Executive Summary: European Heart Rhythm Association Consensus Document on the Management of Supraventricular Arrhythmias

Endorsed by Heart Rhythm Society (HRS), Asia-Pacific Heart Rhythm Society (APHRS), and Sociedad Latinoamericana de Estimulación Cardiaca y Electrofisiologia (SOLAECE)

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Abstract

This paper is an executive summary of the full European Heart Rhythm Association (EHRA) consensus document on the management of supraventricular arrhythmias, published in *Europace*. It summarises developments in the field and provides recommendations for patient management, with particular emphasis on new advances since the previous European Society of Cardiology guidelines. The EHRA consensus document is available to read in full at http://europace.oxfordjournals.org

Keywords

Supraventricular tachycardia, supraventricular arrhythmias, EHRA consensus

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This is an executive summary of the full consensus document on the management of supraventricular tachycardia (SVT) patients published in Europace. The consensus document was prepared by a Task Force from the European Heart Rhythm Association (EHRA) with representation from the Heart Rhythm Society (HRS), Asia-Pacific Heart Rhythm Society (APHRS), and Sociedad Latinoamericana de Estimulación Cardiaca y Electrofisiologia (SOLAECE). It summarises current developments in the field and provides recommendations for the management of patients with SVT based on the principles of evidence-based medicine, with focus on new advances since the last ESC guidelines.[1] It does not cover atrial fibrillation, which is the subject of a separate clinical guideline.

The process for evidence review has been described in the full document. Consensus statements are evidence-based, and derived primarily from published data. Current systems of ranking level of evidence are becoming complicated in a way that their practical utility might be compromised. We have, therefore, opted for an easier and, perhaps, more user-friendly system of ranking that should allow physicians to easily assess current status of evidence and consequent guidance (see *Table 1*). EHRA grading of consensus statements does not have separate definitions of Level of Evidence.

Diagnosis and Management of SVT

The term supraventricular tachycardia literally indicates tachycardias (atrial and/or ventricular rates >100 bpm at rest), the mechanism of which involves tissue from the His bundle or above (see *Table 2*). Traditionally, however, SVT has been used to describe all kinds of tachycardias apart from ventricular tachycardias and atrial fibrillation (AF), the mechanisms of which are illustrated in *Figure 1*. The term narrow-QRS tachycardia indicates those with a QRS duration ≤ 120 ms. A wide-QRS tachycardia refers to one with a QRS duration >120 ms (see *Table 3*). In clinical practice, SVT may present as narrow- or wide-QRS tachycardias, and most of them usually, although not invariably, manifest as regular rhythms.

Recommendations for the differential diagnosis of various forms of supraventricular tachycardias, as well as supporting references, are included in *Figures 2–6*. Recommendations for acute treatment preferences are given. Long-term treatment with antiarrhythmic drugs and/or catheter ablation are also presented and described for each type of SVT, with detailed recommendations given in *Figure 7* and *Tables 4–15*. As compared with the previous SVT guideline from 2003, this consensus document contains several new recommendations based on new trials and meta-analyses, such as the management of patients with asymptomatic Wolff-Parkinson-White syndrome, and the cautious use of certain antiarrhythmic drugs in adult congenital heart diseases. Some discrepancies with the corresponding American College of Cardiology/American Heart Association/Heart Rhythm Society guidelines of 2015[2] may be related to new evidence that has emerged as well as differences in interpretation of studies and experts' opinion. ■

Table 1: Scientific Rationale of Recommendations

Scientific evidence that a treatment or procedure is beneficial and effective. Requires at least one randomised trial, or is supported by strong observational evidence and authors' consensus	Recommended/ indicated	
General agreement and/or scientific evidence favour the usefulness/efficacy of a treatment or procedure. May be supported by randomised trials that are, however, based on too small number of patients to allow a green heart recommendation	May be used or recommended	
Scientific evidence or general agreement not to use or recommend a treatment or procedure	Should NOT be used or recommended	

This categorisation for our consensus document should not be considered as being directly similar to that used for official society guideline recommendations which apply a classification (I-III) and level of evidence (A, B and C) to recommendations.

Table 2: Conventional Classification of Supraventricular Tachycardias

Atrial Tachycardias
Sinus Tachycardia
Physiological sinus tachycardia
Inappropriate sinus tachycardia
Sinus node reentrant tachycardia
Atrial Tachycardia
Focal atrial tachycardia
Multifocal atrial tachycardia
Macro-reentrant tachycardia
Cavotricuspid isthmus-dependent, counter-clockwise or clockwise (typical atrial flutter)
Non cavotricuspid isthmus–dependent, mitral isthmus-dependent, and other atypical left or right atrial flutters
Atrioventricular Junctional Tachycardias
Atrioventricular Nodal Reentrant Tachycardia
Typical
Atypical
Non-reentrant Junctional Tachycardia
Non-paroxysmal junctional tachycardia
Focal junctional tachycardia
Other non-reentrant variants
Atrioventricular Tachycardias
Atrioventricular reentrant tachycardia
Orthodromic
Antidromic (with retrograde conduction through the AV node or, rarely, through another pathway)

