

Table 1. ESC 2019 GL on SVT. Causes of physiological sinus tachycardia

Physiological causes	Emotion, physical exercise, sexual intercourse, pain, pregnancy
Pathological causes	Anxiety, panic attack, anaemia, fever, dehydration, infection, malignancies, hyperthyroidism, hypoglycaemia, pheochromocytoma, Cushing's disease, diabetes mellitus with evidence of autonomic dysfunction, pulmonary embolus, myocardial infarction, pericarditis, valve disease, shock, congestive heart failure
Drugs	Epinephrine, norepinephrine, dopamine, dobutamine, atropine, beta-2 adrenergic receptor agonists (salbutamol), methylxanthines, doxorubicin, daunorubicin, beta-blocker withdrawal
Illicit drugs	Amphetamines, cocaine, lysergic acid diethylamide (LSD), psilocybin, ecstasy, crack, cocaine
Other	Caffeine, alcohol

Table 2. Therapy of sinus tachycardias

ACC/AHA/HRS 2015 GL on SVT. Treatment of Inappropriate Sinus Tachycardia

Evaluation for and treatment of reversible causes	I-C-LD
Ivabradine in symptomatic SVT	IIa-B-R
Beta blockers in symptomatic SVT	IIb-C-LD
Combination of beta blockers and ivabradine	IIb-C-LD

ESC 2019 GL on SVT. Recommendations for the therapy of sinus tachycardias

Inappropriate sinus tachycardia		
Evaluation and treatment of reversible causes.	I	C
Ivabradine alone or in combination with a beta-blocker in symptomatic patients.	IIa	B
Beta-blockers in symptomatic patients.	IIa	C
Sinus nodal re-entrant tachycardia		
Non-dihydropyridine calcium-channel blockers (verapamil or diltiazem, in the absence of HFrEF) may be considered in symptomatic patients.	IIb	C
Catheter ablation should be considered in symptomatic patients who do not respond to drug therapy.	IIa	C
Postural tachycardia syndrome		
A regular and progressive exercise programme	IIa	B
Consumption of up to 2–3 L of water and 10–12 g of NaCl daily	IIb	C
Midodrine or low-dose non-selective beta blocker or pyridostigmine	IIb	B
Ivabradine	IIb	C
<i>HFrEF = heart failure with reduced left ventricular ejection fraction.</i>		

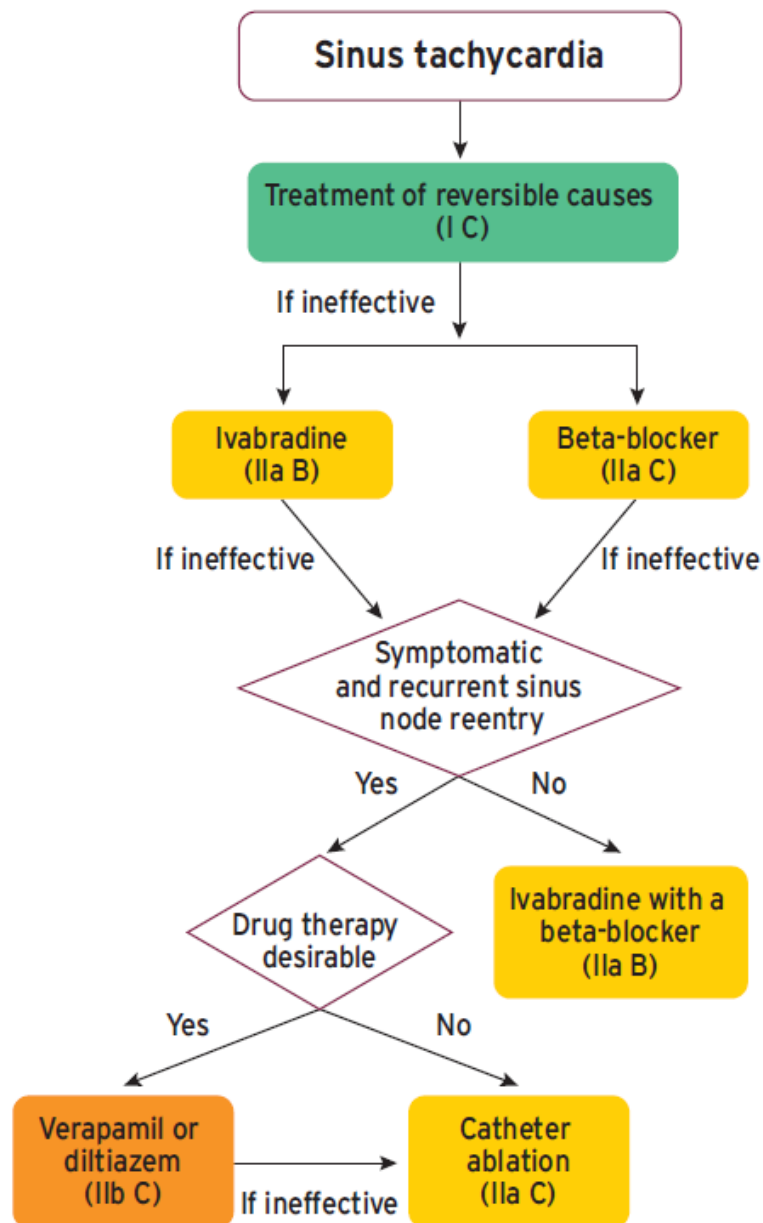


Figure 1. ESC 2019 GL on SVT. Therapy of sinus tachycardias.

Oral verapamil and diltiazem are contraindicated in the presence of HFrEF.

HFrEF = heart failure with reduced left ventricular ejection fraction.

