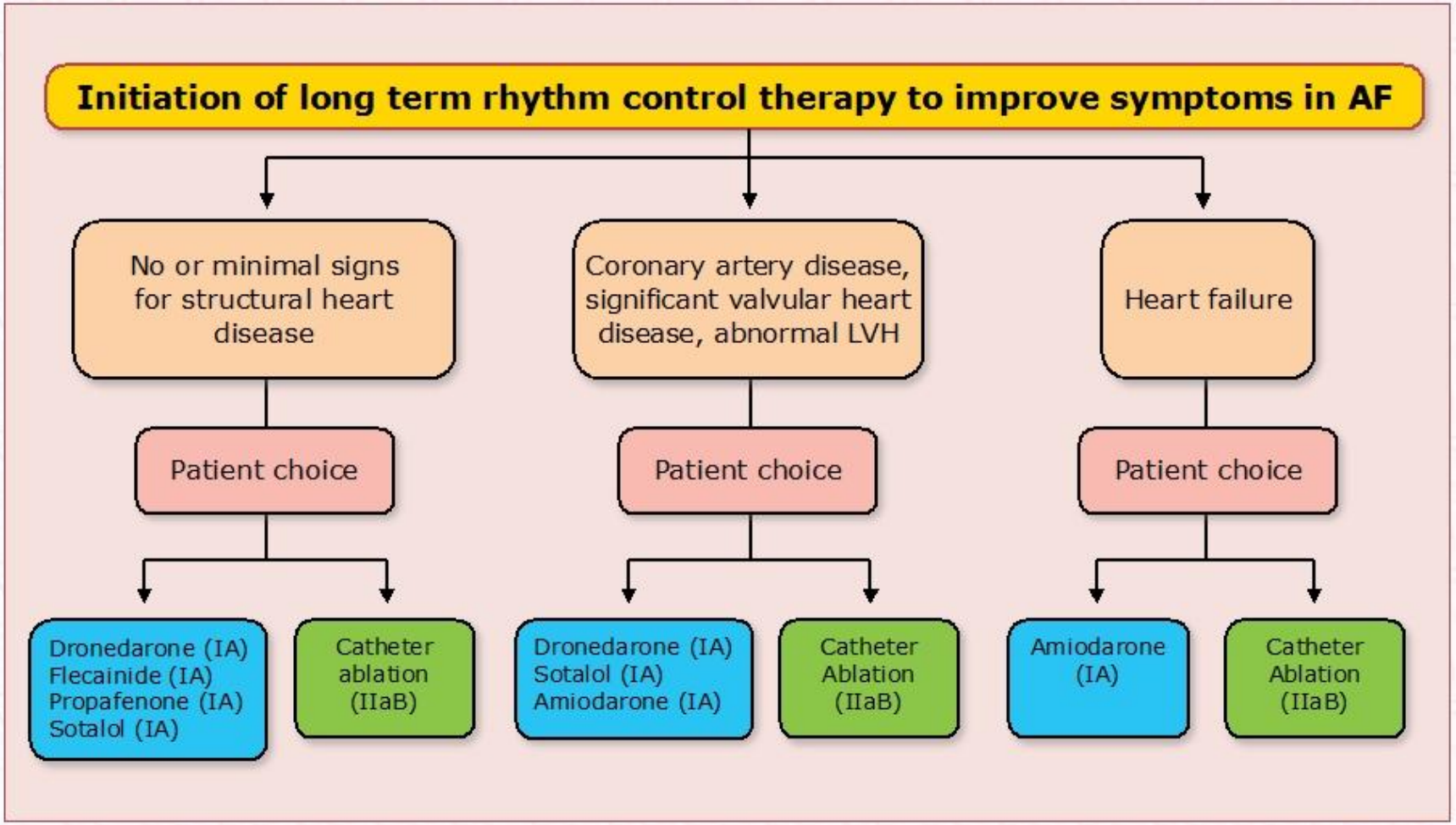
Initiation of long term rhythm control therapy in symptomatic patients with atrial fibrillation



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Rhythm control therapy (6) – Non antiarrhythmic drugs

