Cardiac Review and Rhythm Interpretation

Adult ALS Program
2010 Resuscitation Guidelines
Session Outline

In this session we will review

- Cardiac electrophysiology
- Rhythms for interpretation
- Tachycardia & Bradycardia management
Conduction Pathway

1. Sinoatrial node (pacemaker)
2. Atrioventricular node
3. Atrioventricular bundle (Bundle of His)
4. Bundle branches
5. Purkinje fibers

Superior vena cava
Aorta
Left atrium
Purkinje fibers
Interventricular septum
QRS Complex

- **P wave**: atrial contraction
- **PR interval**: slow conduction through the AV node
- **QRS**: ventricular activation
- **T wave**: ventricular repolarization

<table>
<thead>
<tr>
<th>Time (Seconds)</th>
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<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>0.2</td>
</tr>
<tr>
<td>0.4</td>
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<tr>
<td>0.6</td>
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<tr>
<td>0.8</td>
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Cardiac cycle

- Mechanical events of the heart
  - Muscles contract
  - Increasing pressure within chamber
  - Chamber also passively fills Initiated as electrical impulse activates muscle

- Volume and Pressure increases within chambers
  - Valve opens
  - Blood is ejected to next chamber

- Contraction (systole)
  - Increases pressure in chamber
  - Valve opens

- Relaxation (diastole)
Cardiac Arrhythmias

- **Causes of arrhythmias:**
  - cardiac disease
  - drug toxicity
  - electrolyte imbalance
  - acidosis
  - physical irritation/damage post surgery

- **Common complications of:**
  - Myocardial infarction
  - Hypoxia and Acidosis
  - Electrolyte disturbances
Arrhythmia Management

- Clinical assessment
  - Patient assessment: symptomatic
  - Rhythm identification
  - Potential complications

- Management
  - Clinically determined by symptoms
  - Rate control
  - Rhythm control

- Clinical deterioration
  - Tachyarrhythmia and bradyarrhythmia management algorithms
Tachycardia (with pulse) Algorithm

Adult tachycardia (with pulse) algorithm

- Synchronised DC Shock
  - Up to 3 attempts
  - Amiodarone 300 mg IV over 10-20 min and repeat shock, followed by:
  - Amiodarone 900 mg over 24 h

Adverse features?
- Shock
- Syncope
- Myocardial ischaemia
- Heart failure

Is QRS narrow (< 0.12 s)?

- Broad
  - Broad QRS
    - Is rhythm regular?
      - Yes
        - Use vagal manoeuvres
        - Adenosine 6 mg rapid IV bolus; if unsuccessful give 12 mg, then 24 mg
        - Monitor ECG continuously
      - Seek expert help
        - Sinus rhythm restored?
          - Yes
            - Irregular Narrow Complex Tachycardia
              - Probable atrial fibrillation
              - Control rate with:
                - β-Blocker or diltiazem
              - Consider digoxin or amiodarone if evidence of heart failure
          - No
            - Probable re-entry paroxysmal SVT:
              - Record 12-lead ECG in sinus rhythm
              - If recurrer, give adenosine again & consider choice of anti-arrhythmic prophylaxis
            - Seek expert help
              - Possible atrial flutter
              - Control rate (e.g. β-Blocker)

- Narrow
  - Narrow QRS
    - Is rhythm regular?
      - Yes
        - Sinus rhythm restored?
          - Yes
            - Irregular
              - Seek expert help
              - Possible atrial flutter
              - Control rate (e.g. β-Blocker)
          - No
            - Ventricular tachycardia (or uncertain rhythm):
              - Amiodarone 300 mg IV over 20-60 min; then 900 mg over 24 h
              - If previously confirmed SVT with bundle branch block:
                - Give adenosine as for regular narrow complex tachycardia
      - No
        - Seek expert help
          - Probabilities include:
            - AF with bundle branch block treat as for narrow complex
            - Pre-excited AF consider amiodarone
            - Polymorphic VT (e.g. torsade de pointes - give magnesium 2 g over 10 min)
Bradycardia Algorithm