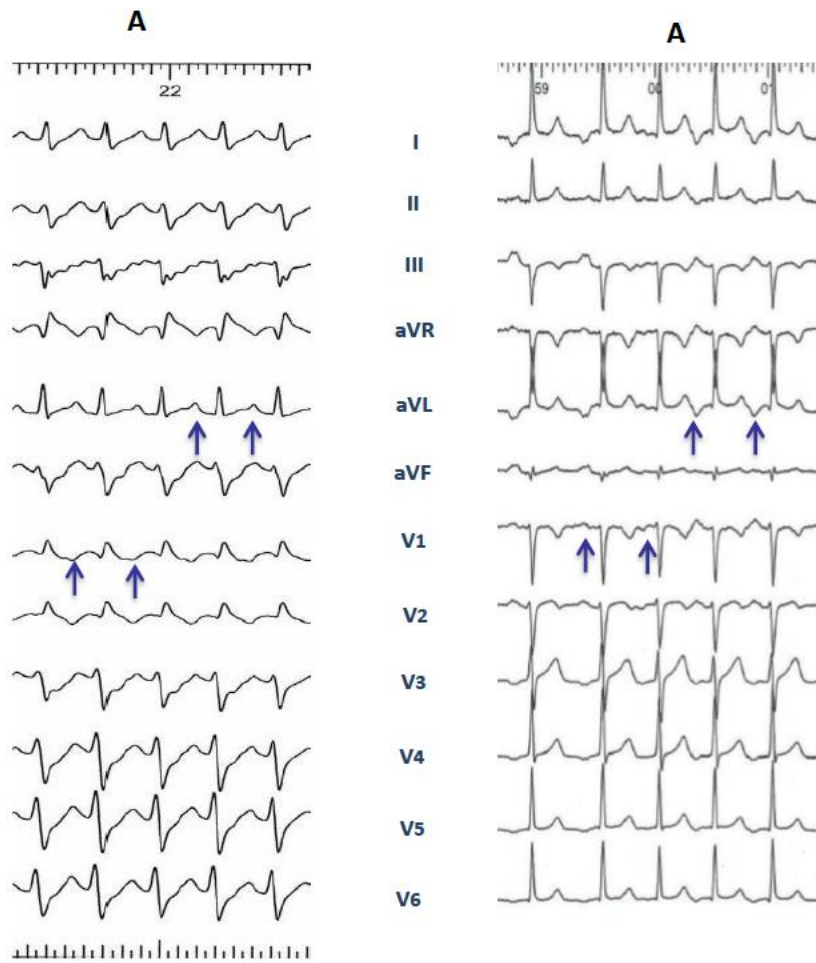


Figure 2. Right (A) and left (B) atrial tachycardia. P waves are indicated by arrows.

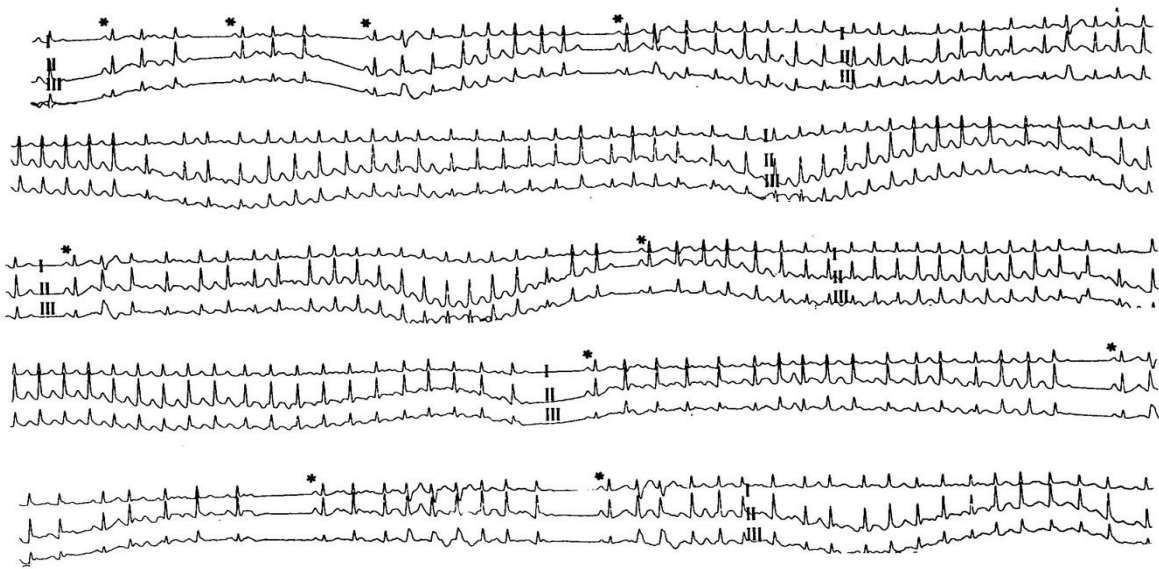


Figure 3. Focal AF coming from the pulmonary vein.

The asterisks mark sinus P waves which are much less frequent than AF activity. Note the very dynamic pattern with frequent initiations and terminations of AF.

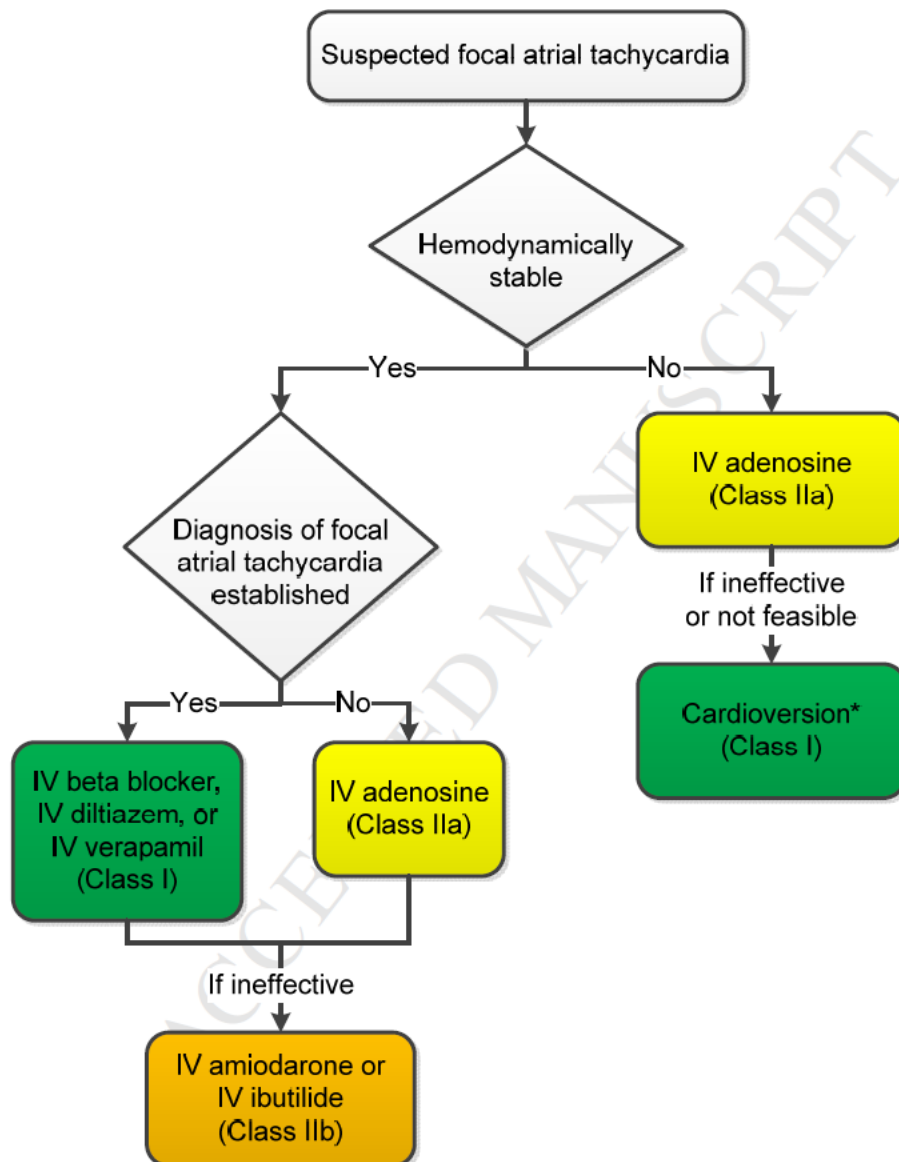


Figure 4. ACC/AHA/HRS 2015 GL on SVT. Acute Treatment of Suspected Focal Atrial Tachycardia

Drugs listed alphabetically.