Recommendations	Class	Level
Antiarrhythmic effects of non-antiarrhythmic drugs		
ACE-Is, ARBs and beta-blockers should be considered for prevention of new-onset AF in patients with heart failure and reduced ejection fraction.	**IIa**	**A**
ACE-Is and ARBs should be considered for prevention of new-onset AF in patients with hypertension, particularly with LV hypertrophy.	**IIa**	**B**
Pre-treatment with ACE-Is or ARBs may be considered in patients with recurrent AF undergoing electrical cardioversion and receiving antiarrhythmic drug therapy.	**IIb**	**B**
ACE-Is or ARBs are not recommended for the secondary prevention of paroxysmal AF in patients with little or no underlying heart disease.	**III (no benefit)**	**B**

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Catheter ablation of atrial fibrillation and atrial fibrillation surgery (1)

Recommendations	Class	Level
Catheter ablation of symptomatic paroxysmal AF is recommended to improve AF symptoms in patients who have symptomatic recurrences of AF on antiarrhythmic drug therapy (amiodarone, dronedarone, flecainide, propafenone, sotalol) and who prefer further rhythm control therapy, when performed by an electrophysiologist who has received appropriate training and is performing the procedure in an experienced centre.	I	A
Ablation of common atrial flutter should be considered to prevent recurrent flutter as part of an AF ablation procedure if flutter has been documented or occurs during the AF ablation.	IIa	B
Catheter ablation of AF should be considered as first-line therapy to prevent recurrent AF and to improve symptoms in selected patients with symptomatic paroxysmal AF as an alternative to antiarrhythmic drug therapy, considering patient choice, benefit, and risk.	IIa	B
All patients should receive oral anticoagulation for at least 8 weeks after catheter (IIaB) or surgical (IIaC) ablation.	IIa	B C
Anticoagulation for stroke prevention should be continued indefinitely after apparently successful catheter or surgical ablation of AF in patients at high-risk of stroke.	IIa	C
When catheter ablation of AF is planned, continuation of oral anticoagulation with a VKA (IIaB) or NOAC (IIaC) should be considered during the procedure, maintaining effective anticoagulation.	IIb	B C
Catheter ablation should target isolation of the pulmonary veins using radiofrequency ablation or cryothermy balloon catheters.	IIa	B

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Catheter ablation of atrial fibrillation and atrial fibrillation surgery (2)

Recommendations	Class	Level
AF ablation should be considered in symptomatic patients with AF and heart failure with reduced ejection fraction to improve symptoms and cardiac function when tachycardiomyopathy is suspected.	IIa	C
AF ablation should be considered as a strategy to avoid pacemaker implantation in patients with AF-related bradycardia.	IIa	C
Catheter or surgical ablation should be considered in patients with symptomatic persistent or long-standing persistent AF refractory to AAD therapy to improve symptoms, considering patient choice, benefit and risk, supported by an AF Heart Team.	IIa	C
Minimally invasive surgery with epicardial pulmonary vein isolation should be considered in patients with symptomatic AF when catheter ablation has failed. Decisions on such patients should be supported by an AF Heart Team.	IIa	B
Maze surgery, possibly via a minimally invasive approach, performed by an adequately trained operator in an experienced centre, should be considered by an AF Heart Team as a treatment option for patients with symptomatic refractory persistent AF or post-ablation AF to improve symptoms.	IIa	C
Maze surgery, preferably biatrial, should be considered in patients undergoing cardiac surgery to improve symptoms attributable to AF, balancing the added risk of the procedure and the benefit of rhythm control therapy.	IIa	A
Concomitant biatrial maze or pulmonary vein isolation may be considered in asymptomatic AF patients undergoing cardiac surgery.	IIb	C

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Complications related to catheter ablation of atrial fibrillation

Complication severity	Complication type	Rate
Life-threatening complications	Periprocedural death	<0.2%
	Oesophageal injury (perforation/fistula)	<0.5%
	Periprocedural stroke (including TIA/air embolism)	<1%
	Cardiac tamponade	1–2%
Severe complications	Pulmonary vein stenosis	<1%
	Persistent phrenic nerve palsy	1–2%
	Vascular complications	2–4%
	Other severe complications	≈1%
Other moderate or minor complications		1–2%
Unknown significance	Asymptomatic cerebral embolism (silent stroke)	5–20%
	Radiation exposure	