Table 3: Differential Diagnosis of Narrow and Wide QRS Tachycardias

Narrow QRS (≤120 ms) Tachycardias
Regular
Physiological sinus tachycardia
Inappropriate sinus tachycardia
Sinus nodal reentrant tachycardia
Focal atrial tachycardia
Atrial flutter
Atrial fibrillation with very fast ventricular response
Atrioventricular nodal reentrant tachycardia
Non-paroxysmal or focal junctional tachycardia
Orthodromic atrioventricular reentrant tachycardia
Idiopathic ventricular tachycardia (especially high septal VT)
Irregular
Atrial fibrillation
Atrial focal tachycardia or atrial flutter with varying AV block
Multifocal atrial tachycardia
Wide QRS (>120 ms) Tachycardias
Regular
Antidromic atrioventricular reentrant tachycardia
Any regular atrial or junctional reentrant tachycardias with: aberration/bundle branch block preexcitation/bystander accessory pathway
Ventricular tachycardia/flutter
Irregular
Atrial fibrillation or atrial tachycardia with varying block conducted with aberration
Antidromic atrioventricular reentrant tachycardia with a variable VA conduction
Pre-excited AF
Polymorphic VT
Torsade de pointes
Ventricular fibrillation

Table 4: Acute Management of SVT without Established Diagnosis

Haemodynamically unstable SVT		
Recommendation	Reference	
Synchronised electrical cardioversion is recommended*	3, 4	
Haemodynamically stable SVT		
Recommendation	Reference	
Vagal manoeuvres, preferably in the supine position, or adenosine are recommended	5–12	
IV diltiazem or verapamil may be considered	9, 10, 13–15	
IV beta-blockers may be considered	13, 16, 17	

** recommendation supported by strong observational evidence and authors' consensus but no specific RCT.*

Table 5: Therapy of Sinus Tachycardia

Inappropriate Sinus Tachycardia		
Recommendation	Reference	
Therapy is recommended mainly to control symptoms. Ivabradine is recommended for symptomatic patients	18, 19	
Beta-blockers and non-dihydropyridine calcium channel blockers are frequently ineffective or not tolerated at required doses. Therefore, may be considered as second- and third-line therapy, respectively	19, 20	
Catheter ablation should not be routinely considered in patients with inappropriate sinus tachycardia. This treatment must be restricted to the most symptomatic patients after the failure of other therapy and measures	21–23	
Sinus Nodal Reentrant Tachycardia		
Recommendation	Reference	
Catheter ablation may be used in patients with symptomatic sinus nodal reentrant tachycardia	24	
Oral beta-blockers, diltiazem or verapamil may be used in patients with symptomatic sinus nodal reentrant tachycardia	19, 25	

Table 6: Therapy of Focal Atrial Tachycardia

Acute therapy		
Recommendation	Reference	
Synchronised DC cardioversion is recommended for haemodynamically unstable patients*	4	
Adenosine may be used in terminating a non-reentrant AT or diagnosing the tachycardia mechanism	26, 27	
IV beta-blockers or verapamil or diltiazem may be used for pharmacologic cardioversion or rate control	9, 15, 28	
IV flecainide or propafenone may be used for pharmacologic cardioversion in the absence of structural or ischaemic heart disease	29, 30	
IV amiodarone may be used for pharmacologic cardioversion or rate control	31, 32	
IV ibutilide may be used for pharmacologic cardioversion of micro-reentrant AT	33	

** randomised data exist only for post-AF ablation AT. AT: atrial tachycardia.*

Chronic therapy		
Recommendation	Reference	
Catheter ablation is recommended, especially for incessant AT*	34, 35	
Beta-blockers or verapamil or diltiazem may be considered	36, 37	
Flecainide or propafenone in the absence of structural or ischaemic heart disease may be considered	29, 30, 38	

** recommendations supported by strong observational evidence and authors' consensus but no specific RCT.*

Table 7: Therapy of Multifocal Atrial Tachycardia

Recommendation	Reference	
Metoprolol is recommended in the absence of pulmonary disease	28, 39	
Verapamil or diltiazem may be considered in the presence of pulmonary disease	28	

