Paediatric Critical Care
Cardiac arrhythmias

- Life threatening arrhythmias are uncommon in childhood. Exclude primary pathologies (e.g. septic shock/ hypoxia).
- Poorly tolerated by: neonates, children with congenital heart disease (CHD) or heart failure
- Consider associated cardiac conditions ( myocarditis, cardiomyopathy).
- History: ? previous episodes (pallor, sweating, breathlessness) or drug ingestion
- **Standard resuscitation** is as important as treatment of the abnormal rhythm
- See separate guideline if immediately post-cardiac surgery (JET or pacing guideline)

**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 electrolytes (aim for iCa>1.0, K >4.0, Mg>1.0) & fever

**ECG interpretation:**
- P wave: rate, rhythm, axis (NSR: P upright in I,II,III,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

**SUPRAVENTRICULAR TACHYCARDIA (SVT)**
Associations: Wolf-Parkinson-White syndrome
ECG: usually narrow QRS (may be wide if aberration) and very fast (>220 bpm but not always).
NB infants may have sinus tachycardia > 200 bpm when shocked (should transiently respond to fluid)
Management: ABC and general measures above (including ventilation if shocked)
- CVS stable ECG must be recording: Vagal manoeuvres (ice to face, unilateral carotid massage, valsalva)
  - **Adenosine** by rapid injection-see below for administration
- CVS unstable **Adenosine** whilst setting up for cardioversion (if awake needs anaesthetic and intubation)
  - Synchronised cardioversion at 1J/kg. Repeat 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
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 2J/kg if no response.

**ADENOSINE:** rapid injection into good vascular access and immediate 10 ml saline flush: onset instantaneous
- **Indication:** Terminates SVT. Aids identification of other arrhythmias (sinus tach, atrial flutter, atrial fibrillation, VT)
- **Dosage:** Start at 100 mcg/kg, ↑ by 100mcg/kg if no response to max 500 mcg/kg (neonates resistant to lower doses)
- Attach defibrillator, record continuous ECG strip (preferably 3 or 12 lead).
- **Side effects:** ↓BP, bronchospasm, sinus arrest, chest pain, tachycardia acceleration, treatment failure

**VENTRICULAR TACHYCARDIA:** >3 PVCs in succession
Associations: Prolonged QT, CHD, anti-arrhythmic meds, tricyclic overdose (treat with Na bicarb)
ECG: Wide, bizarre QRS complexes with AV dissociation
Management: ABC, general measures as above (including ventilation if shocked) and actively treat electrolyte abnormalities
- CVS stable (with pulse) **Magnesium sulphate 50mg/kg** over 20 minutes (max dose 2g). Can repeat dose if no effect.
  - 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 2J/kg. Add amiodarone if no response
  - Follow VF protocol

**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 bolus 5 mg/kg iv STAT before next attempted cardioversion
  - Stable VT or SVT: **Infuse 25 mcg/kg/min** for 4 hours then **10 mcg/kg/min** (usually in PICU, liaise with cardiology)
**Acute side effects (potentiated by low calcium):** bradycardia, depressed cardiac function, hypotension, liver derangement
  - Consider IV calcium to prevent and treat side effects

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

**HEART BLOCK**
Associations: congenitally corrected TGA, post operative AVSD, congenital (maternal antibodies), anti-arrhythmic toxicity
ECG: Bradycardia. 2° Atrioventricular block - Type I: progressive increase in PR interval followed by non-conducted beat
  - **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 5th edition 2010. GSTT paediatric formulary (see STRS Website)
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