

Tachyarrhythmias

Definition of tachycardia

- Cardiac arrhythmia with a rate >100 beats per minute (bpm)

Differential diagnosis of tachycardia

- Narrow complex tachycardias
 - Regular (supraventricular tachycardia [SVT])
 - Sinus tachycardia
 - Physiological response to insult. Impulse originates from sino-atrial (SA) node.
 - Atrial tachycardia
 - Aberrant atrial focus producing impulse independent of SA node
 - Atrioventricular nodal re-entry tachycardia (AVNRT)
 - Re-entry circuit within or near AV node
 - AV re-entry tachycardia (AVRT)
 - Re-entry circuit conducted from atria to ventricles via abnormal accessory pathway; usually due to Wolff-Parkinson-White (WPW) syndrome
 - Atrial flutter with regular AV block (eg 2:1, 3:1)
 - Re-entry circuit within the atria
 - Irregular
 - Atrial fibrillation (AF)
 - Atria twitch instead of beating in a coordinated manner
- Broad complex tachycardias
 - Regular
 - Ventricular tachycardia (VT)
 - Generated by a single ventricular focus
 - SVT with bundle branch block (BBB)
 - This is rare. Any broad complex tachycardia should be treated as VT unless there the patient has an old ECG with clear previous bundle branch block of unchanged morphology.
 - Irregular
 - Polymorphic VT (Torsades de pointes)
 - Sinusoidal morphology usually due to abnormal ventricular repolarisation (long QT)
 - AF with bundle branch block

Aetiology of tachyarrhythmias (pathological as opposed to physiological)

- Cardiac
 - Post-cardiac arrest
 - Post-myocardial infarction (MI)
 - Long QT syndrome
 - Valvular heart disease
 - Cardiomyopathy
- Non-cardiac
 - Hypoxia
 - Hypovolaemia
 - Electrolyte abnormalities
 - Especially hypo/hyper-kalaemia, -calcaemia or -magnesaemia

- Hypoglycaemia
- Hypo/hyperthermia
- Hypo/hyperthyroidism
- Sepsis
- Drug-induced
 - Cocaine
 - Amphetamines
 - Tricyclic antidepressants
 - Beta blockers
 - Digoxin
 - Amiodarone

Clinical features of tachycardias

- Adverse features
 - Shock
 - Hypotension, diaphoresis, pallor, increased capillary refill time (CRT)
 - Syncope
 - Transient loss of consciousness
 - Myocardial ischaemia
 - Ischaemic chest pain and/or ischaemic electrocardiogram (ECG) changes
 - Cardiac failure
 - Orthopnoea, paroxysmal nocturnal dyspnoea (PND), bibasal crepitations, raised jugular venous pressure (JVP)
- Non-adverse features
 - Palpitations
 - Dyspnoea
 - Anxiety

Initial investigation of tachycardia

- Bloods
 - Full blood count
 - Urea & electrolytes
 - Magnesium
 - Bone profile (particularly noting calcium and phosphate)
 - Thyroid function tests
 - Other: liver function (useful pre-medication); coagulation (may need anticoagulation)
- Chest radiograph (CXR)

Further investigation of tachycardia

- Echocardiogram (echo)

Initial management of tachycardia

- Assess patient from an ABCDE perspective
- Maintain a patent airway
 - Use manoeuvres, adjuncts, supraglottic or definitive airways as indicated
- Controlled oxygen
 - Maintain saturations (S_pO_2) 94-98%

- Attach monitoring
 - Pulse oximetry
 - Non-invasive blood pressure
 - Three-lead cardiac monitoring
 - Defibrillator pads
- 12 lead ECG
- Obtain intravenous (IV) access and take bloods
- Give IV fluid challenge if appropriate and repeat as necessary
- Identify and treat any reversible causes e.g. electrolyte abnormalities on initial VBG