*For rhythms that break or recur spontaneously, synchronized cardioversion is not appropriate.

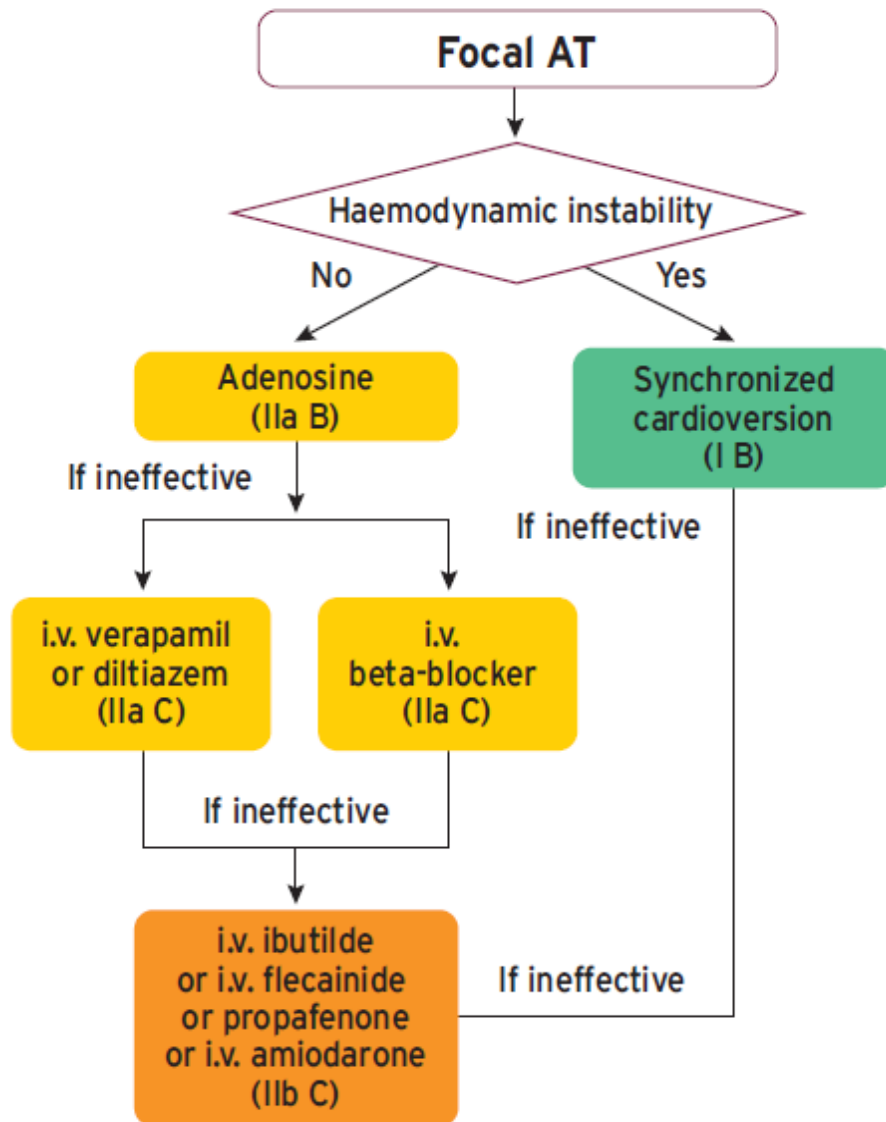


Figure 5. ESC 2019 GL on SVT. Acute therapy of focal atrial tachycardia.

i.v. ibutilide is contraindicated in patients with prolonged QTc interval. i.v. flecainide and propafenone are contraindicated in patients with ischaemic or structural heart disease.
AT = atrial tachycardia; i.v. = intravenous; SVT = supraventricular tachycardia.

Table 3. Focal atrial tachycardia

ACC/AHA/HRS 2015 GL on SVT. Focal AT		
Acute treatment		
IV beta blockers, diltiazem, or verapamil for haemodynamically stable patients		I-C-LD
Synchronized cardioversion for haemodynamically unstable patients		I-C-LD
Adenosine to restore sinus rhythm or diagnose the tachycardia mechanism		IIa-B-NR
IV amiodarone to restore sinus rhythm or slow the ventricular rate in haemodynamically stable patients		IIb-C-LD
Ibutilide to restore sinus rhythm in haemodynamically stable patients		IIb-C-LD
Ongoing management of symptomatic focal AT		
Catheter ablation		I-B-NR
Oral beta blockers, diltiazem or verapamil		IIa-C-LD
Flecainide or propafenone for patients without structural heart disease or ischemic heart disease		IIa-C-LD
Sotalol or amiodarone		IIb-C-LD

ESC 2019 GL on SVT. Recommendations for the therapy of focal atrial tachycardia

Acute therapy		
Haemodynamically unstable patients		
Synchronized direct-current cardioversion for haemodynamically unstable patients.	I	B
Haemodynamically stable patients		
Adenosine (6–18 mg i.v. bolus)	IIa	B
i.v. beta-blockers (esmolol or metoprolol), if adenosine fails	IIa	C
i.v. verapamil or diltiazem for haemodynamically stable patients, if adenosine fails.	IIa	C
If the above measures fail, the following may be used: i.v. ibutilide or i.v. flecainide or propafenone or i.v. amiodarone.	IIb	C
Synchronized direct-current cardioversion when drug therapy fails to convert or control the tachycardia.	I	B
Chronic therapy		
Catheter ablation for recurrent focal atrial tachycardia, especially if incessant or causing tachycardiomyopathy.	I	B
Beta-blockers or non-dihydropyridine calcium-channel blockers (verapamil or diltiazem, in the absence of HFrEF), or propafenone or flecainide, in the absence of structural or ischaemic heart disease, if ablation is not desirable or feasible.	IIa	C
Ivabradine with a beta blocker if the above measures fail.	IIb	C
Amiodarone if the above measures fail.	IIb	C

i.v. verapamil and diltiazem are contraindicated in the presence of hypotension or HFrEF.

i.v. beta-blockers are contraindicated in the presence of decompensated heart failure.

i.v. ibutilide is contraindicated in patients with prolonged QTc interval.

i.v. flecainide and propafenone are contraindicated in patients with ischaemic or structural heart disease. They also prolong the QTc interval but much less than class III agents.

i.v. amiodarone prolongs the QTc but torsades des pointes is rare.