Table 8: Therapy of Atrial Flutter/ Macro-reentrant Tachycardia

Acute Therapy		
Recommendation	Reference	
Synchronised DC cardioversion is recommended for haemodynamically unstable patients with AFL/MRT*	40, 41	
IV anticoagulation may be considered in case emergency cardioversion is necessary. Anticoagulation should be continued for 4 weeks after sinus rhythm is established	42, 43	
Intravenous beta-blockers, diltiazem or verapamil are recommended for acute rate control in patients with AFL who are haemodynamically stable	44–46	
IV ibutilide or dofetilide, under close monitoring due to proarrhythmic risk, are recommended to cardiovert AFL	47–51	
Amiodarone may be considered to control ventricular rate in the acute setting	52, 53	
Atrial overdrive pacing (via oesophagus or endocardial) may be considered for conversion of AFL/MRT	54–57	
Oral dofetilide may be considered to cardiovert AFL in non-urgent situations but only in hospitalised patients since there is a proarrhythmic risk	58	
Class Ic antiarrhythmic drugs should not be used in the absence of AV blocking agents because of the risk of slowing atrial rate, and leading to 1:1 AV conduction	59, 60	
Chronic Therapy		
Recommendation	Reference	
One-time or repeated cardioversion associated with AAD are recommended as a long-term alternative for patients with infrequent AFL recurrences or refusing ablation	61, 62	
In patients with recurrent or poorly tolerated typical AFL, CTI ablation is recommended for preventing recurrences with a low incidence of complications	62, 63	
In patients with depressed LV systolic function, ablation may be considered to revert dysfunction due to tachycardiomyopathy and prevent recurrences	64, 65	
Atypical AFL/MRT appearing early (3–6 months) after AF ablation may be initially treated by cardioversion and AAD, as it may not recur in the long term	66, 67	
In patients with recurrent atypical or multiple ECG AFL patterns, catheter ablation may be considered after documentation of mechanism	68–73	
Given the high incidence of AF after CTI ablation for typical AFL, correction of 'AF risk factors' may be considered after ablation	74–76	
Oral anticoagulation may be considered for patients with episodes of atrial flutter	42, 43, 77–79	
Stroke prevention is recommended with the same indications as in AF amongst patients with typical AFL and associated episodes of AF:* • 'Low risk' AFL patients, defined as CHA_2DS_2-VASc 0 in males or 1 in females, do not need antithrombotic therapy • Effective stroke prevention in patients with CHA_2DS_2-VASc score ≥1, is oral anticoagulation, whether with well controlled vitamin K antagonist (VKA) with a time in therapeutic range >70 %, or with a non-VKA oral anticoagulant (NOAC, either dabigatran, rivaroxaban, apixaban or edoxaban) • Bleeding risk should be assessed using the HAS-BLED score. Patients at high risk (score >3) should be identified for more regular review and follow-up, and the reversible bleeding risk factors addressed. A high HAS-BLED score is not a reason to withhold anticoagulation	42, 43	

** recommendations supported by strong observational evidence and authors' consensus but no specific RCT. AF: atrial fibrillation; AFL: atrial flutter;AV: atrioventricular; CTI: cavotricuspid isthmus; LV: left ventricular; MRT: macro-reentrant tachycardia.*

Table 9: Therapy of Atrioventricular Nodal Reentrant Tachycardia

Acute Therapy		
Recommendation	Reference	
Valsalva manoeuvre, preferably in the supine position, is recommended	5-8	
IV adenosine is recommended	9–12	
Synchronised direct-current cardioversion is recommended for haemodynamically unstable patients in whom adenosine fails to terminate the tachycardia*	80	
IV verapamil or diltiazem may be considered in the absence of hypotension or suspicion of VT or pre-excited AF	9, 10, 13–15, 81	
IV beta-blockers (metoprolol or esmolol) may be considered	13, 16, 17	
IV amiodarone may be considered	82	
Single oral dose of diltiazem and propranolol may be considered	83, 84	
Chronic Therapy		
Recommendation	Reference	
Catheter ablation for slow pathway modification is recommended in symptomatic patients or in patients with an ICD	85–89	
Diltiazem or verapamil may be considered	90–93	
Beta-blockers may be considered	84, 92	
No therapy for minimally symptomatic patients with infrequent, short-lived episodes of tachycardia	94	

** recommendation supported by strong observational evidence and authors' consensus but no specific RCT. AF: atrial fibrillation; ICD: implantable cardioverter-defibrillator.*

Table 10: Therapy of Focal Junctional Tachycardia

Acute Therapy		
Recommendation	Reference	
IV propranolol with or without procainamide, verapamil or flecainide may be considered for acute therapy	95–97	
Chronic Therapy		
Recommendation	Reference	
Beta-blockers, and in the absence of ischaemic or structural heart disease flecainide or propafenone, may be considered for chronic therapy	95, 98, 99	
Catheter ablation may be considered but at a risk of AV block	100, 101	

AV: atrioventricular.

Table 11: Therapy of Atrioventricular Reentrant Tachycardias Due to Manifest or Concealed Accessory Pathways

Acute Therapy		
Recommendation	Reference	
Vagal manoeuvres (Valsalva and carotid sinus massage), preferably in the supine position, are recommended as the first-line approach to achieve SVT termination. However, reversion rates range from 45.9% to 54.3%	5–8	
Adenosine is recommended for conversion to sinus rhythm but should be used with caution because it may precipitate AF with a rapid ventricular rate and even ventricular fibrillation	10, 11, 102	
Synchronised DC shock is recommended in haemodynamically unstable patients with AVRT if vagal manoeuvres or adenosine are ineffective or not feasible*	3	
IV ibutilide, procainamide, propafenone or flecainide in antidromic AVRT may be considered	103–105	
IV beta-blockers, diltiazem, verapamil in orthodromic AVRT may be considered	16, 106, 107	
IV digoxin, beta-blockers, diltiazem, verapamil and, possibly, amiodarone are potentially harmful in patients with pre-excited AF	108–113	

** recommendation supported by strong observational evidence and authors' consensus but no specific RCT. AF: atrial fibrillation; AVRT: atrioventricular reentrant tachycardia; SVT: supraventricular tachycardia.*

Chronic Therapy		
Recommendation	Reference	
Catheter ablation of the accessory pathway is recommended in patients with symptomatic AVRT and/or pre-excited AF*	114–116	
Catheter ablation of concealed accessory pathways may be considered in symptomatic patients with frequent episodes of AVRT	85, 86, 88, 89	
Oral flecainide or propafenone, preferably in combination with a beta-blocker, may be considered in patients with AVRT and/or pre-excited AF, and without structural or ischaemic heart disease	117–122	
Oral beta-blockers, diltiazem or verapamil may be considered for chronic management of AVRT if no pre-excitation sign on resting ECG are present	90–93	
Oral amiodarone may be considered only among patient in whom other AADs are ineffective or contraindicated, and catheter ablation is not an option	123, 124	