- If adverse features are present [shock, syncope, myocardial ischaemia, heart failure] prepare for DC cardioversion under general anaesthesia or conscious sedation
 - Once ready, warn all those nearby to stand clear and remove any oxygen delivery device whilst the defibrillator is set to synchronised mode and charged to 120 J
 - Once the defibrillator is charged and all are clear, deliver the shock
 - Should this fail, two subsequent shocks at increasing increments may be tried
 - Should this fail, give a loading dose of amiodarone 300 mg IV over 10-20 minutes and repeat DC cardioversion followed by amiodarone 900 mg IV over 24 hours

- If adverse features are not present, assess the rhythm:
- Narrow complex tachycardias (QRS duration <0.12 s)
 - Regular: likely SVT
 - Attempt vagal manoeuvres
 - Valsalva (ask patient to blow into syringe); carotid sinus massage.
 - If this fails then:
 - Adenosine 6 mg IV
 - Rapid bolus ideally into a large-bore cannula in the antecubital fossa
 - Warn patients of transient unpleasant side effects: flushing, nausea and chest tightness, 'feeling of impending doom'
 - Avoid in patients with asthma, WPW syndrome, and denervated hearts
 - Caution in taking throphylline, dipyridamole or carbamazepine
 - If 6mg unsuccessful:
 - Adenosine 12 mg IV
 - If first 12mg unsuccessful:
 - Further adenosine 12 mg IV
 - If adenosine is contraindicated, consider verapamil 2.5-5.0 mg IV, or flecainide 2 mg/kg IVI over 20-30 min if no evidence of structural heart disease
 - Irregular: likely AF
 - Onset <48 hours
 - Aim for rhythm control
 - Flecainide 2 mg/kg IVI over 20-30 min if no evidence of structural heart disease or amiodarone 300 mg IV over 20-30 min and 900 mg over 24 hours if flecainide contraindicated
 - Anticoagulate with enoxaparin 1.5 mg/kg subcutaneous (SC) prior to this
 - Onset >48 hours
 - Aim for rate control
 - Metoprolol 5 mg IV OR bisoprolol 5 mg orally (PO) OR verapamil 5 mg IV
 - If signs of heart failure try digoxin 0.5 mg IVI over 30-60 min
 - Digoxin can be added to the above if beta-blockade unsuccessful

- Anticoagulate with enoxaparin 1.5 mg/kg subcutaneous (SC) prior to this
- Broad complex tachycardias (QRS duration >0.12 s)
 - Regular
 - If likely monomorphic VT
 - Give amiodarone 300 mg IVI over 20-30 min followed by amiodarone 900 mg IVI over 24 hours
 - Any broad complex tachycardia should be treated as VT unless there the patient has an old ECG with clear previous bundle branch block of unchanged morphology.
 - If definitely SVT with BBB
 - Try adenosine as for regular narrow complex tachycardias
 - Irregular
 - If likely AF with BBB
 - Treat as for irregular narrow complex tachycardias
 - If likely polymorphic VT (Torsades de pointes)
 - Magnesium 2 g IV over 10 min
 - Stop any medications which prolong the QT interval
 - Correct any electrolyte abnormalities if not already done so, and give

Further management of tachycardia

- Request 12 lead ECG once back in sinus rhythm
 - Look specifically for ischaemic changes (ST elevation, ST depression and T wave inversion), prolonged QT interval ($QT_c > 440$ ms) and signs of WPW syndrome (shortened PR interval, delta wave and broad QRS complex)
- Identify and correct any underlying cause if not already done so
- Call cardiologist
 - Arrange for an implantable cardioverter defibrillator (ICD) if appropriate

Common questions concerning tachycardia

- List the adverse features which signify an unstable tachyarrhythmia
- What is the appropriate management of a tachyarrhythmia if one or more adverse features are present?
- What procedure must be performed in a conscious patient in order to facilitate this management?
- If no adverse features are present, outline your approach to the assessment of a stable tachyarrhythmia
- How would you manage a patient in stable SVT?
- How would you manage a patient in stable AF of onset <48 hours?
- How would you manage a patient in stable AF of onset >48 hours?
- How would you manage a patient in stable VT?
- Once the tachyarrhythmia has reverted back to sinus rhythm, what follow up investigations would you request?