Clinical Practice Guidelines:
Cardiac/Cardiac arrhythmias

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Date	September, 2024
Purpose	To ensure consistent management of patients with cardiac arrhythmias
Scope	Applies to Queensland Ambulance Service (QAS) clinical staff.
Health care setting	Pre-hospital assessment and treatment.
Population	Applies to all ages unless stated otherwise.
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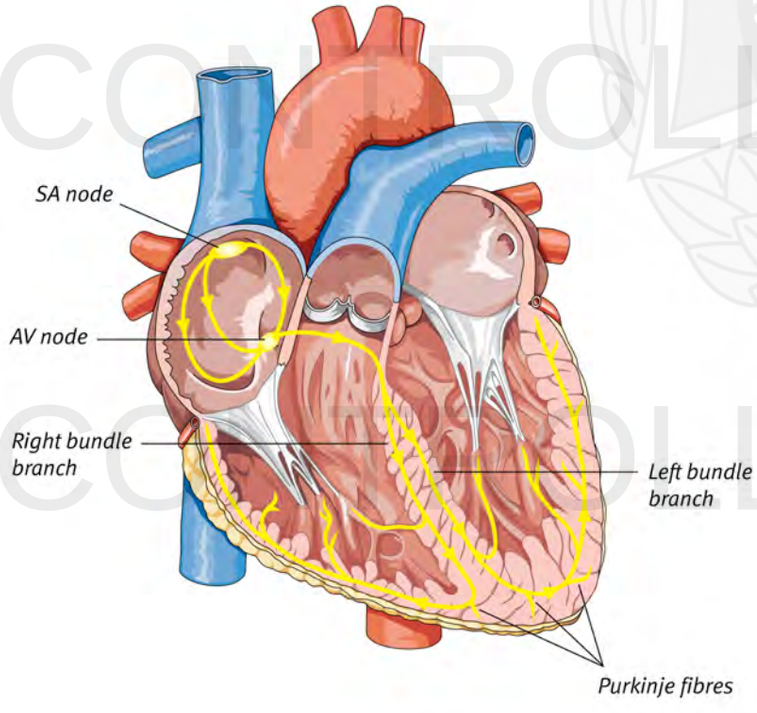
Cardiac arrhythmias

September, 2024

This Clinical Practice Guideline (CPG) provides advice and evidence-based recommendations developed using the GRADE-ADOLOPMENT framework. It applies to patients with arrythmias of a cardiac aetiology in the out-of-hospital setting. Arrythmias induced by other conditions should be managed in accordance with the relevant guideline.

Bradycardia

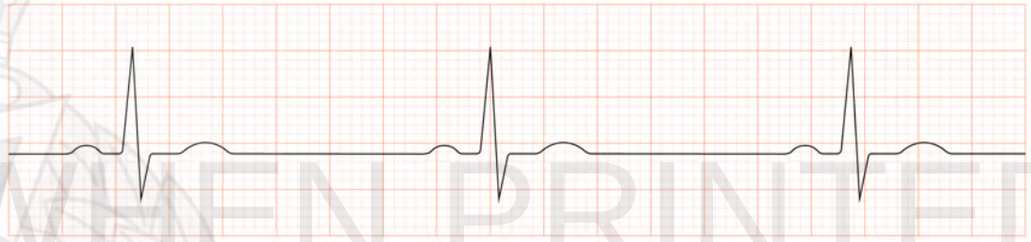
Bradycardia is a non-specific condition characterised by a heart rate of less than 60 beats per minute (BPM) in adults, or below the age-dependant normal physiological rate in paediatrics. In patients with normal cardiac function, the coordinated contraction of the ventricles occurs following the generation and transmission of electrical signals through an organised conduction system. Briefly, this involves the generation of electrical impulses in the sinoatrial (SA) node which are conducted via internodal pathways to the atrioventricular (AV) node and propagated through the His-Purkinje network.[1,2]