**: recommendation supported by strong observational evidence and authors' consensus but no specific RCT. AAD: anti-arrhythmic drug; AF: atrial fibrillation; AVRT: atrioventricular reentrant tachycardia.*

Table 12: Management of Asymptomatic Pre-excitation

Recommendation	Reference	
Electrophysiological testing may be considered for risk stratification in subjects with asymptomatic ventricular pre-excitation	116, 125–131	
Catheter ablation of accessory pathways may be considered in asymptomatic patients with accessory pathways with antegrade refractory period <240 ms, inducible atrioventricular reentrant tachycardia triggering pre-excited atrial fibrillation, and multiple accessory pathways*	116, 128, 131	
Observation without treatment may be reasonable in asymptomatic WPW patients who are considered to be at low risk following electrophysiology study or due to intermittent preexcitation	116, 127	
Screening programmes may be considered for risk stratification of asymptomatic subjects with pre-excited ECG	116, 127	

** recommendation supported by two randomised trials based on small numbers of patients. WPW: Wolff-Parkinson-White syndrome.*

Table 13: Acute Therapy of Supraventricular Tachycardias in Adult Congenital Heart Disease Patients

SVT Haemodynamically Unstable		
Recommendation	Reference	
Electrical cardioversion is recommended (caution for sinus node dysfunction and impaired ventricular function with need for chronotropic or inotropic support)*	132	
IV adenosine for conversion may be considered (caution for sinus node dysfunction and impaired ventricular function with need for chronotropic or inotropic support)	26, 27	
AVNRT/AVRT Haemodynamically Stable		
Recommendation	Reference	
IV adenosine may be considered	26, 27	
Atrial overdrive pacing (via oesophagus or endocardial) may be considered	54–57	
Atrial flutter/AT haemodynamically stable		
Recommendation	Reference	
IV ibutilide for conversion of atrial flutter may be considered (caution for pro-arrhythmia in patients with impaired ventricular function)	133	
IV metoprolol (caution for hypotension) may be considered for conversion and rate control	16, 39	
Atrial overdrive pacing for conversion of atrial flutter (via oesophagus or endocardial) may be considered	54–57	

**: recommendation supported by strong observational evidence and authors' consensus but no specific RCT.*

Table 14: Chronic Therapy of Supraventricular Tachycardias in Adult Congenital Heart Disease Patients

Recurrent symptomatic SVT		
Recommendation	Reference	
Haemodynamic evaluation of structural defect for potential repair may be considered as initial evaluation of SVT	134, 135	
Catheter ablation may be considered	136–142	
Oral beta-blockers may be considered for recurrent AT or atrial flutter	143	
Amiodarone may be considered for prevention, if other medications and catheter ablation are ineffective or contraindicated	144	
Antithrombotic therapy for AT or atrial flutter is the same as for patients with AF, since CHD patients with atrial tachycardias and atrial flutter probably have similar risks for thromboembolism as patients with AF	145, 146	
Oral sotalol should not be used related to increased risk for proarrhythmias and mortality	147	
Flecainide should not be used in patients with ventricular dysfunction related to increased risk for proarrhythmia and mortality	148	
Implantation of a pacemaker for atrial-based pacing to decrease recurrence of atrial tachycardia/flutter is not recommended	149	
Planned surgical repair and symptomatic SVT		
Recommendation	Reference	
Surgical ablation of AT, atrial flutter or accessory pathway may be considered	150, 151	
In patients planned for surgical repair of Ebstein's anomaly, preoperative electrophysiological study may be considered as a routine test	152, 153	
In patients with SVT planned for surgical repair of Ebstein's anomaly, preoperative catheter ablation or intraoperative surgical ablation of accessory pathways, flutter or AT may be considered.	152–155	

AF: atrial fibrillation; AT: atrial tachycardia; CHD: congenital heart disease; SVT: supraventricular tachycardia.

Table 15: Recommendations for Treatment of Supraventricular Tachycardias During Pregnancy