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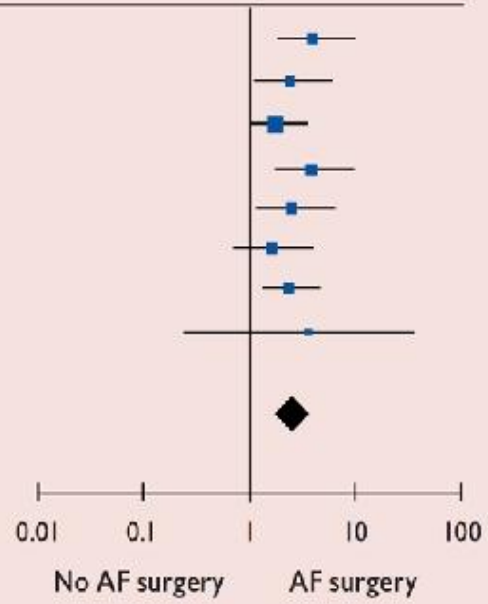
Rhythm outcomes in patients undergoing surgical AF ablation compared to no ablation

Freedom from atrial fibrillation, atrial flutter and atrial tachycardia after surgical atrial fibrillation ablation

Study or Subgroup	Surgical ablation Events	Surgical ablation Total	No ablation Events	No ablation Total	Weight	Risk Ratio Fixed effects, 95% CI
Abreu Filho 2005	31	42	7	28	10.9%	2.95 [1.52, 5.75]
Blomstrom-Lundqvist 2007	16	34	8	35	10.2%	2.06 [1.02, 4.17]
Budera 2012	36	117	20	105	27.3%	1.62 [1.00, 2.61]
Cherniavsky 2014	49	61	11	34	18.3%	2.48 [1.50, 4.10]
Jonsson 2012	19	35	9	35	11.6%	2.11 [1.11, 4.00]
Knaut 2010	11	24	7	21	9.7%	1.38 [0.65, 2.90]
Pokushalov 2012	16	18	8	17	10.6%	1.89 [1.11, 3.21]
Schuetz 2003	3	24	1	19	1.4%	2.38 [0.27, 21.05]
Total (95% CI)		**355**		**294**	**100.0%**	**2.04 [1.63, 2.55]**
Total events	181		71			

Heterogeneity Chi² = 3.87, df = 7 (P = 0.79); I² = 0%

Test for overall effect: Z = 6.25 (P <0.00001)



CI = confidence interval.

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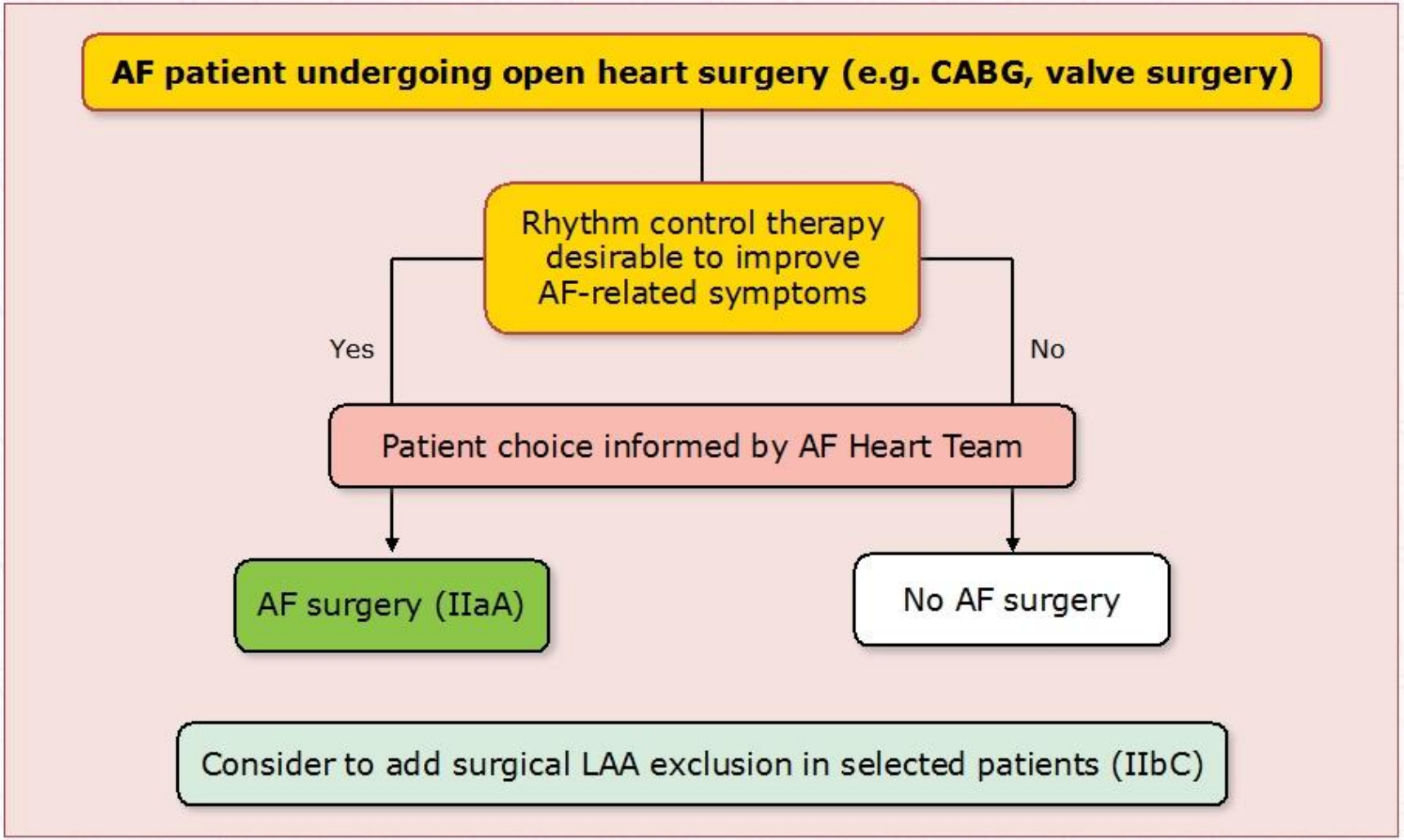
Surgical rhythm control in patients with atrial fibrillation undergoing cardiac surgery