Sinus node dysfunction or aberrancy in the conduction pathway are the primary mediators of bradycardia of a cardiac aetiology and may present any of the following cardiac rhythms:

- ***Sinus bradycardia***

(reduced electrical impulse formation/automaticity in the SA node)



Lead II (25 mm/sec)

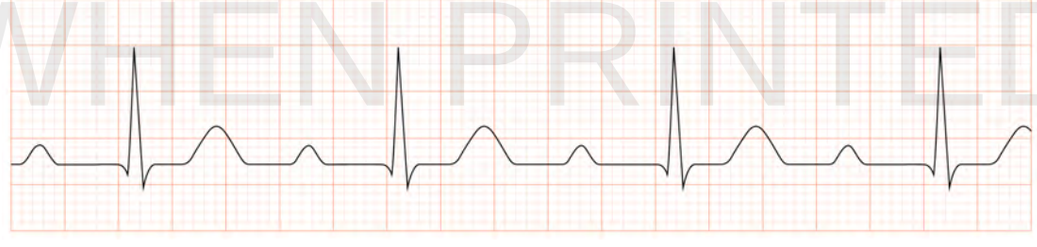
- ***Sinus pause/arrest***

(failure of the SA node to generate electrical impulse)

Lead II (25 mm/sec)

- ***1st degree AV block***

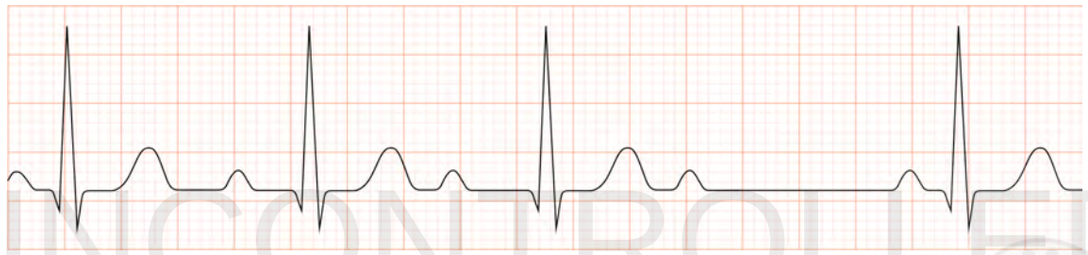
(delayed electrical conduction through the AV node)



Lead II (25 mm/sec)

- ***2nd degree AV block Mobitz-type I; Wenckeback***

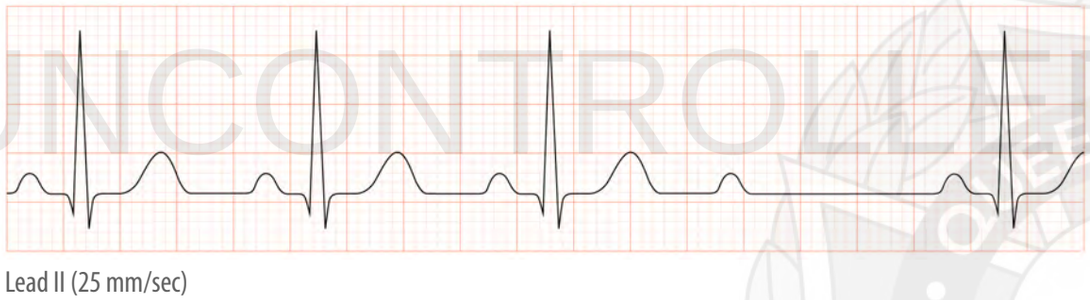
(progressive prolongation of the PR interval leading to a non-conducted P wave)



Lead II (25 mm/sec)

