

Cardiac Rhythm Disturbances

(Jack CF Chong), M.D., M.S.

<http://www.jack119.org>

Cardiac Rhythms

- Dynamic Monitor
- Rhythm Strip
- 12-Lead ECG (complete ECG)

General Approach

- First, rule out artifacts
 - Flat line
 - Tall T as extra R
 - P absent - check other lead
 - Rhythmic movement artifacts
- If stable obtain 12-lead ECG with rhythm strip prior to intervention
- Record rhythm strip during intervention
- Repeat 12-lead ECG with rhythm strip after successful intervention

Rhythm Groups

- Slow pulse = Bradyarrhythmias
- Fast pulse = Tachyarrhythmias
- No pulse = Collapse rhythms

Rhythm Groups

- Fast
 - Infant > 220
 - Child > 180
- Slow
 - Infant < 80
 - Child < 60

Cardiac Output & BP

- $CO = HR \times \text{Stroke Volume}$
- $BP = SVR \times CO$

Circulatory Instability

- Unstable
 - Compensated shock
 - Decompensated shock (BP ↓)
 - Cardiopulmonary arrest

Assessment

- Perfusion (conscious/skin signs/urine)
- Pulse
- P-QRS
- Pattern of ECG

Arrhythmia Assessment

- **Stable**
 - Responsive
 - Good BP, strong pulse, good cap. refill
 - No signs of CHF
- **Unstable**
 - Lethargic or unresponsive
 - Poor BP, weak or absent pulses, poor cap. refill
 - Signs of CHF: HSM, edema or rales

ST or SVT ?

- **ST**
 - P present and normal
 - Infant < 220 bpm
 - Child < 180 bpm
 - Variable RR with constant PR
- **SVT**
 - P absent or abnormal
 - Infant > 220 bpm
 - Child > 180 bpm
 - Abrupt rate change to or from NSR

Sinus Tachycardia (ST)

- Tachycardia appropriate for clinical condition
- Therapy is directed to underlying cause:
 - anxiety
 - fever
 - volume depletion
 - pain
 - stimulant medications
 - anemia
 - CHF
 - thyrotoxicosis

Supraventricular Tachycardia (SVT)

- HR usually > 220 (up to 300 bpm)
- Etiologies: idiopathic in approximately 50%, Wolff-Parkinson-White syndrome (WPW), CHD (Ebstein's anomaly, single ventricle, L-TGA), hydrops fetalis, sepsis, trauma, central lines
- Wide QRS (10%) may be indistinguishable from V-Tach
- May see ischemic ST-T changes in SVT of long duration
- Long-lasting SVT may cause a cardiomyopathy and/or congestive heart failure (cardiomegaly on CXR)

Fast Pulse

- SVT with aberrant conduction
- VT (QRS > 0.08 sec)

Wide QRS tachycardia in children is VT until proven otherwise!

Tachyarrhythmia With Pulse

- **Narrow QRS (SVT)**
 - Adenosine (0.1-0.2 mg/kg)
 - Synchronized 0.5-1 J/kg cardioversion
- **Wide QRS (VT)**
 - Synchronized 0.5-1 J/kg cardioversion
 - Lidocaine (1 mg/kg)
 - Amiodarone (?)
 - Bretylium (?)

Synchronized Cardioversion

- Dose: 0.5-1.0 joules/kg
- If persists, repeat at 2.0 joules/kg
- If no success, consider sinus tachycardia, atrial fibrillation or atrial flutter

Verapamil

Contraindications:

- CHF present
- Age < 1 year
- Concomitant Beta-blocker therapy
- Myocardial depression
- Bypass tract (WPW syndrome)

Antidote:

- Calcium chloride

Bradyarrhythmias: Priority

- Optimize ventilation and oxygenation !

Bradyarrhythmias: Causes

- Hypoxemia +/- acidosis (most !!)
- Drugs
- Heart disease (rare)

Bradyarrhythmias: Treatment

- Ensure adequate *ventilation*
- Chest compressions
- Epinephrine
- Atropine
- Cardiac pacing (?)
- Isoproterenol infusion (if not in shock)

Bradyarrhythmias: Epinephrine

- IV / IO dose
 - 0.01 mg/kg
 - 0.1 mL/kg of 1:10,000
- ET dose
 - 0.1 mg/kg
 - 0.1 mL/kg of 1:1,000

Bradyarrhythmias: Atropine

- IV / IO dose
 - 0.02 mg/kg
 - Minimum 0.1 mg
 - Maximum single dose (may repeat once)
 - Child: 0.5 mg
 - Adolescent: 1 mg

Absent or Disorganized Rhythms

- Asystole
- PEA / EMD
- VF / pulseless VT

No Pulse: Treatment

Asystole / PEA

- CPR
- A: Secure airway (endo)
- B: Ventilate with 100% FiO₂
- C: IV / IO
- D:
 - Drugs: Epinephrine q3-5 min
 - D/D: Treat cause

PEA: Causes

- Hypoxia
- Hypovolemia (trauma)
- H⁺ (acidosis)
- Hypothermia
- Hyperkalemia / hypokalemia
- Tension pneumothorax
- Tamponade
- Tablets
- Thrombosis (AMI)
- Thrombosis (Pulm. embolism)

Defibrillation

- CPR
- Defib. (shock-shock-shock)
 - 2 à 2-4 à 4 J/kg
- Epi – Shock
- Lido - Shock

Ventricular Fibrillation

- Uncommon terminal event in pediatrics
- Very rare in infants
- Causes
 - Postoperative, hypoxia, hyperkalemia, myocarditis, infarctions
 - Digitalis or quinidine toxicity, catecholamines, anesthetics

Defibrillation and Cardioversion

- Paddle size:
 - 4.5 cm for infants (< 1 yr, or < 10 kg)
 - 8 or 13 cm for older children (> 1 yr, or > 10 kg)
 - Rule of thumb: Largest paddle size possible

Summary: Arrhythmia + Shock

- Fast pulse:
 - Sync. Cardioversion
 - Adenosine (if SVT)
- Slow pulse:
 - CPR – Epinephrine
- No pulse:
 - VF / VT à Shock-shock-shock
 - Asystole / PEA à CPR – Epinephrine – D/D

Warning

- Treat the patient – not the rhythm !!