HFrEF = heart failure with reduced left ventricular ejection fraction; i.v. = intravenous.

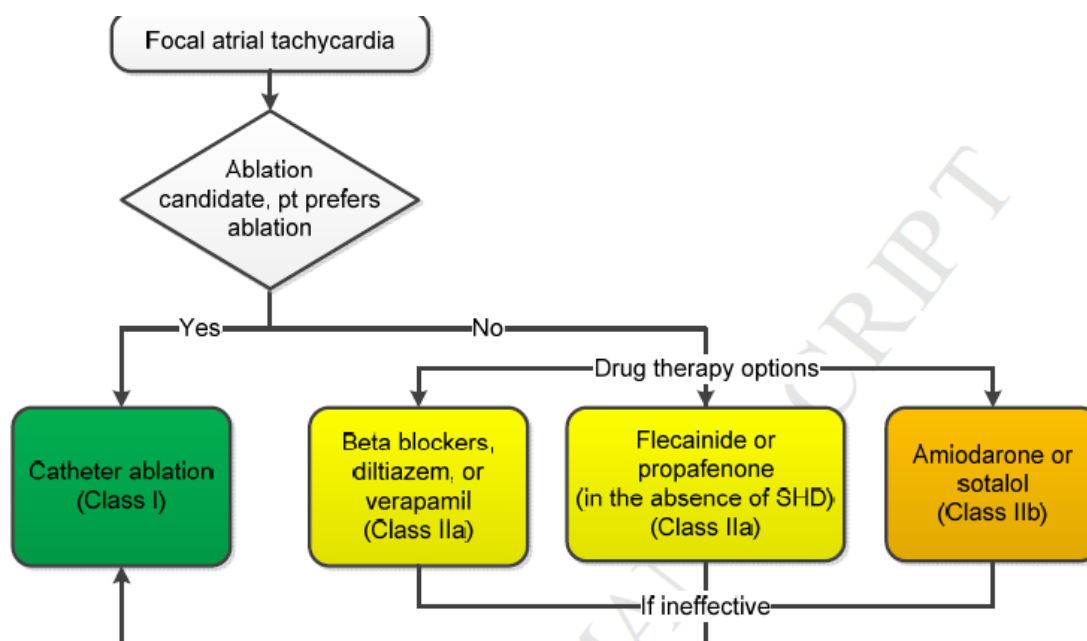


Figure 6. ACC/AHA/HRS 2015 GL on SVT. Ongoing Management of Suspected Focal Atrial Tachycardia

Colors correspond to Class of Recommendation ; drugs listed alphabetically.
SHD, structural heart disease (including ischemic heart disease).

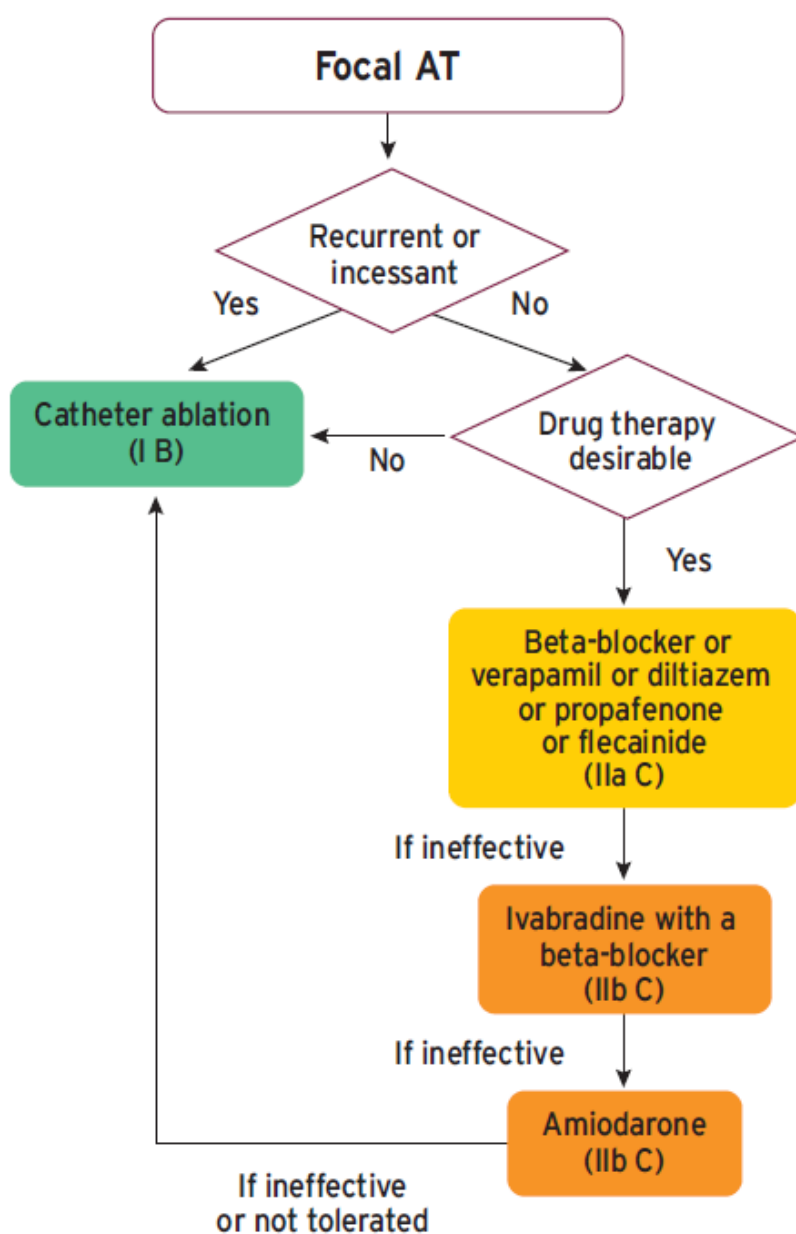


Figure 7. ESC 2019 GL on SVT. Chronic therapy of focal atrial tachycardia.

Oral verapamil and diltiazem are contraindicated in the presence of HFrEF.

Oral flecainide and propafenone are contraindicated in patients with ischaemic or structural heart disease.

AT = atrial tachycardia; HFrEF = heart failure with reduced left ventricular ejection fraction.