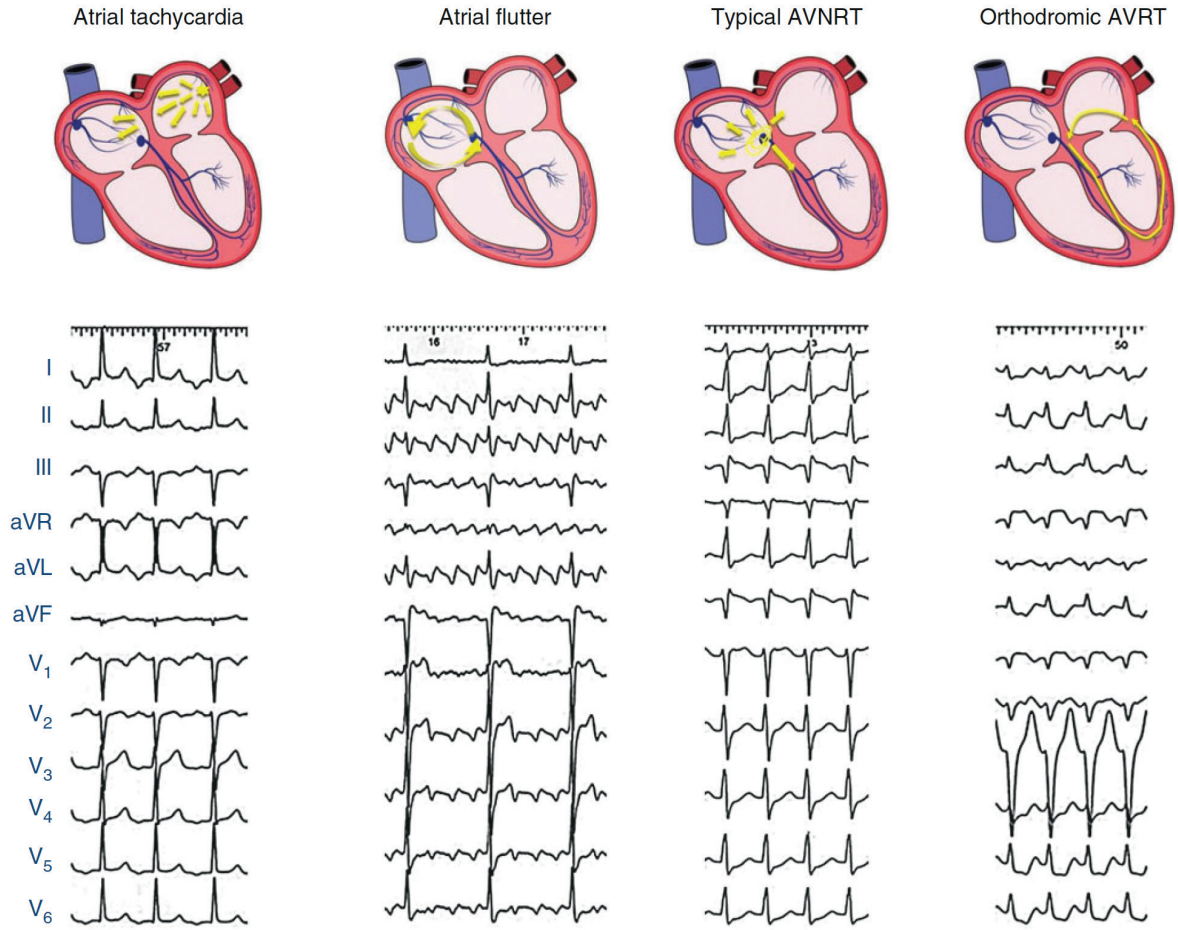
Acute therapy		
Recommendation	Reference	
DC cardioversion in patients with SVT causing haemodynamic instability*	156	
Vagal manoeuvres, preferably in the supine position, may be considered as first line therapy		
Adenosine may be considered if vagal manoeuvres fail	157	
IV metoprolol or propranolol may be considered as a second line drug if adenosine is ineffective	158	
IV verapamil may be considered if adenosine and beta-blockers are ineffective or contraindicated	159	

** recommendation supported by strong observational evidence and authors' consensus but no specific RCT. DC: direct current; SVT: supraventricular tachycardias.*

Chronic therapy		
Recommendation	Reference	
No medical therapy may be considered in patients with tolerable symptoms		
Metoprolol, proprabolol or acebutolol may be considered in highly symptomatic patients*	158, 160	
Verapamil may be reasonable in highly symptomatic patients when beta-blockers are ineffective or contraindicated*	161	
Sotalol and flecainide may be reasonable in highly symptomatic patient when beta-blockers are ineffective or contraindicated*	162, 163	
Catheter ablation may be considered in highly symptomatic, drug refractory SVT after the first trimester	164	
Atenolol is not recommended	158, 165	

