Clinical Guidance

Paediatric Critical Care: Cardiac Arrhythmias

Summary
This guidance offers advice for staff treating children with a cardiac arrhythmia. It discusses assessment and diagnosis, offers guidance for investigation and treatment options when managing a child with an arrhythmia.

Document Detail	
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Author(s)	Geoff Burnhill, PICU Fellow, Jon Lillie, PICU Consultant
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Relevant external law, regulation, standards	
This clinical guideline was produced by the South Thames Retrieval Service (STRS) at Evelina London for nurses, doctors and ambulance staff to refer to in the emergency care of critically ill children. This guideline represents the views of STRS and was produced after careful consideration of available evidence in conjunction with clinical expertise and experience. The guideline does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.	

Change History		
Date	Change details, since approval	Approved by
07/18	Minor format changes only	Evelina London Clinical Guidelines Committee
04/21	Formatting, clarification of adenosine, amendments to wording, magnesium dose change	Evelina London Clinical Guidelines Committee
10/22	Dosage for adenosine adjusted	Paediatric Guidelines Committee

Glossary: PVC: premature ventricular contraction

Paediatric Critical Care

Cardiac arrhythmias

- Primary life-threatening arrhythmias are uncommon in childhood. Exclude and treat other pathologies (especially septic shock/ hypoxia) initially.
- Consider congenital (structural defect), infectious (sepsis or myocarditis), biochemical (drug, electrolyte disorder, endocrine), inherited (conduction pathway, cardiomyopathies) causes.
- History: Previous episodes (including subclinical), heart surgery, family history as above.
- **Standard resuscitation** is as important as treatment of the abnormal rhythm
- See separate guideline if immediately post-cardiac surgery (JET or pacing guideline)

Contact Paed Cardiology:
- Switch: 020 7188 7188

ECG Transfers:
- Cardiology
  - Liaise with SpR
- STRS
  - STRS.mail@nhs.net

General Management Principles:
- Shocked patients may need ventilation- discuss with STRS
- 12 lead ECG and CXR
- Continuous rhythm strip while giving adenosine or DC shock
- Treat fever & electrolytes (aim for iCa >1.0, K >4.0, Mg >1.0)

ECG interpretation:

P wave: rate, rhythm, axis (NSR: P upright in I, aVF)

P-QRS relationship: 1:1 association, PR interval <0.2sec

QRS complex: rate, axis, broad or narrow

QT duration corrected: QTc=QT/√RR < 0.46s

SUPRAVENTRICULR TACHYCARDIA (SVT)

Associations: Wolf-Parkinson-White syndrome

ECG: narrow QRS (though *may* be broad), very fast (*usually* >220 bpm)
In contrast to sinus tachycardia does not respond to changes in temperature or fluid boluses

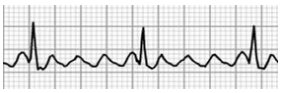
SVT

Management: ABC and general measures above (including ventilation if shocked)
- CVS stable — 12 lead ECG recording: **1st Vagal manoeuvres** (ice to face, Valsalva, carotid massage (likely less effective))
  2nd Adenosine by rapid injection (see below for administration)
- CVS unstable — **Adenosine** whilst setting up for cardioversion (if awake, cardioversion needs anaesthetic and intubation)
  Rhythm strip recording: **Synchronised cardioversion** at **1J/kg**. Repeat Synchronised at **2J/kg** if no response.

ATRIAL FLUTTER

Associations: Dilated right atrium, atrial surgery, digoxin overdose

ECG: Regular atrial activity, sawtooth flutter waves, narrow QRS



Atrial Flutter

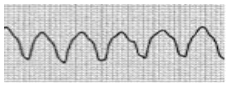
Management: ABC and general measures above. ECG monitoring of all treatment
- CVS stable — **Adenosine** will disclose flutter waves. Discuss with cardiology.12 lead ECG and Echo
- CVS unstable — **Synchronised cardioversion** at **1J/kg**. Repeat at synchronised **2J/kg** if no response.

ADENOSINE: rapid injection into large vein then immediate 10mL 0.9% sodium chloride flush using 3 way tap: onset instantaneous
- **Indication:** Terminates some SVT. Aids identification of other arrhythmias (sinus tachycardia, atrial flutter, atrial fibrillation, VT). **Contraindicated** in pre-excited AF (broad, irregular tachycardia)
- **Dosage: <12yrs:** Start at **100 microgram/kg,** ↑ by 100microgram/kg if no response to **max 500 microgram/kg** (neonates resistant to lower doses) **>12yrs**: Start at **3mg**, increased to **6mg** then **12mg** if no response.
- ECG must be continuously recording (12 lead – if not possible then defib rhythm strip), **mark when adenosine doses given**
- **Side effects:** ↓BP, bronchospasm, sinus arrest, chest pain, tachycardia acceleration, treatment failure (see below)
- **Treatment Failure:** If AV pause achieved but rhythm disturbance ongoing then further increased doses are unlikely to cardiovert, consult a cardiologist for further advice

VENTRICULAR TACHYCARDIA: >4 broad complexes (PVCs) in succession will require treatment

Associations: Prolonged QT, CHD, anti-arrhythmic meds, tricyclic overdose (treat with sodium bicarbonate)

ECG: Wide, bizarre QRS complexes with AV dissociation



Ventricular Tachycardia

Management: ABC, general measures as above (including ventilation if shocked) and actively treat electrolyte abnormalities
- CVS stable (with pulse) — **Magnesium sulphate 50-100mg/kg** over 20 minutes (max dose 2g).
  Discuss with cardiology Re: anti-arrhythmic medication: **Amiodarone** (see below) or **lignocaine**
  Cardiology may consider use of adenosine if diagnosis unclear
- CVS unstable (with pulse) — Synchronised **cardioversion 1J/kg,** then synchronised **2J/kg.** Add amiodarone if no response.

AMIODARONE: bolus or infusion depending on clinical state, NB. May precipitate cardiac arrest in shocked child

Indication: Effective in most supra- and ventricular tachyarrhythmias.

Dosage: Unstable VT *in extremis*: bolus **5 mg/kg IV** before next attempted cardioversion, may cause profound hypotension
Stable VT/SVT: **infuse 25 micrograms/kg/minute** for 4 hours then **10 microgram/kg/minute** (usually in PICU-liaise with cardiology)

Acute side effects (potentiated by low calcium): bradycardia, depressed cardiac function, hypotension, liver derangement

BRADYCARDIA: most commonly sinus bradycardia due to hypoxia or peri-arrest, rarely a primary rhythm disturbance

HEART BLOCK:

Associations: congenitally corrected TGA, post cardiac surgery, congenital (maternal antibodies), anti-arrhythmic toxicity

ECG: Bradycardia **2° Atrioventricular block** - **Type I**: progressive increase in PR interval followed by non-conducted beat
Type II: normal PR interval, intermittent non conduction of P wave
Complete Atrioventricular block: P waves unrelated to QRS

Management: Ensure resuscitated (correct hypoxia, hypothermia, hypoglycaemia)
Discuss isoprenaline infusion or cardiac pacing with STRS and cardiologist

References: APLS 6th edition 2015. GSTT paediatric formulary (see STRS Website)