If appropriate, give oxygen, cannulate a vein, and record a 12-lead ECG

Adverse signs?
- Systolic BP < 90 mmHg
- Heart rate < 40 beats min⁻¹
- Ventricular arrhythmias compromising BP
- Heart failure

Yes

Atropine
500 mcg IV

Satisfactory response?
Yes

Risk of asystole?
- Recent asystole
- Möbitz II AV block
- Complete heart block with broad QRS
- Ventricular pause > 3s

Yes

Interim measures:
- Atropine 500 mcg IV
- Adrenaline 2-10 mcg min⁻¹
- Alternative drugs
- Transcutaneous pacing

Seek expert help
Arrange transvenous pacing

No

Observe

No

Alternatives include:
- Aminophylline
- Isoprenaline
- Dopamine
- Glucagon (if beta-blocker or calcium-channel blocker overdose)
- Glycopyrrolate can be used instead of atropine

**500-600 mcg
Normal Sinus Rhythm

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
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<tbody>
<tr>
<td>Rate</td>
<td>60 – 100 beats/min</td>
</tr>
<tr>
<td>P Wave</td>
<td>normal</td>
</tr>
<tr>
<td>QRS</td>
<td>normal</td>
</tr>
<tr>
<td>PR interval</td>
<td>normal</td>
</tr>
<tr>
<td>Rhythm</td>
<td>regular</td>
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</table>
Sinus Bradycardia

- **Rate**: < 60 beats/min
- **P Wave**: normal
- **QRS**: normal
- **PR interval**: normal
- **Rhythm**: regular
Supraventricular Tachycardia

Rate >200 often 250-300 beats/min
P Wave hidden, sometimes retrograde
QRS normal
PR interval unable to determine
Rhythm regular
Atrial Flutter

Rate
ventricular response depends on number of blocked flutter waves
150 – 170 beats/min in 2:1 block

P Wave
replaced by saw-tooth flutter waves

QRS
usually normal

PR interval
not measurable

Rhythm
usually regular
Atrial Fibrillation

- **Rate**: usually 100-150 beats/min
  if < 100 “controlled AF”
- **P Wave**: none – fibrillatory waves
- **QRS**: usually normal
- **PR interval**: not measurable
- **Rhythm**: irregular
Junctional Rhythm

- Rate: 40 - 60 beats/min
- P Wave: inverted or hidden in QRS
- QRS: normal
- PR interval: short
- Rhythm: regular
Ventricular Ectopic Beats (VEB’s)

- Rate: underlying rhythm normal
- P Wave: absent in the ectopic beat
- QRS: occurs early, wide, QRS opposite polarity to T wave
- PR interval: not measurable
- Rhythm: irregular due to pause after PVC
Idioventricular Rhythm

- Rate: 20 - 40 beats/min
- P Wave: absent
- QRS: wide
- PR interval: normal
- Rhythm: regular
Third Degree AV Block (Complete Heart Block)

- Rate: atrial may be normal, ventricular response slow
- P Wave: normal
- QRS: depends on underlying rhythm
- PR interval: p waves not related to QRS – AV dissociation
- Rhythm: regular but slow
Ventricular Tachycardia

- Rate: 140 – 200 beats/min
- P Wave: absent, or lost in complexes
- QRS: wide slurred complexes
- PR interval: not measurable
- Rhythm: essentially regular
Ventricular Fibrillation

- Rate: no pattern or regularity
- P Wave: can’t be determined
- QRS: can’t be determined
- PR interval: not measurable
- Rhythm: irregular
Torsades de Pointes

- Rate: 200 – 250 beats/min
- P Wave: can’t be discerned
- QRS: undulating
- PR interval: not measurable
- Rhythm: irregular