- ***2nd degree AV block Mobitz-type II***

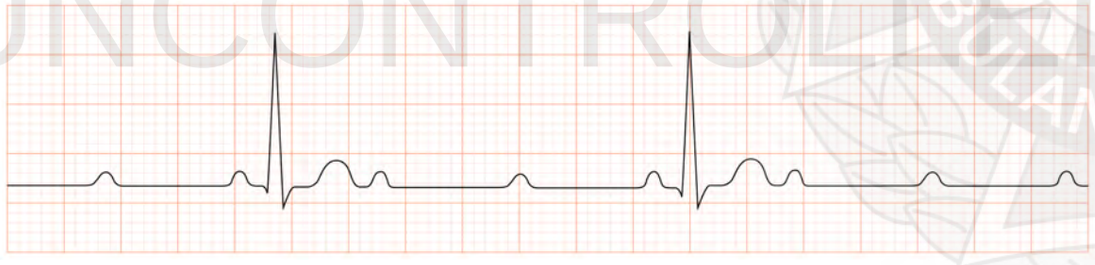
(presence of intermittent, non-conducted P wave without prolongation of the PR interval)



Lead II (25 mm/sec)

- ***3rd degree AV block***

(complete disassociation of the SA and AV nodes)



Lead II (25 mm/sec)

In clinical practice, bradycardia may be considered a benign finding in the absence of associated symptoms, with these patients rarely requiring out-of-hospital interventions. Conversely, patients that present with acute symptoms indicative of haemodynamic instability are a time-critical patient cohort.

Acute symptomatic bradycardia is defined as a bradyarrhythmia that directly induces any of the following clinical manifestations:

(i) syncope or presyncope;
(ii) transient dizziness or light-headedness;
(iii) symptoms of congestive heart failure;
(iv) chest pain;
(v) hypotension;
(vi) cerebral hypoperfusion.[2]

Annually, the Queensland Ambulance Service (QAS) attends approximately 800 patients that present with acute symptomatic bradycardia. These patients are typically responsive to pharmacological interventions with only 12.5% requiring temporary transcutaneous pacing.

Clinical features

- Syncope/presyncope
- Transient dizziness or light-headedness
- Congestive cardiac failure
- Chest pain
- Hypotension (< 90 mmHg systolic)
- Cerebral hypoperfusion

Risk assessment

- All patients that present with bradycardia of a cardiac aetiology must receive a comprehensive clinical assessment that includes dynamically assessing all pertinent vital signs, performing a 12-lead electrocardiogram (ECG) and attaining a thorough patient history.
- Ambulance clinicians should be cognisant that bradycardia can be induced by a myriad of intrinsic and extrinsic physiological processes which include acute coronary syndrome, toxicology/toxinology exposure, infective processes, trauma, environmental exposure, electrolyte imbalance and endocrine disorders.[3-5] If bradycardia is suspected to be induced by any of these conditions, management must be provided in accordance with the relevant CPG.

Additional information

- All pertinent ECG rhythm strips must be captured using the clinical images function within the Digital Ambulance Report Form application and be annotated with the patient's name. The physical copy of these ECGs should then be provided to the clinical staff at the receiving health care facility.
- Pharmacological interventions such as atropine, adrenaline (epinephrine) or isoprenaline are unlikely to be efficacious in patients with 3rd degree heart block. These patients typically will require temporary transcutaneous cardiac pacing.

Additional information *(cont.)*

- When managing patients with bradycardia, clinical care should be provided in alignment with the following **good practice statements**:
  - (i) In patients that require clinical intervention, vascular access should be attained where possible. In instances where intravenous (IV) access cannot be achieved, or the patient is hemodynamically unstable or likely to deteriorate, intraosseous (IO) access may be an appropriate alternative.
  - (ii) Clinical care should be provided using a stepwise escalation approach that involves an iterative process of assessment, provision of treatment and examination of the patient's response. In some clinical scenarios, escalation directly to particular therapies may be appropriate and should occur on a case-by-case basis using clinical judgement.
  - (iii) In patients that are clinically unstable or have a high risk of deterioration requiring advanced clinical interventions, a Critical Care Paramedic (CCP) should be requested where possible. In instances where an appropriate hospital facility is within close proximity, undelayed transport may be an appropriate alternative.
  - (iv) In circumstances where the patient is unresponsive to standard therapies, the *QAS Clinical Consultation & Advice Line* should be contacted for case specific management advice.