Table 4. Multifocal AT**ACC/AHA/HRS 2015 GL on SVT. Multifocal AT**

Acute treatment	
IV metoprolol or verapamil	Ila-C-LD
Ongoing management of recurrent symptomatic multifocal AT	
Verapamil	Ila-B-NR
Diltiazem	Ila-C-LD
Metoprolol	Ila-C-LD

ESC 2019 GL on SVT. Recommendations for the therapy of multifocal atrial tachycardia

Recommendation	Class^a	Level^b
Acute therapy		
Treatment of an underlying condition as a first step, if feasible.	I	C
i.v. beta-blockers or non-dihydropyridine calcium-channel blockers (verapamil or diltiazem)	Ila	B
Chronic therapy		
Oral verapamil or diltiazem for patients with recurrent symptomatic multifocal atrial tachycardia in the absence of HFrEF.	Ila	B
A selective beta blocker for patients with recurrent symptomatic multifocal atrial tachycardia.	Ila	B
AV nodal ablation followed by pacing (preferable biventricular or His-bundle pacing) for patients with LV dysfunction due to recurrent multifocal atrial tachycardia refractory to drug therapy.	Ila	C

i.v. verapamil and diltiazem are contraindicated in the presence of hypotension or HFrEF.

i.v. beta-blockers are contraindicated in the presence of decompensated heart failure.

HFrEF = heart failure with reduced left ventricular ejection fraction ; LV = left ventricle.

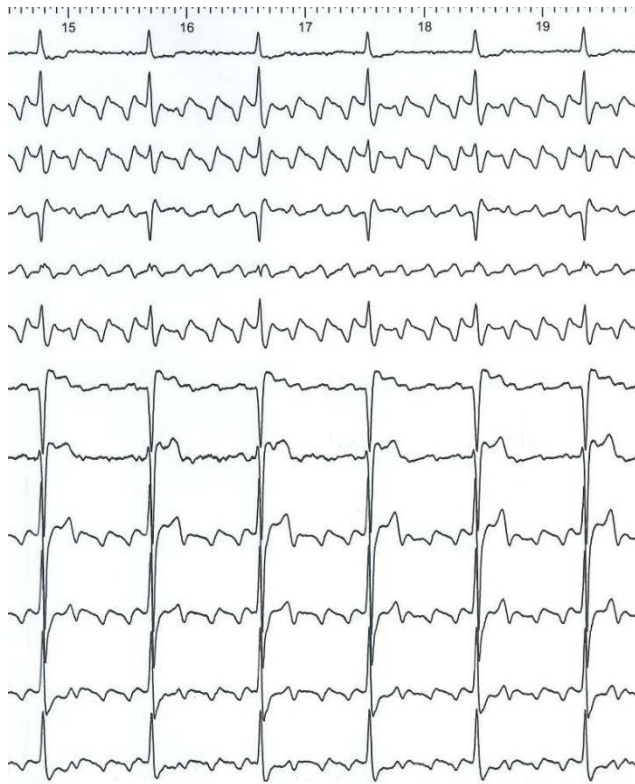


Fig 8. Typical and counterclockwise atrial flutter with saw-tooth P waves in inferior leads.

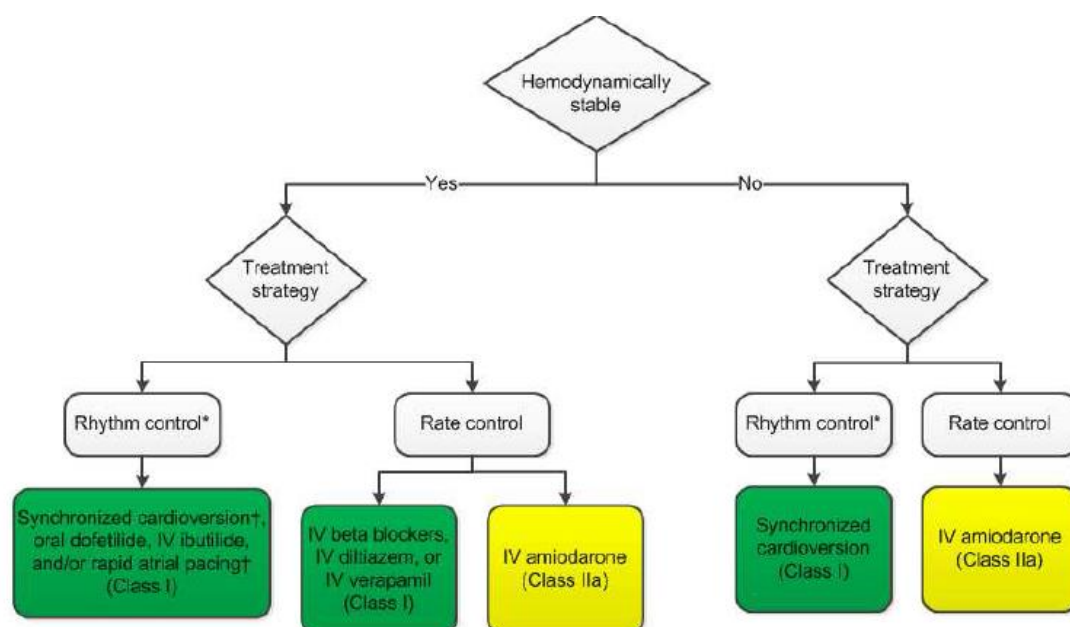


Figure 9. ACC/AHA/HRS 2015 GL on SVT. Acute Treatment of atrial flutter

Colors correspond to Class of Recommendation; drugs listed alphabetically.

*Anticoagulation as per guideline is mandatory.

†For rhythms that break or recur spontaneously, synchronized cardioversion or rapid atrial pacing is not appropriate.

IV indicates intravenous.