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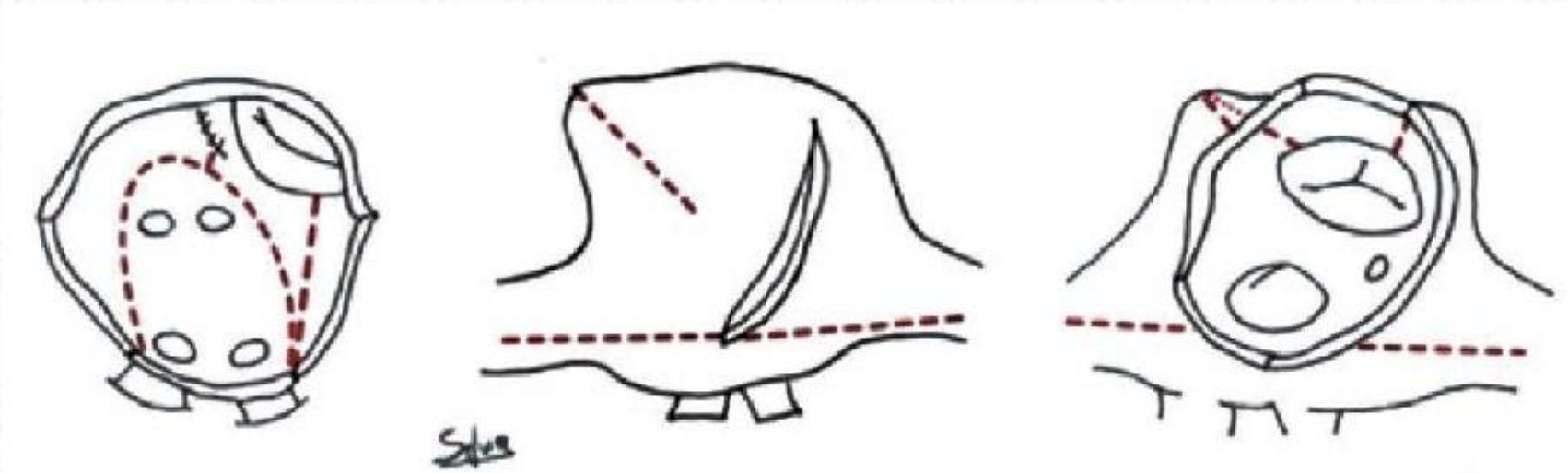
Surgical lesion sets for the biatrial Cox maze procedure for concomitant AF surgery.