Tachyarrhythmias

Characterised by a ventricular rate that exceeds 100 BPM, tachyarrhythmias are a broad constellation of aberrant physiological processes that disrupt the standard conduction system of the heart.[1,2] Normally, the myocardium contracts following the generation of an action potential in the sinoatrial (SA) node that forms an electrical impulse that is conducted to the His-Purkinje network through an organised pathway.[3,4] Tachyarrhythmias arise when the formation of the impulse is abnormal, or the conduction of the impulse is altered. This can occur secondary to three main mechanisms:

(i) Abnormal automaticity (generation of a spontaneous action potential by abnormal tissue).

(ii) Triggered activity (impulse generation occurs from oscillations in membrane potential from the preceding action potential. Unlike automaticity, triggered activity is not a self-generating rhythm but rather a response to a preceding impulse or series of impulses).

(iii) Re-entry (electrical impulses are conducted via an accessory pathway and reactivate an area of the heart that has recoverable excitability).

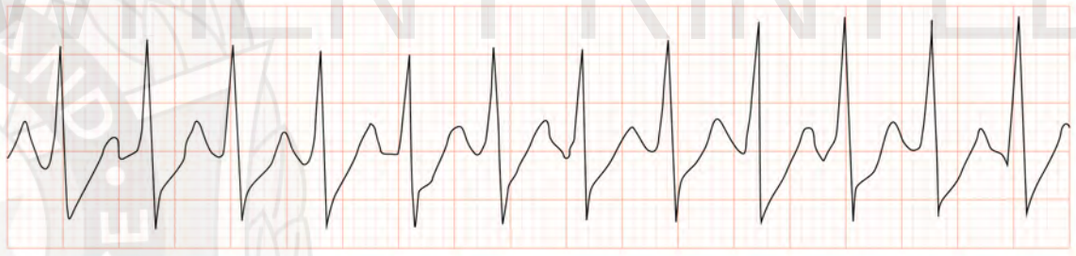
In clinical practice, tachyarrhythmias can initially be dichotomously categorised as 'stable' or 'unstable' based on the physiological manifestations the arrythmia produces. Unstable tachyarrhythmias precipitate clinical symptoms such as hypotension, an altered conscious state or inadequate tissue perfusion and if left untreated, are likely to deteriorate into cardiac arrest. This patient cohort present a time-critical emergency that requires immediate synchronised cardioversion. Conversely, tachyarrhythmias that do not induce haemodynamic instability are managed using specific pharmacological therapies, depending on the characteristics of the underlying arrythmia.

The QAS attends approximately 2,000 patients annually that present with tachyarrhythmias. The vast majority of these patients are haemodynamically stable with only a small cohort (5%) requiring synchronised cardioversion.

The ECG is a pivotal assessment tool that allows the differentiation of tachyarrhythmias with treatment decisions made based on the morphology, regularity, and width of the QRS complex. Interpretation of the ECG allows tachyarrhythmias to be broken into two discernible groups: 'narrow complex (QRS width less than or equal to 0.12 seconds)' and 'broad complex (QRS width greater than 0.12 seconds)'.

