

## CARDIAC ARRHYTHMIAS

### Supporting information

**This guideline has been prepared with reference to the following:**

ESC Scientific Document Group. 2019 ESC Guidelines for the management of patients with supraventricular tachycardia: The Task Force for the management of patients with supraventricular tachycardia of the European Society of Cardiology (ESC). Eur Heart J. 2020; 41: 655–720

<https://academic.oup.com/eurheartj/article/41/5/655/5556821>

Scottish Intercollegiate Guidelines Network (SIGN). Cardiac arrhythmias in coronary heart disease. 2018. SIGN

<https://www.sign.ac.uk/our-guidelines/cardiac-arrhythmias-in-coronary-heart-disease/>

Al-Khatib SM, Stevenson WG, Ackerman MJ et al. 2017 AHA/ACC/HRS Guideline for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death. J Am Coll Cardiol. 2018;72:1677-1749

<https://www.ahajournals.org/doi/full/10.1161/CIR.0000000000000549>

Page RL, Joglar JA, Caldwell MA et al. 2015 ACC/AHA/HRS Guideline for the Management of Adult Patients With Supraventricular Tachycardia: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. Circulation. 2016;133:e471-505

<https://www.ahajournals.org/doi/full/10.1161/CIR.0000000000000310>

#### **In symptomatic bradycardia, atropine 600 mcg IV, repeated once after 5 min if appropriate, improves the clinical outcome?**

In a small study used to evaluate the effectiveness of atropine 0.02mg/kg in identifying individuals with abnormal intrinsic sinus automaticity (Cappato, 1987), atropine increased heart rate in all 49 evaluable patients with persistent sinus bradycardia.

A retrospective review in 172 patients (Brady, 1999) found a partial or complete response to atropine therapy in approximately 50% of cases.

Brady WJ, Swart G, DeBehnke DJ, et al. The efficacy of atropine in the treatment of hemodynamically unstable bradycardia and atrioventricular block: prehospital and emergency department considerations. Resuscitation 1999;41:47-55

Cappato R, Alboni P, Paparella N, et al. Bedside evaluation of sinus bradycardia: usefulness of atropine test in discriminating organic from autonomic involvement of sinus automaticity. Am Heart J 1987;114:1384-8

#### **Evidence Level: V**

#### **In sinus pauses and sino-atrial block, pacing is appropriate if prolonged and symptomatic?**

Electrophysiological testing of 28 symptomatic patients with sinus pauses and/or sinoatrial block revealed abnormal responses in 23 patients (Scheinman, 1978). A life-threatening arrhythmia was seen in 5 of 28 patients. Symptomatic patients are at high risk and pacing should be considered.

Scheinman MM, Strauss HC, Abbott JA, et al. Electrophysiological testing in patients with sinus pauses and/or sinoatrial exit block. Eur J Cardiol 1978;8:51-60

#### **Evidence Level: V**

#### **No treatment is necessary for first degree atrioventricular (AV) conduction block?**

A 2016 systematic review of 14 comparative studies (with 400,750 participants) concluded that prolonged PR interval and first-degree atrioventricular block are not benign conditions and are associated with increased mortality, heart failure and atrial fibrillation (Kwok et al, 2016). Physicians should not, therefore, consider first-degree atrioventricular block as a benign condition. Contrary to current expert advice, the results suggested that closer monitoring may be warranted for future events, although effective risk reduction strategies still need to be developed.

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Kwok CS, Rashid M, Beynon R et al. Prolonged PR interval, first-degree heart block and adverse cardiovascular outcomes: a systematic review and meta-analysis. *Heart*. 2016;102:672-80  
<http://heart.bmj.com/content/102/9/672.full>

#### **Evidence Level: I**

#### **In intraventricular conduction block/bundle branch block, pacing is unnecessary, except in the following circumstances?**

##### **Bifascicular block:**

432 patients with MI and bundle branch block were assessed for the cause of high degree AV block or sudden death (Hindman, 1978). Patients at highest risk of these events were those with new bifascicular block.

##### **Trifascicular block:**

An observational study (Ritter, 1976) reports that 33 of 71 patients with RBBB and alternating hemiblock developed transient complete block during MI. Of these, 15 died from heart failure before discharge. In five of the 6 unpaced patients who died, mean survival was 2.4 months (the 6<sup>th</sup> was lost to follow-up). The remaining 12 patients were all paced and survived a mean of 18 months.