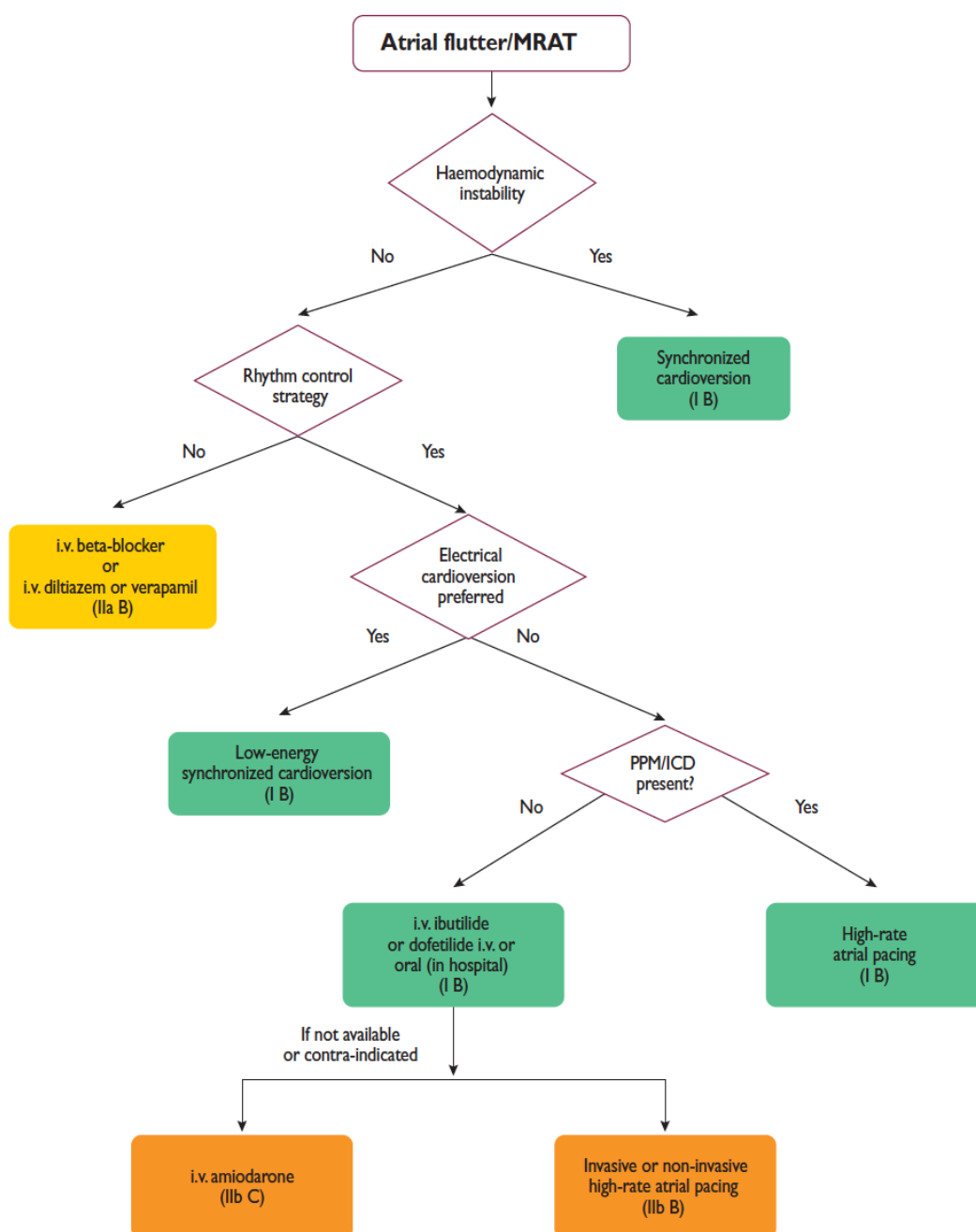


Figure 10. ESC 2019 GL on SVT. Acute therapy of stable atrial flutter/macro-re-entrant atrial tachycardia.

i.v. verapamil and diltiazem are contraindicated in the presence of hypotension or HFrEF

i.v. beta blockers are contraindicated in the presence of decompensate heart failure

TABLE 5. Therapy of macro-reentrant atrial tachycardias**ACC/AHA/HRS 2015 GL on SVT****Acute treatment of atrial flutter**

Oral dofetilide or IV ibutilide for acute pharmacological cardioversion	I-A
IV or oral beta blockers, diltiazem, or verapamil for acute rate control in hemodynamically stable patients	I-B-R
Elective synchronized cardioversion in stable patients with welltolerated atrial flutter when a rhythm control strategy is being pursued	I-B-NR
Synchronized cardioversion of atrial flutter in hemodynamically unstable patients who do not respond to pharmacological therapies	I-B-NR
Rapid atrial pacing for acute conversion in patients who have pacing wires in place as part of a permanent pacemaker or implantable cardioverter-defibrillator or for temporary atrial pacing after cardiac surgery	I-C-LD
Acute antithrombotic therapy as for AF	I-B-NR
IV amiodarone for acute control of the ventricular rate (in the absence of pre-excitation) in patients with systolic heart failure when beta blockers are contraindicated or ineffective	IIa-B-R

Ongoing management of atrial flutter

Catheter ablation of the CTI is useful in patients either symptomatic or refractory to pharmacological rate control	I-B-R
Beta blockers, diltiazem, or verapamil to control the ventricular rate in hemodynamically tolerated atrial flutter	I-C-LD
Catheter ablation for recurrent symptomatic non-CTI-dependent flutter after failure of at least 1 antiarrhythmic agent	I-C-LD
Antithrombotic therapy as for AF	I-B-NR
Drugs to maintain sinus rhythm in patients with symptomatic, recurrent atrial flutter, with the drug choice depending on underlying heart disease and comorbidities:	IIa-B-R
a. Amiodarone	
b. Dofetilide	
c. Sotalol	
Catheter ablation for CTI-dependent atrial flutter that occurs as the result of flecainide, propafenone, or amiodarone used for treatment of AF	IIa-B-NR
Catheter ablation of the CTI in patients undergoing catheter ablation of AF who also have a history of documented clinical or induced CTI-dependent atrial flutter	IIa-C-LD
Catheter ablation for recurrent symptomatic non-CTI-dependent flutter as primary therapy, before therapeutic trials of antiarrhythmic drugs	IIa-C-LD
Flecainide or propafenone to maintain sinus rhythm in patients without structural heart disease or ischemic heart disease and symptomatic recurrent atrial flutter	IIb-B-R
Cather ablation for asymptomatic patients with recurrent atrial flutter	IIb-C-LD

ESC 2019 GL on SVT. Recommendations for the therapy of macro-re-entrant atrial arrhythmias

Anticoagulation as in AF for patients with atrial flutter and concomitant AF.	I	B
Patients with atrial flutter without AF should be considered for anticoagulation but the threshold for initiation is not established.	IIa	C
Acute therapy		
Synchronized direct-current cardioversion for haemodynamically unstable patients.	I	B
i.v. ibutilide or i.v. or oral (in-hospital) dofetilide for conversion to sinus rhythm.	I	B
Low-energy (≤ 100 J biphasic) electrical cardioversion for conversion to sinus rhythm.	I	B
If available, high-rate atrial pacing for termination of atrial flutter in the presence of an implanted pacemaker or defibrillator.	I	B
i.v. beta-blockers or non-dihydropyridine calcium-channel blockers (verapamil or diltiazem), for control of rapid ventricular rate.	IIa	B
Invasive and non-invasive high-rate atrial pacing for termination of atrial flutter.	IIb	B
i.v. amiodarone if the above are not available or desirable.	IIb	C
Propafenone and flecainide for reversion to sinus rhythm.	III	B
Long-term therapy		
Catheter ablation after the first episode of symptomatic typical atrial flutter.	IIa	B
Catheter ablation for symptomatic, recurrent episodes of cavotricuspid isthmus -dependent flutter.	I	A
Catheter ablation in experienced centres for symptomatic, recurrent episodes of non- cavotricuspid isthmus -dependent flutter.	I	B
Catheter ablation in patients with persistent atrial flutter or in the presence of depressed LV systolic function due to tachycardiomyopathy.	I	B
Beta-blockers or non-dihydropyridine calcium-channel blockers (verapamil or diltiazem, in the absence of HFrEF), if ablation is not desirable or feasible.	IIa	C
Amiodarone to maintain sinus rhythm if the above measures fail.	IIb	C
AV nodal ablation followed by pacing (preferable biventricular or His-bundle pacing) if all the above fails and the patient has symptomatic persistent macro re-entrant atrial arrhythmias with fast ventricular rates	IIa	C