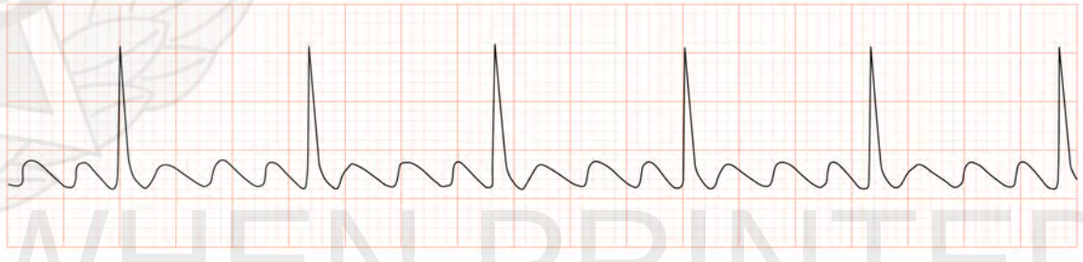
Common tachyarrhythmias include:

- ***Narrow complex tachyarrhythmias (QRS width < 0.12 seconds)***
  - *Supraventricular tachycardia (SVT).*
    (re-entry arrythmia involving tissue above the Bundle of His)



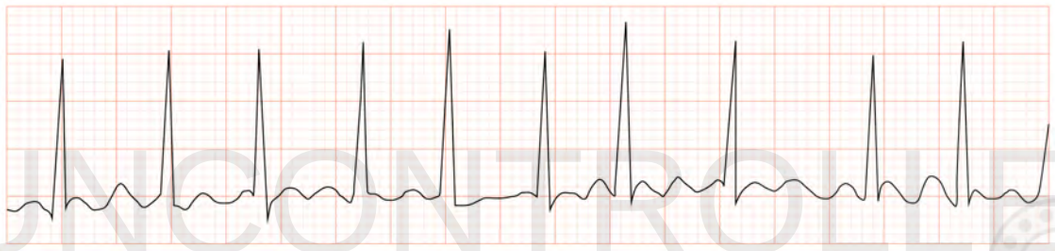
Lead II (25 mm/sec)

  - *Atrial flutter*
    (supraventricular arrythmia characterised by an atrial re-entry circuit)



Lead II (25 mm/sec)

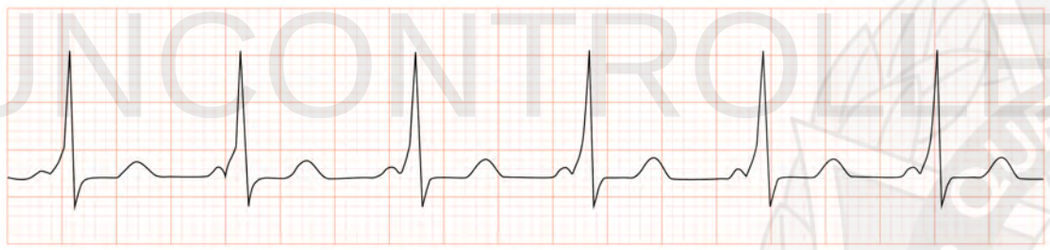
– *Atrial fibrillation (AF)*
(disorganised electrical impulses in the atria resulting in an irregularly irregular ventricular response)



Lead II (25 mm/sec)

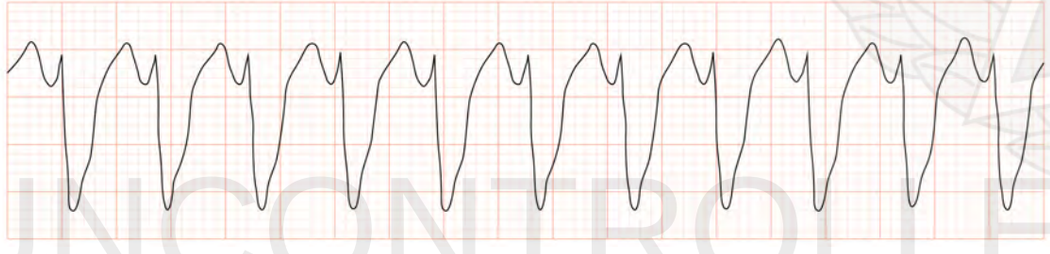
- ***Wolf-Parkinson-White (WPW)***

(an abnormal conduction pathway develops connecting the atria and ventricle, also know as the Bundle of Kent)