Hindman MC, Wagner GS, Jaro M, et al. The clinical significance of bundle branch block complicating acute myocardial infarction. 2. Indications for temporary and permanent pacemaker insertion. *Circulation* 1978;54:689-99

<http://circ.ahajournals.org/content/58/4/689.long>

Ritter WS, Atkins JM, Blomqvist CG, et al. Permanent pacing in patients with transient trifascicular block during acute myocardial infarction. *Am J Cardiol* 1976;38:205-8

#### **Evidence Level: III**

#### **Tachycardias - Carotid massage is useful if initial diagnosis is in doubt?**

Carotid sinus massage has been shown to terminate supraventricular tachycardia and atrioventricular nodal reentrant tachycardia (Lim, 1998; Mehta, 1988). Carotid sinus massage should not be performed in patients with suspected carotid artery disease.

A 2021 systematic review of 14 RCTs compared the effectiveness and adverse events amongst vagal maneuvers on supraventricular tachycardia (Huang, 2021). Compared with carotid sinus massage, the modified Valsalva maneuver was found to be the most effective vagal maneuver after initial performance [surface under the cumulative ranking curve - SUCRA: 0.9992, RR: 5.47 (95% CI: 1.77 to 16.93)] and at the end of study [SUCRA: 1.0000, RR: 3.62 (5% CI: 2.04 to 6.39)]. The authors concluded that the modified Valsalva maneuver should be the first choice of vagal maneuvers for rhythm conversion before the pharmacological management of supraventricular tachycardia.

Huang EP, Chen CH, Fan CY et al. Comparison of Various Vagal Maneuvers for Supraventricular Tachycardia by Network Meta-Analysis. *Front Med (Lausanne)*. 2022;8:769437

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8850969/>

Lim SH, Anantharaman V, Teo WS, et al. Comparison of treatment of supraventricular tachycardia by Valsalva maneuver and carotid sinus massage. *Ann Emerg Med* 1998;31:30-5

Mehta D, Wafa S, Ward DE, et al. Relative efficacy of various physical manoeuvres in the termination of junctional tachycardia. *Lancet* 1988;i:1181-5

#### **Evidence Level: I**

#### **Adenosine should be given if carotid massage is unsuccessful?**

Nine patients with broad QRS complex tachycardia (SVT) were given adenosine (Griffith, 1988). Six were converted to sinus rhythm, 1 converted to a narrow QRS complex tachyarrhythmia, 1 developed AV block and 1 had no response. 17 patients with broad QRS complex tachycardia (VT) were also given adenosine. In 16 this had no effect, though 1 had exercise-induced VT terminated. In 9 patients with narrow complex QRS complex tachyarrhythmia, adenosine terminated the arrhythmia in 8 and led to AV block in the ninth.

These findings were reproduced in 24 patients with broad QRS complex tachyarrhythmias given adenosine doses up to 20mg (Rankin, 1989). The arrhythmias were terminated in 6 patients, converted to atrial or sinus arrhythmia in 4 but persisted in 14 patients indicating VT.

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Dipyridamole is an inhibitor of adenosine uptake and may therefore potentiate the effect of adenosine. Adenosine should not be administered to patients receiving dipyridamole but where this is unavoidable the dose should be reduced by a factor of 4 (Watt, 1986).

A "BestBets" review of 8 studies (Gebril, 2012) found that:

"No serious side-effects at all were reported in the eight papers we found looking at the safety and efficacy of using adenosine in patients with unstable PSVT. There were only short-lived, transient side effects such as headache, flushing, transient arrhythmias and chest tightness, which are well recognised effects in stable patients anyway. In addition, the efficacy of adenosine in converting patients to sinus rhythm is similar for both stable and unstable patients, although some of the papers looked at in this review do not specifically compare the results in stable and unstable patients. In addition, the definition of stable varied between studies. In view of the above and the speed and ease of giving adenosine to unstable patients as opposed to the need for and potential risks of anaesthesia in DC cardioversion, it seems sensible to use adenosine as first-line treatment in unstable patients. The evidence indicates that this is the case for both adults and children. However, there has not been a prospective randomised controlled trial comparing the two treatments."