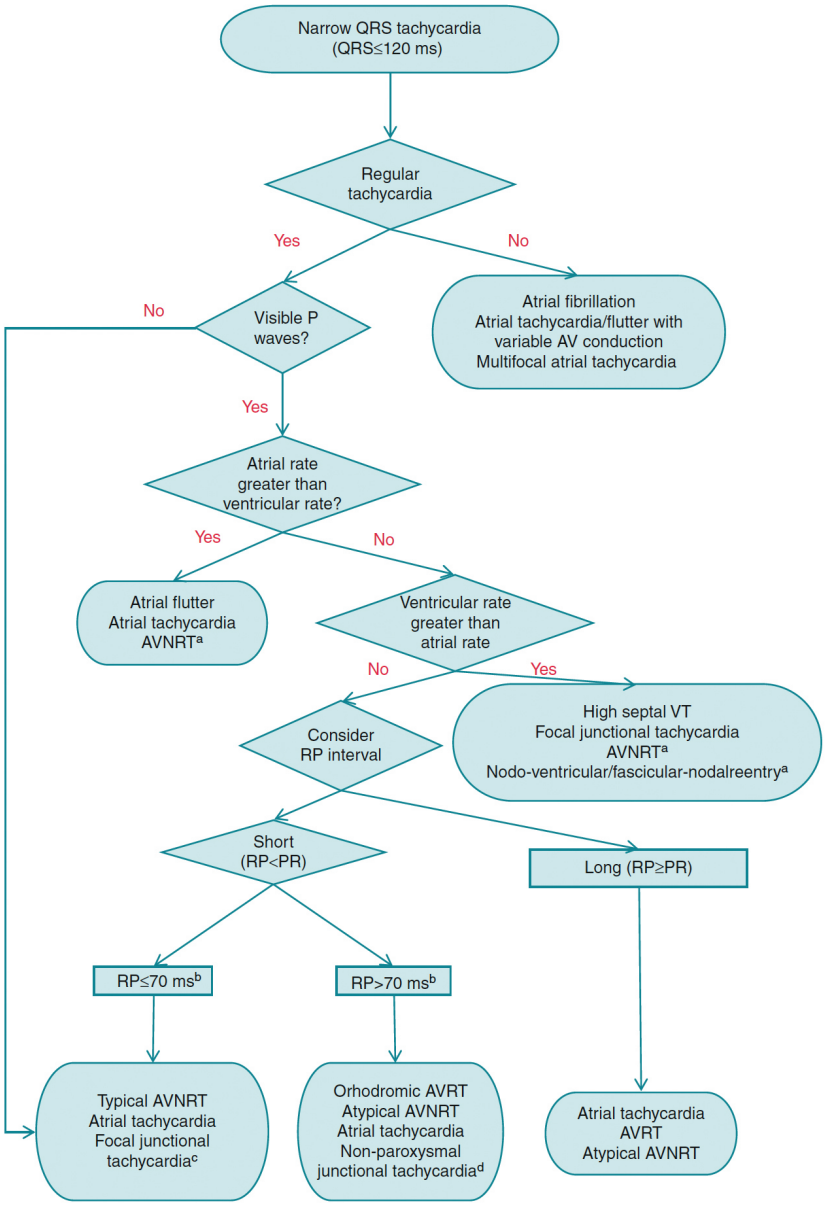
** drugs should be avoided during the first trimester if possible. SVT: supraventricular tachycardias.*

Figure 1: Tachycardia Circuit and Typical 12-lead ECGs in Different Types of Narrow- and Wide-QRS Supraventricular Tachycardias



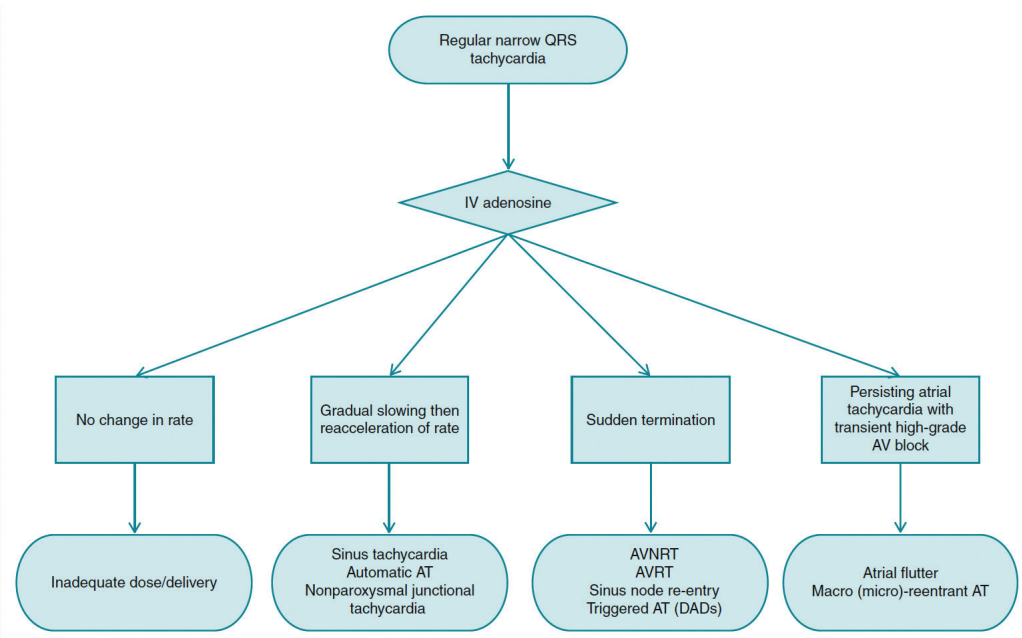
From left to right: typical (anti-clockwise) atrial flutter; left atrial tachycardia; typical AVNRT (slow-fast); orthodromic AVRT due to a left lateral accessory pathway; atypical AVNRT with LBBB aberration; antidromic AVRT due to an atriofascicular pathway (usually produces a horizontal or superior QRS axis, but normal axis may also occur, depending on the way of insertion into the right bundle and fusion over the left anterior fascicle). AVNRT: atrioventricular nodal reentrant tachycardia; AVRT: atrioventricular reentrant tachycardia; AP: accessory pathway, LBBB: left bundle branch reentry.