i.v. verapamil and diltiazem are contraindicated in the presence of hypotension or HFrEF.

i.v. beta-blockers are contraindicated in the presence of decompensated heart failure.

i.v. ibutilide, and i.v. and oral dofetilide are contraindicated in patients with prolonged QTc interval.

i.v. amiodarone prolongs the QTc but torsades des pointes is rare.

HFrEF = heart failure with reduced left ventricular ejection fraction; AF = atrial fibrillation; i.v. = intravenous; J = joules; LV = left ventricle.

ACC/AHA/ACCP/HRS 2023 guideline on AF Anticoagulation of Typical AFL*

For patients with AFL, anticoagulant therapy is recommended according to the same risk profile used for AF. 1 B-NR

In patients with AFL who undergo successful cardioversion or ablation resulting in restoration of sinus rhythm, anticoagulation should be continued for at least 4 weeks postprocedure. 1 C-LD

Patients who have undergone successful CTI ablation and have had AF previously detected before AFL ablation should receive ongoing oral anticoagulation postablation as indicated for AF. 1 A

Patients who have undergone successful CTI ablation and are deemed to be at high thromboembolic risk, without any known previous history of AF, should receive close follow-up and arrhythmia monitoring to detect silent AF if they are not receiving ongoing anticoagulation in view of significant risk of AF. 1 B-NR

In patients who have undergone successful CTI ablation without any known previous history of AF who are at high risk for development of AF (eg, LA enlargement, inducible AF, chronic obstructive pulmonary disease, HF), prescribe long-term anticoagulation if thromboembolic risk assessment suggests high risk (>2% annual risk) for stroke. 2b B-NR

*This section refers to typical right-sided (CTI-dependent) AFL. Left-sided AFLs or atrial tachycardias (ATs) that develop after ablation of AF should be anticoagulated and managed in a manner similar to AF.

“Typical” AFL is defined as either typical counterclockwise AFL when the macroreentrant circuit is dependent on the CTI using the isthmus from the patient’s right to left or typical clockwise AFL when the macroreentrant circuit is dependent on the CTI and uses this isthmus from the patient’s left to right.

“Atypical” AFL is not dependent on the CTI and may arise from a macroreentrant circuit in the LA, such as perimitral or LA roof flutter or could be dependent on scar from previous ablation or surgery.

ESC 2024 GI on AF. Recommendations for prevention of thromboembolism in atrial flutter

Oral anticoagulation is recommended in patients with atrial flutter at elevated thromboembolic risk to prevent ischaemic stroke and thromboembolism I B

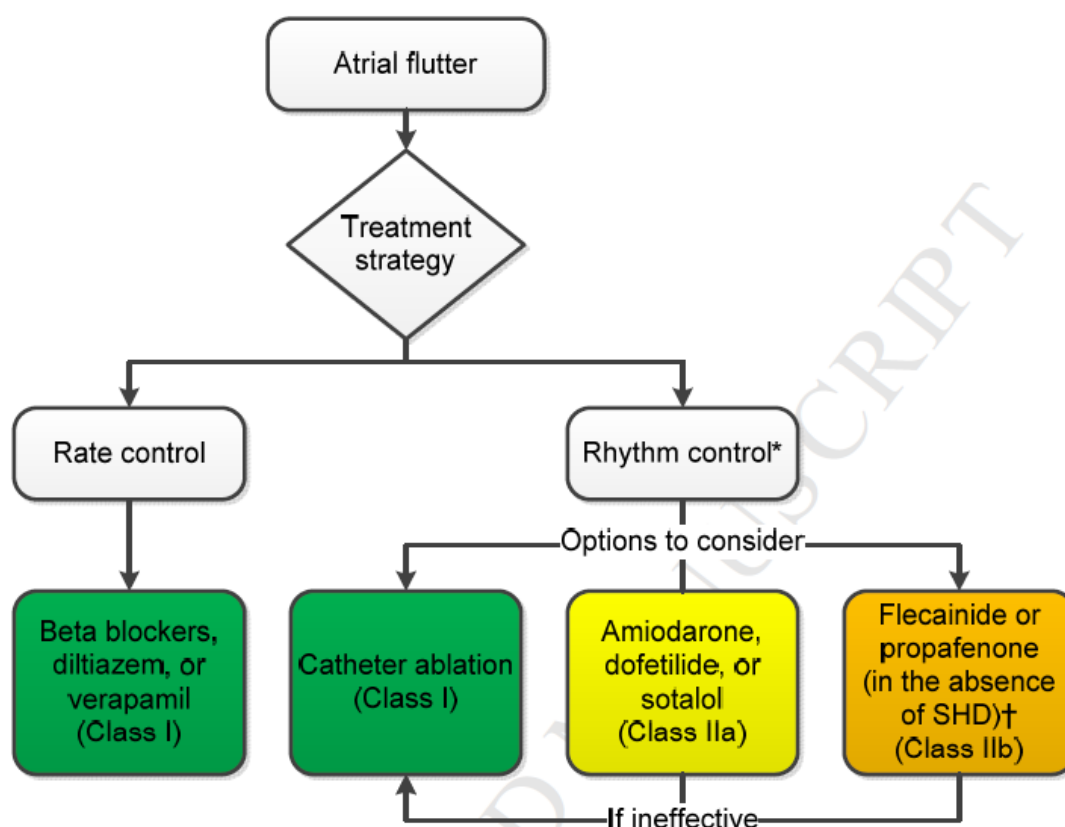


Figure 11. ACC/AHA/HRS 2015 GL on SVT. Ongoing Management of atrial flutter

Colors correspond to Class of Recommendation; drugs listed alphabetically.

*After assuring adequate anticoagulation or excluding left atrial thrombus by transesophageal echocardiography before conversion.

†Should be combined with AV nodal–blocking agents to reduce risk of 1:1 conduction during atrial flutter.