Surgeon' s view showing left atrial lesions (left panel) and right atrial lesions (middle and right panel)

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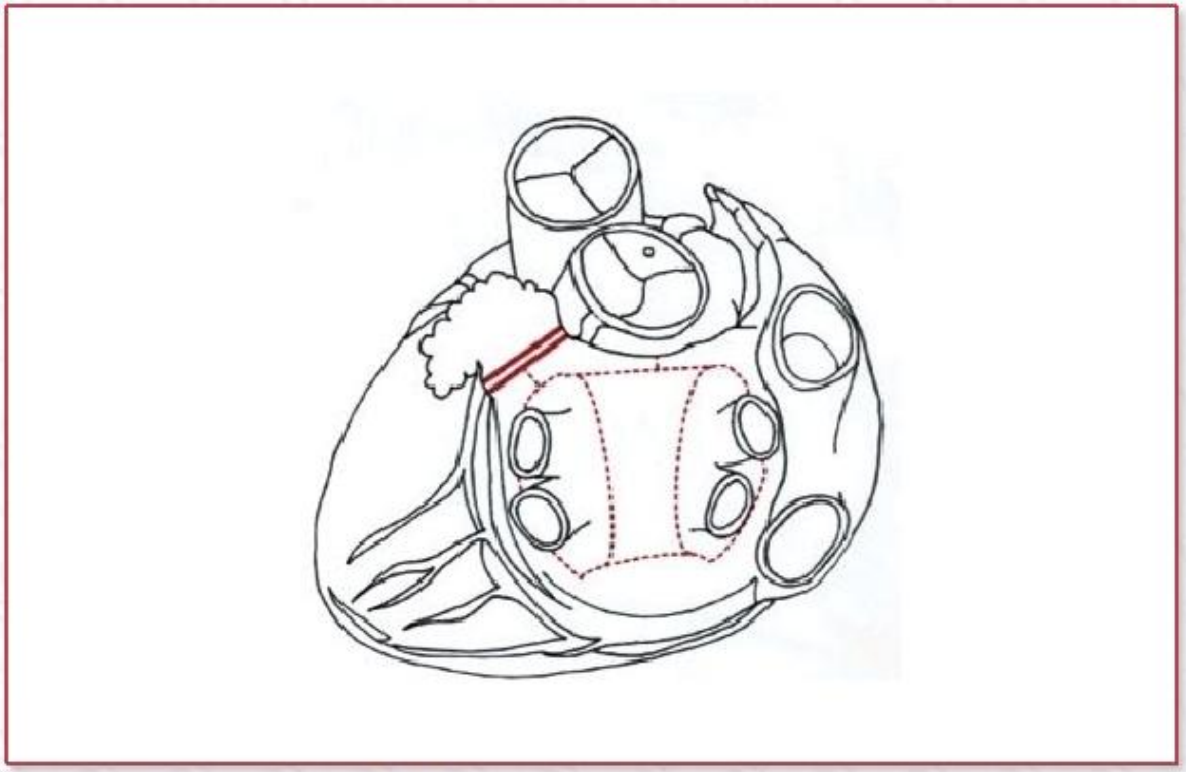
Left atrial lesions for thoracoscopic stand-alone AF surgery (dashed lines), including left appendage exclusion (double line)



Posterior view onto the left atrium

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Complications of thoracoscopic atrial fibrillation surgery

Complication	Rate
Conversion to sternotomy	0–1.6%
Pacemaker implantation	0–3.3%
Drainage for pneumothorax	0–3.3%
Pericardial tamponade	0–6.0%
Transient ischaemic attack	0–3.0%