Figure 2: Differential Diagnosis of Narrow-QRS Tachycardia



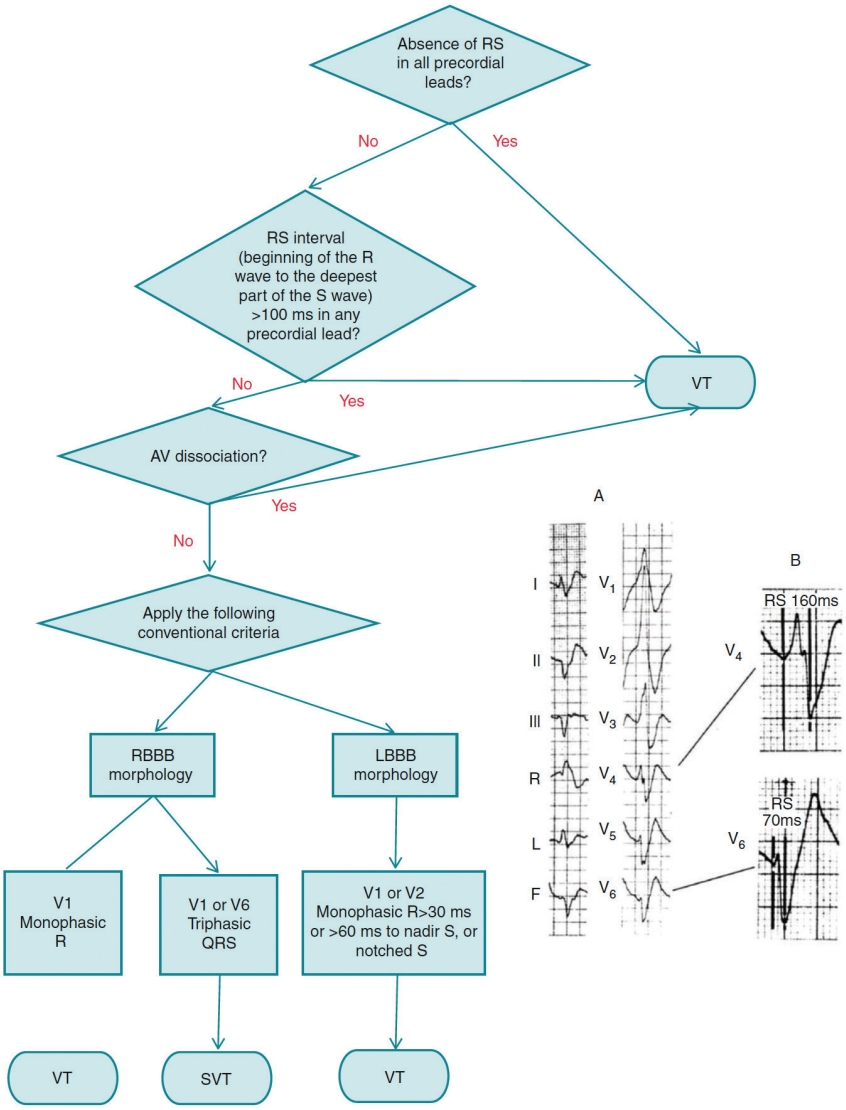
a: rare causes; b: arbitrary number based on the VA interval for which data exist. An interval of 90 ms may also be used for surface ECG measurements if P waves are visible; c: it may also present with AV dissociation; d: it may also present with a short RP AVNRT: atrioventricular nodal reentrant tachycardia. AVRT: atrioventricular reentrant tachycardia; AP: accessory pathway.

Figure 3: Responses of Narrow Complex Tachycardias to Adenosine



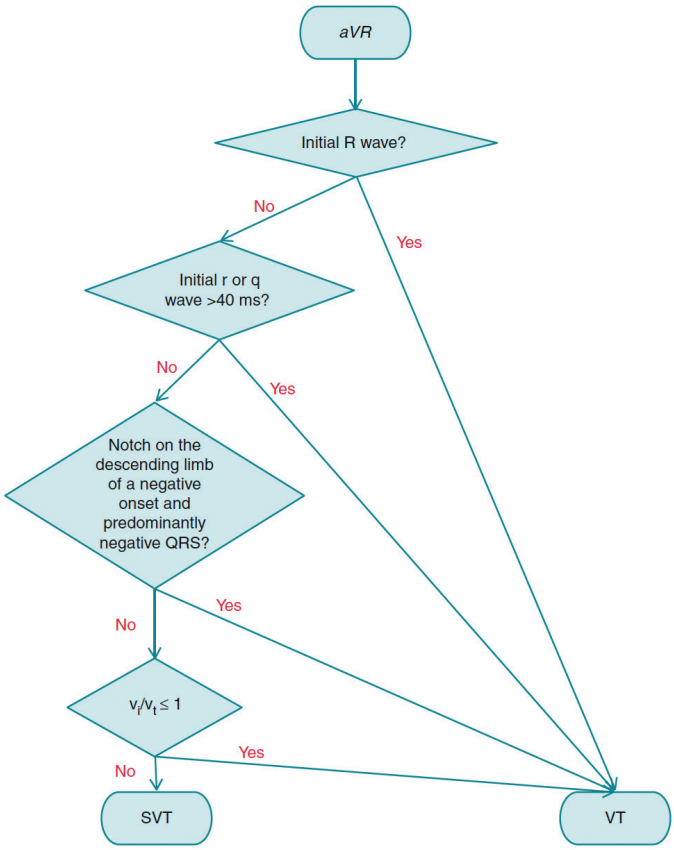
AVNRT: atrioventricular nodal reciprocating tachycardia; AVRT: atrioventricular reciprocating tachycardia; AT: atrial tachycardia; AV: atrioventricular; IV: intravenous; DAD: delayed afterdepolarisation; VT: ventricular tachycardia.