AV indicates atrioventricular; SHD, structural heart disease (including ischemic heart disease).

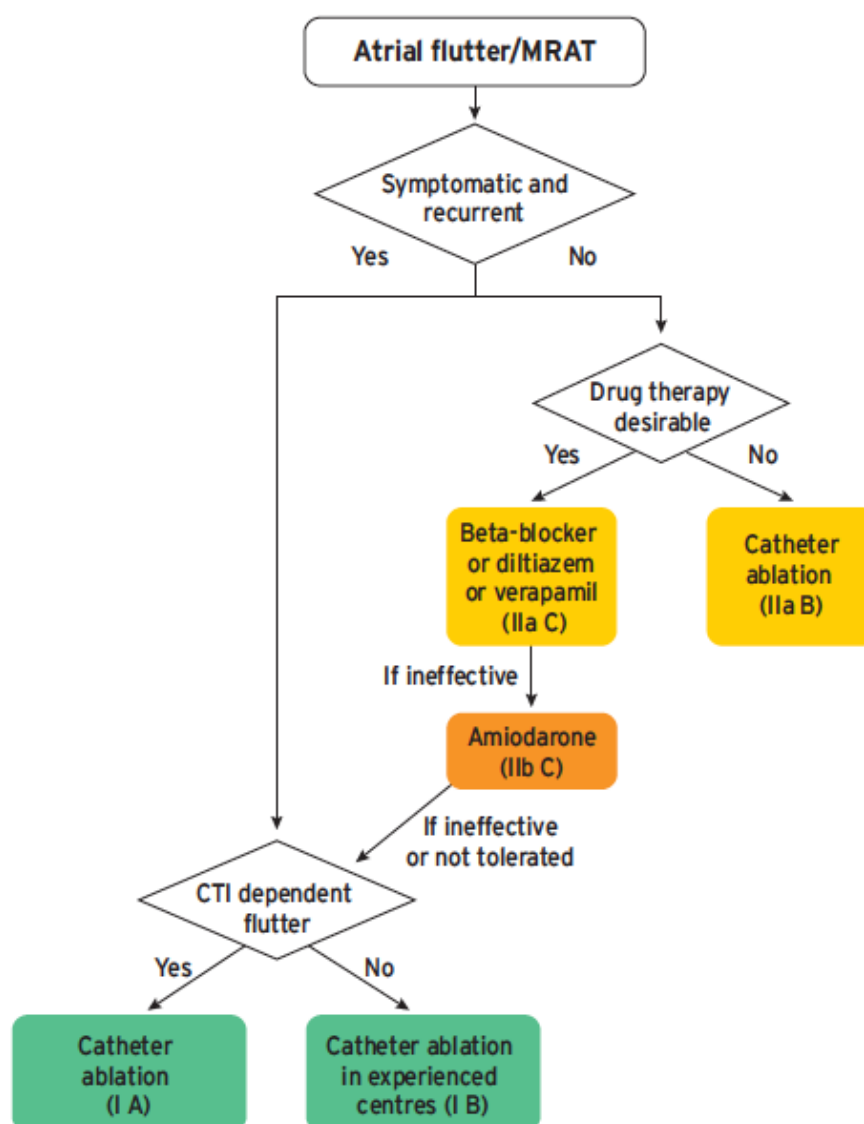


Figure 12. ESC 2019 GL on SVT. Chronic therapy of atrial flutter/macro-re-entrant atrial tachycardia.

Oral verapamil and diltiazem are contraindicated in the presence of HFrEF.

CTI = cavotricuspid isthmus; MRAT = macro-re-entrant atrial tachycardia; HFrEF = heart failure with reduced left ventricular ejection fraction.

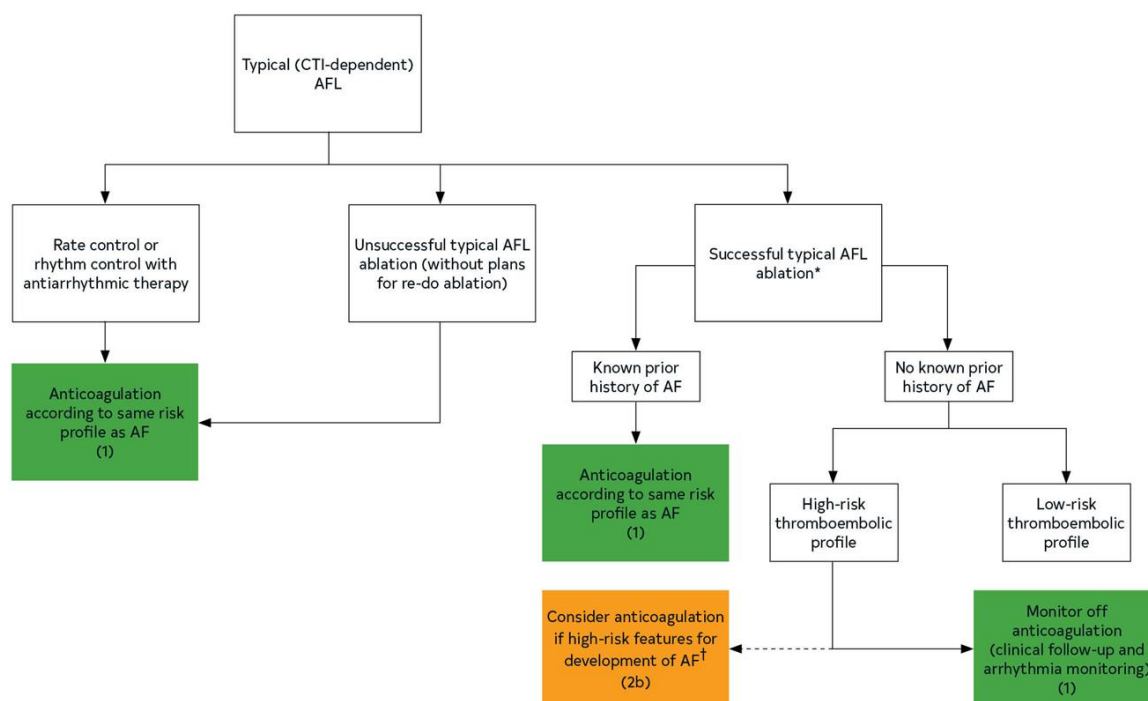


Figure 13. ACC/AHA/ACCP/HRS 2023 GL on AF. Anticoagulation for Typical (CTI-Dependent) AFL

*Intraprocedural documentation of bidirectional block. †For example, left atrial enlargement, inducible AF, COPD, concomitant heart failure.

AF indicates atrial fibrillation; AFL, atrial flutter; COPD, chronic obstructive pulmonary disease; and CTI, cavotricuspid isthmus.