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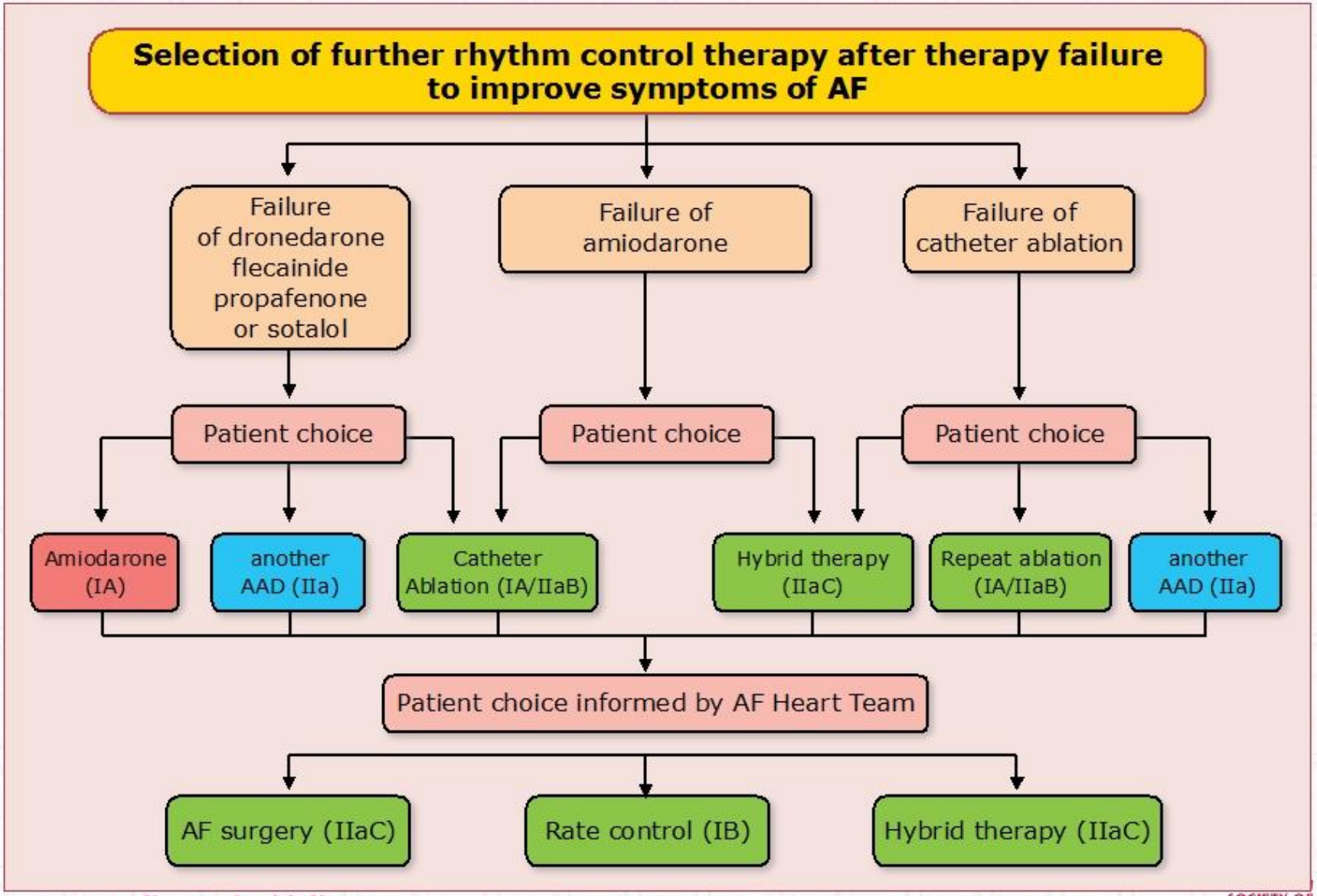
Choice of rhythm control therapy following treatment failure



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Gender should not alter AF management

Recommendations	Class	Level
AF clinicians must offer effective diagnostic tools and therapeutic management to women and men equally to prevent stroke and death.	I	A
Catheter or surgical ablation techniques should be regarded as equally effective in women and men.	IIa	B

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WPW Syndrome and Inherited Cardiomyopathies