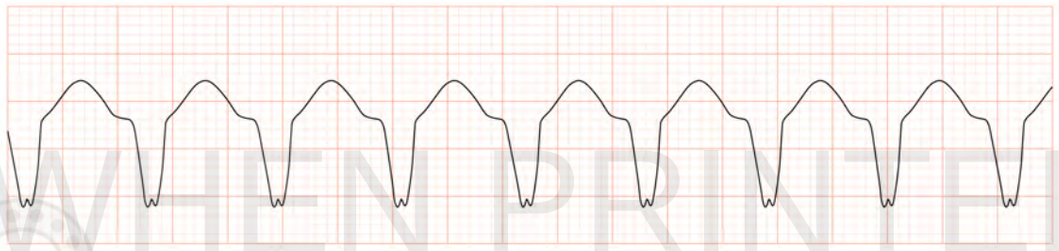
Lead II (25 mm/sec)

- ***Broad complex tachyarrhythmias (QRS width > 0.12 seconds)***
  – *Ventricular tachycardia (VT)*
  (abnormal automaticity, triggered activity or a re-entry circuit exists in the ventricles)



Lead II (25 mm/sec)

– *SVT with aberrant conduction*
(re-entry arrythmia involving tissue above the Bundle of His complicated by a bundle branch block)



Lead II (25 mm/sec)

Clinical features

- Cerebral hypoperfusion
- Chest pain
- Dizziness
- Dyspnoea
- Fatigue
- Hypotension (< 90 mmHg systolic)
- Palpitations
- Syncope/presyncope

Risk assessment

- The identification of the underlying cardiac rhythm can be difficult in the out-of-hospital setting. Consequently, ambulance clinicians should have a low threshold for contacting the *QAS Consultation & Advice Line* for case specific management advice.
- In patients that present with a broad complex tachyarrhythmia and a history of ischemic heart disease, the rhythm should be considered VT until proven otherwise.
- In patients that present with narrow complex tachyarrhythmia assessing the regularity of the rhythm can assist with identification. Generally, an irregular rhythm is indicative of AF or atrial flutter, while a regular rhythm is SVT.
- The transport of patients with a tachyarrhythmia to hospital for further investigation is highly recommended. This includes instances where the rhythm spontaneously reverts following clinical intervention.

Additional information

- All pertinent ECG rhythm strips must be captured using the clinical images function with the *Digital Ambulance Report Form* application and be annotated with the patient's name. The physical copy of these ECGs should then be provided to the clinical staff at the receiving health care facility.

Additional information *(cont.)*

- Patients that require synchronised cardioversion should be provided appropriate sedation prior to performing this intervention.
- When attending patients with tachyarrhythmias, clinical care should be provided in alignment with the following **good practice statements**:

  (i) In patients that require clinical intervention, vascular access should be attained where possible. In instances where intravenous (IV) access cannot be achieved, or the patient is hemodynamically unstable or likely to deteriorate, intraosseous (IO) access may be an appropriate alternative.