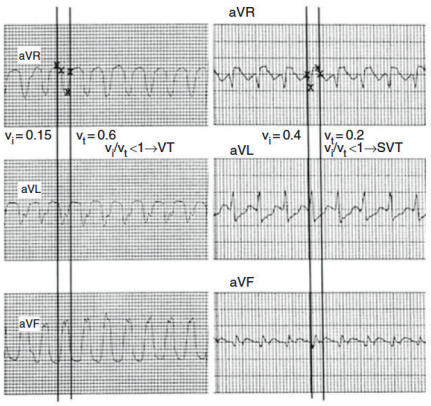
Figure 4: Differential Diagnosis of Wide QRS using the Brugada et al. Algorithm. The RS Interval (enlarged in the right panel) Measures 160 ms in lead V, and 70 ms in lead V6. Thus, the Longest RS Interval is More Than 100 ms and Diagnostic of Ventricular Tachycardia



Source: Brugada et al., 1991.[166]

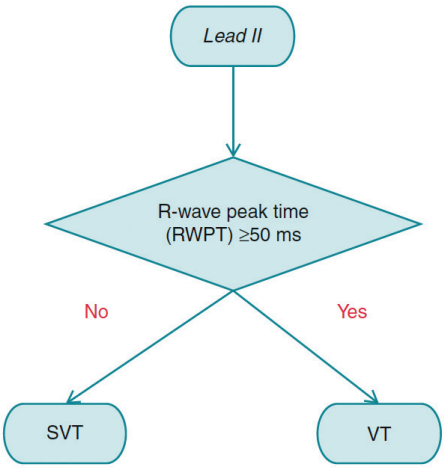
Figure 5: Differential Diagnosis of Wide-QRS Tachycardia using the Vereckei et al. Algorithm

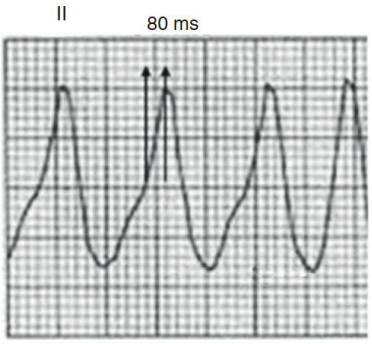




In the lower panel, the crossing points of the vertical lines with the QRS contour in lead aVR show the onset and end of the QRS complex in lead aVR. The crossing points and initial and terminal 40 ms of the chosen QRS complex are marked by small crosses. v_i/v_t is the ventricular activation velocity ratio by measuring the vertical excursion in mV recorded on the ECG during the initial (v_i) and terminal (v_t) 40 ms of the QRS complex. Left: During the initial 40 ms of the QRS, the impulse traveled vertically 0.15 mV; therefore, v_i = 0.15. During the terminal 40 ms of the QRS, the impulse traveled vertically 0.6 mV; therefore, v_t = 0.6. Thus, v_i/v_t<1 yields a diagnosis of VT. Right: v_i = 0.4 and v_t = 0.2, determined the same way as in the left panel; thus, v_i/v_t>1 suggests a diagnosis of SVT. Source: Vereckei et al., 2008.[167]

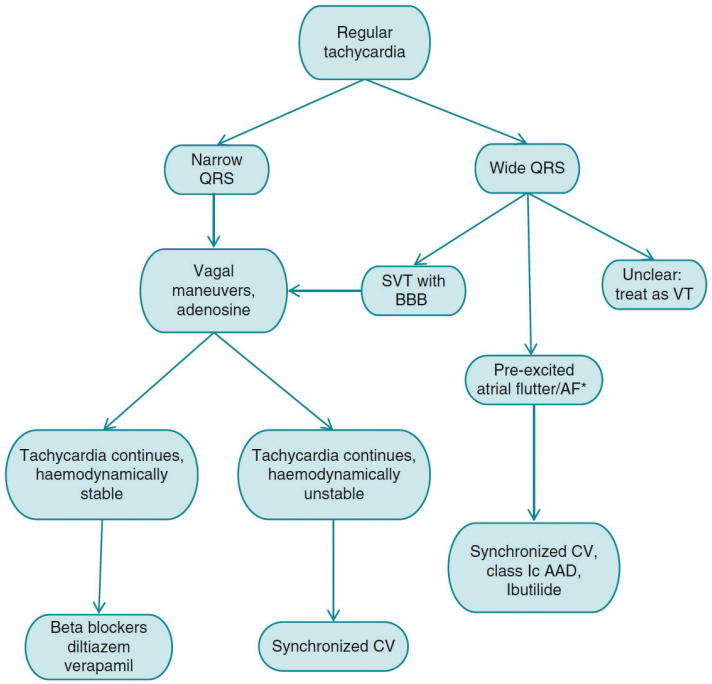
Figure 6: Measurement of the R-wave Peak Time (RWPT) in Lead II





R-wave peak time (RWPT) measured from the isoelectric line to the point of first change in polarity is >50 ms (80 ms), thus indicating ventricular tachycardia. Source: Pava et al., 2010.[168]

Figure 7: Acute Treatment of Regular Tachycardia



Source: Pava et al., 2010.[168]

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