Recommendations	Class	Level
WPW Syndrome		
Catheter ablation of the accessory pathway in WPW patients with AF and rapid conduction over the accessory pathway is recommended to prevent sudden cardiac death.	I	B
Catheter ablation of the accessory pathway is recommended without delay in WPW patients who survive sudden cardiac death.	I	C
Asymptomatic patients with overt pre-excitation and AF should be considered for accessory pathway ablation after careful counselling.	IIa	B
Hypertrophic cardiomyopathy		
Lifelong oral anticoagulation to prevent stroke is recommended in HCM patients who develop AF.	I	B
Restoration of sinus rhythm by electrical or pharmacological cardioversion to improve symptoms is recommended in HCM patients with symptomatic new-onset AF.	I	B
In haemodynamically stable HCM patients with AF, ventricular rate control using beta-blockers and diltiazem/verapamil is recommended.	I	C
Treatment of LV outflow tract obstruction should be considered in AF patients with HCM to improve symptoms.	IIa	B
Amiodarone should be considered to achieve rhythm control and maintain sinus rhythm in HCM patients with recurrent symptomatic AF.	IIa	C
Inherited cardiomyopathies and channelopathies		
Targeted genetic testing should be considered in patients with AF and a suspicion of inherited cardiomyopathies or channelopathies based on clinical history, family history or electrocardiographic phenotype.	IIa	A

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Physical activity in patients with atrial fibrillation

Recommendations	Class	Level
Moderate regular physical activity is recommended to prevent AF, while athletes should be counselled that long-lasting intense sports participation can promote AF.	I	A
AF ablation should be considered to prevent recurrent AF in athletes.	IIa	B
The ventricular rate while exercising with AF should be evaluated in every athlete (by symptoms and/or by monitoring), and titrated rate control should be instituted.	IIa	C
After ingestion of pill-in-the-pocket flecainide or propafenone, patients should refrain from sports as long as AF persists and until two half-lives of the antiarrhythmic drug have elapsed.	IIa	C

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Preventing postoperative atrial fibrillation

Recommendations	Class	Level
Peri-operative oral beta-blocker therapy is recommended for the prevention of postoperative AF after cardiac surgery.	I	B
Restoration of sinus rhythm by electrical cardioversion or antiarrhythmic drugs is recommended in postoperative AF with haemodynamic instability.	I	C
Long-term anticoagulation should be considered in patients with AF after cardiac surgery at risk for stroke, considering individual stroke and bleeding risk.	IIa	B
Antiarrhythmic drugs should be considered for symptomatic postoperative AF after cardiac surgery in an attempt to restore sinus rhythm.	IIa	C
Peri-operative amiodarone should be considered as prophylactic therapy to prevent AF after cardiac surgery.	IIa	A
Asymptomatic postoperative AF should initially be managed with rate control and anticoagulation.	IIa	B
Intravenous vernakalant may be considered for cardioversion of postoperative AF in patients without severe heart failure, hypotension, or severe structural heart disease (especially aortic stenosis).	IIb	B

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Atrial fibrillation during pregnancy

Recommendations	Class	Level
Electrical cardioversion can be performed safely at all stages of pregnancy, and is recommended in patients who are haemodynamically unstable due to AF, and whenever the risk of ongoing AF is considered high for the mother or the foetus.	I	C
Anticoagulation is recommended in pregnant patients with AF at risk of stroke. To minimize teratogenic risk and intrauterine bleeding, dose-adjusted heparin is recommended during the first trimester of pregnancy and in the 2–4 weeks before delivery. Vitamin K antagonists or heparin can be used in the remaining parts of the pregnancy.	I	B
NOACs should be avoided in pregnancy and in women planning a pregnancy.	III (harm)	C

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Patients with grown-up congenital heart disease

Recommendations	Class	Level
Atrial septal defect closure should be considered before the fourth decade of life to diminish the chance of atrial flutter and fibrillation.	IIa	C
In patients who need surgical closure of an atrial septal defect and who have a history of symptomatic atrial arrhythmia, AF ablation should be considered at the time of surgical closure	IIa	C
Cox maze surgery should be considered in patients with symptomatic AF and an indication for corrective repair of congenital heart defects. All such surgery should be done in experienced centres.	IIa	C
Oral anticoagulation should be considered in all adult patients with intracardiac repair, cyanosis, Fontan palliation or systemic right ventricle and a history of AF, atrial flutter or intra- atrial reentrant tachycardia. In all other congenital heart disease patients with AF, anticoagulation should be considered if CHA_2DS_2VASc score is ≥1.	IIa	C
Catheter ablation of atrial arrhythmias associated with congenital heart defects may be considered when performed in experienced centres.	IIb	C
In patients with congenital heart disease, transoesophageal echo-cardiography may be considered together with 3-week anticoagulation therapy before cardioversion.	IIb	C

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Management of atrial flutter