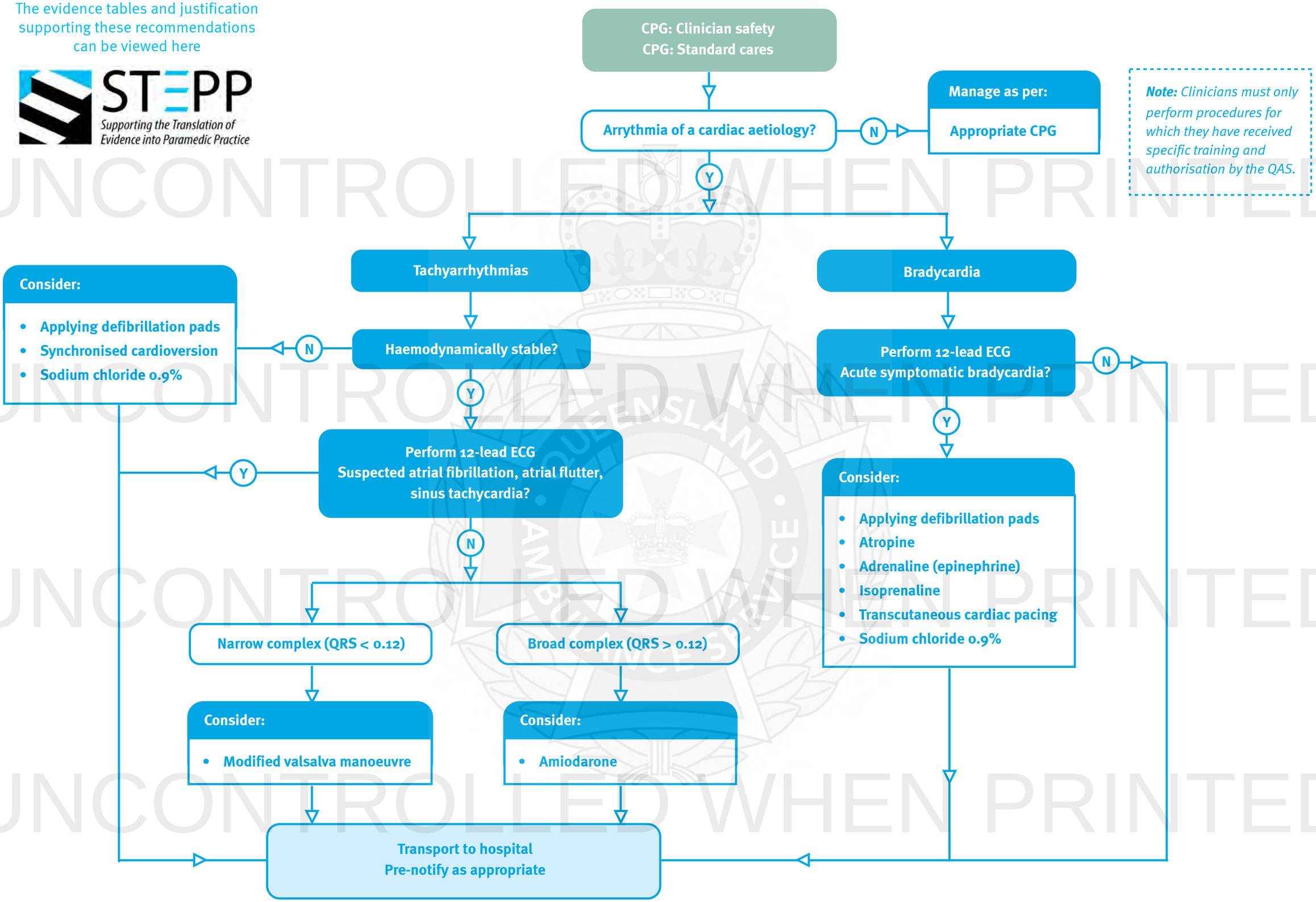
  (ii) Clinical care should be provided using a stepwise escalation approach that involves an iterative process of assessment, provision of treatment and examination of the patient's response. In some clinical scenarios, escalation directly to particular therapies may be appropriate and should occur on a case-by-case basis using clinical judgement.

  (iii) In patients that are clinically unstable or have a high risk of deterioration requiring advanced clinical interventions, a Critical Care Paramedic (CCP) should be requested where possible. In instances where an appropriate hospital facility is within close proximity, undelayed transport may be an appropriate alternative.

  (iv) In circumstances where the patient is unresponsive to standard therapies, the *QAS Clinical Consultation & Advice Line* should be contacted for case specific management advice.

The evidence tables and justification supporting these recommendations can be viewed here

STEPP
Supporting the Translation of Evidence into Paramedic Practice



Note: *Clinicians must only perform procedures for which they have received specific training and authorisation by the QAS.*