Gebril A; Hawes S. Towards evidence-based emergency medicine: best BETs from the Manchester Royal Infirmary. BET 1: is intravenous adenosine effective and safe in patients presenting with unstable paroxysmal supraventricular tachycardia? Emerg Med J 2012;29:251-4  
<http://emj.bmj.com/content/29/3/251.2.long>

Griffith MJ, Linker NJ, Ward DE, et al. Adenosine in the diagnosis of broad complex tachycardia. Lancet 1988;i:672-5

Rankin AC, Oldroyd KG, Chong E, et al. Value and limitations of adenosine in the diagnosis and treatment of narrow and broad complex tachycardias. Br Heart J 1989;62:195-203  
<http://heart.bmj.com/content/62/3/195.long>

Watt AH, Bernard MS, Webster J, et al. Intravenous adenosine in the treatment of supraventricular tachycardia: a dose-ranging study and interaction with dipyridamole. Br J Clin Pharmacol 1986;21:227-30  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1400919/pdf/briclinpharm00133-0102.pdf>

## **Evidence Level: II**

### **Sinus tachycardia should be treated with beta-blockers if inappropriate and distressing?**

Inappropriate sinus tachycardia is a rare, ill-defined condition. This may explain the paucity of case-series or trials comparing treatments (Morillo, 1994).

A 2019 review of the evidence found that inappropriate sinus tachycardia patients may benefit from beta-blockade. To assuage tachycardia, during exercise, a beta-blocker may be useful. However, for many patients who have IST, beta-blockers, even at high doses, may be ineffective. Occasionally, the beta-blocker, nadolol is a potent and useful treatment (Olshansky, 2019).

Morillo CA, Klein GJ, Thakur RK, et al. Mechanism of 'inappropriate' sinus tachycardia: role of sympathovagal balance. Circulation 1994;90:873-7  
<http://circ.ahajournals.org/content/90/2/873.long>

Olshansky B & Sullivan RM. Inappropriate sinus tachycardia. Europace. 2019;21:194-207

## **Evidence Level: V**

### **Atrial tachycardia should be treated with flecainide?**

Flecainide has been shown to improve the symptoms associated with supraventricular tachycardias, including atrial tachycardia (Hopson, 1996; Hohnloser, 1992).

Hopson JR, Buxton AE, Rinkenberger RL, et al. Safety and utility of flecainide acetate in the routine care of patients with supraventricular tachyarrhythmias: results of a multicenter trial. The Flecainide Supraventricular Tachycardia Study Group. Am J Cardiol 1996;77:72A-82A

Hohnloser SH, Zabel M. Short- and long-term efficacy and safety of flecainide for supraventricular arrhythmias. Am J Cardiol 1992; 70: 3A-10A

## **Evidence Level: II**

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**Wolff-Parkinson-White Syndrome is also treated with flecainide or sotalol?**

Flecainide has been shown in a prospective, descriptive study to be effective in the termination of circus movement tachycardias and atrial fibrillation associated with W-P-W syndrome (Neuss, 1988). Sotalol enabled 15/16 patients with the syndrome to be clinically free of symptoms over a median of 36 months of follow-up (Kunze, 1987).

Kunze KP, Schluter M, Kuck KH. Sotalol in patients with Wolff-Parkinson-White syndrome. *Circulation* 1987;75: 1050-7

<http://circ.ahajournals.org/content/75/5/1050.long>

Neuss H, Schlepper M. Long-term efficacy and safety of flecainide for supraventricular tachycardia. *Am J Cardiol* 1988;62:56D-61D

**Evidence Level: IV****Junctional re-entry tachycardia is treated with adenosine or verapamil?**

Both adenosine and verapamil are effective in the termination of paroxysmal junctional tachycardia. Adenosine may be more effective in patients with AV re-entrant tachyarrhythmias (Garratt, 1989). Verapamil is ineffective and potentially hazardous in wide QRS complex arrhythmias. 45 of 57 episodes of wide QRS complex tachyarrhythmias failed to respond to verapamil. Two patients suffered cardiac arrest, and 12 severe hypotension (Rankin, 1987).

Garratt C, Linker N, Griffith M, et al. Comparison of adenosine and verapamil for termination of paroxysmal junctional tachycardia. *Am J Cardiol* 1989;64:1310-16.

Rankin AC, Rae AP, Cobbe SM. Misuse of intravenous verapamil in patients with ventricular tachycardia. *Lancet* 1987;ii: 472-4.

**Evidence Level: III****Ventricular tachycardia is treated with lidocaine (lignocaine)?**

A series of drug trials in 24 patients with sustained VT (Griffith 1990) concluded that lidocaine (lignocaine) was the safest drug and should continue to be the drug of first choice. Disopyramide is also effective, as is flecainide – although this has a worse side-effect profile.

Griffith MJ, Linker NJ, Garratt CJ, et al. Relative efficacy and safety of intravenous drugs for termination of sustained ventricular tachycardia. *Lancet* 1990; 336: 670-3

**Evidence Level: IV**

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