Recommendations	Class	Level
For patients with atrial flutter, antithrombotic therapy is recommended according to the same risk profile used for AF.	I	B
Overdrive atrial pacing of atrial flutter should be considered as an alternative to electrical cardioversion, depending on local availability and experience.	IIa	B
Management of typical atrial flutter with ablation of the cavotricuspid isthmus is recommended for patients failing antiarrhythmic drug therapy or as first-line treatment considering patient preference.	I	B
If atrial flutter has been documented before AF ablation, ablation of the cavotricuspid isthmus should be considered as part of the AF ablation procedure.	IIa	C

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Patient involvement, education and self-management

Recommendations	Class	Level
Tailored patient education is recommended in all phases of AF management to support patients' perception of AF and to improve management.	I	C
Patient involvement in the care process should be considered to encourage self-management and responsibility for lifestyle changes.	IIa	B
Shared decision making should be considered to ensure that care is based on the best available evidence and fits the needs, values and preferences of the patient.	IIa	C

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The 2016 ESC AF guidelines in 17 bullet points (1)

Here, we provide 17 simple rules to guide diagnosis and management of AF patients according to the 2016 ESC/EACTS/ESO Guidelines for the management of atrial fibrillation

1. **Use ECG screening in at risk populations for atrial fibrillation, especially stroke survivors and the Elderly.**
2. **Document AF by ECG before starting treatment.**
3. **Evaluate all AF patients by clinical evaluation, ECG, and echocardiogram for underlying cardiovascular conditions such as hypertension, heart failure, valvular heart disease, and others.**
4. **Provide tailored information and education to AF patients to empower them to support AF management.**
5. **Propose life style changes to all suitable AF patients to make their management more effective.**
6. **Treat underlying cardiovascular conditions adequately, e.g. valve repair or replacement in AF patients with significant valvular heart disease, treatment of heart failure, or management of hypertension, among others.**

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The 2016 ESC AF guidelines in 17 bullet points (2)

Here, we provide 17 simple rules to guide diagnosis and management of AF patients according to the 2016 ESC/EACTS/ESO Guidelines for the management of atrial fibrillation

7. **Use oral anticoagulation in all AF patients unless they are at low risk for stroke based on the CHA_2DS_2-VASc score or have true contraindications for anticoagulant therapy.**
8. **Anticoagulate patients with atrial flutter similar to atrial fibrillation. Offer isthmus ablation to symptomatic flutter patients.**
9. **Reduce all modifiable bleeding risk factors in all AF patients on oral anticoagulation, e.g. by treating hypertension, minimising the duration and intensity of concomitant antiplatelet and NSAID therapy, treating anaemia and eliminating causes for blood loss, maintaining stable INR values in patients on vitamin K antagonists, and moderating alcohol intake.**
10. **Check ventricular rate in all AF patients and use rate control medications to achieve lenient heart rate control (<110bpm at rest initially).**

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The 2016 ESC AF guidelines in 17 bullet points (3)

Here, we provide 17 simple rules to guide diagnosis and management of AF patients according to the 2016 ESC/EACTS/ESO Guidelines for the management of atrial fibrillation

11. **Evaluate AF-related symptoms in all AF patients using the modified EHRA score. Whenever patients have AF-related symptoms, aim to improve symptoms by adjustment of rate control therapy and by offering antiarrhythmic drugs, cardioversion, or catheter or surgical ablation.**
12. **Select antiarrhythmic drugs based on their safety profile and consider catheter or surgical ablation when antiarrhythmic drugs fail.**
13. **Do not offer routine genetic testing in AF patients unless there is a suspicion for an inherited cardiac condition.**
14. **Do not use antiplatelet therapy for stroke prevention in AF.**
15. **Do not permanently discontinue oral anticoagulation in AF patients at increased risk of stroke unless such a decision is taken by a multidisciplinary team.**

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The 2016 ESC AF guidelines in 17 bullet points (4)

Here, we provide 17 simple rules to guide diagnosis and management of AF patients according to the 2016 ESC/EACTS/ESO Guidelines for the management of atrial fibrillation

16. **Do not use rhythm control therapy in asymptomatic AF patients, nor in patients with permanent AF.**
17. **Do not perform cardioversion or catheter ablation without anticoagulation unless an atrial thrombus has been ruled out by transesophageal echocardiogram.**

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CATCH ME is supported by the European Union grant agreement No 633196 [CATCH ME].

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