CARDIAC MONITORING & RHYTHM RECOGNITION
Objectives

To understand:

• Indications & techniques for ECG monitoring
• Basic electrocardiography
• How to read a rhythm strip
  – cardiac arrest rhythms
  – peri-arrest arrhythmias
Which patients?

- Cardiac arrest or other important arrhythmias
- Chest pain
- Heart failure
- Collapse / syncope
- Shock / hypotension
- Palpitations
How to monitor the ECG (1): Monitoring leads

- 3-lead system approximates to I, II, III
- Colour coded
- Remove hair
- Apply over bone
- Lead setting (II)
- Gain
How to monitor the ECG (2): Defibrillator paddles

- Suitable for “quick-look”
- Movement artefact
- Risk of spurious asystole
How to monitor the ECG (3): Adhesive monitoring electrodes

- “Hands-free” monitoring and defibrillation
12-lead ECG
12-lead ECG

- 3D electrical activity from heart
- More sophisticated ECG interpretation
- ST segment analysis
Basic electrocardiography (1)

- Depolarisation initiated in SA node
- Slow conduction through AV node
- Rapid conduction through Purkinje fibres
Basic electrocardiography (2)

- P wave = atrial depolarisation
- QRS = ventricular depolarisation (< 0.12 s)
- T wave = ventricular repolarisation
Cardiac arrest rhythms

- Ventricular fibrillation
- Pulseless ventricular tachycardia
- Asystole
- Pulseless Electrical Activity (PEA)
Ventricular fibrillation

- Bizarre irregular waveform
- No recognisable QRS complexes
- Random frequency and amplitude
- Unco-ordinated electrical activity
- Coarse / fine
- Exclude artifact
  - movement
  - electrical interference
Pulseless ventricular tachycardia

- Monomorphic VT
  - Broad complex rhythm
  - Rapid rate
  - Constant QRS morphology
- Polymorphic VT
  - Torsade de pointes
Asystole

- Absent ventricular (QRS) activity
- Atrial activity (P waves) may persist
- Rarely a straight line trace
- Consider fine VF
Pulseless Electrical Activity

• Clinical features of cardiac arrest
• ECG normally associated with an output
How to read a rhythm strip

1. Is there any electrical activity?
2. What is the ventricular (QRS) rate?
3. Is the QRS rhythm regular or irregular?
4. Is the QRS width normal or prolonged?
5. Is atrial activity present?
6. How is it related to ventricular activity?
ECG rhythm interpretation

- Effective treatment often possible without precise ECG diagnosis
- Haemodynamic consequences of any given rhythm will vary
- Treat the patient not the rhythm
What is the ventricular rate?

- Normal: 60-100 min
- Bradycardia: < 60 min
- Tachycardia: > 100 min

\[
\text{Rate} = \frac{300}{\text{Number of large squares between consecutive QRS complexes}}
\]

* At standard paper speed of 25 mm sec, 5 large squares = 1 second
Is the QRS rhythm regular or irregular?

- Unclear at rapid heart rates
- Compare R-R intervals
- Irregularly irregular = AF
Is the QRS width normal or prolonged?

- Normal QRS:
  - $< 0.12 \text{ s} (< 3 \text{ small squares})$
  - originates from above bifurcation of bundle of His
Is the QRS width normal or prolonged?

- Prolonged QRS (> 0.12 s) arises from:
  - ventricular myocardium, or
  - supraventricular with aberrant conduction
A broad complex tachycardia should be assumed to be ventricular in origin unless there is a very good reason to suspect otherwise.
Is atrial activity present?

- P waves (leads II and V1)
- Rate, regularity, morphology
- Flutter waves
- Atrial activity may be revealed by slowing QRS rate with adenosine
How is atrial activity related to ventricular activity?

- Consistent, fixed PR interval
- Variable, but recognisable pattern
- No relationship - atrioventricular dissociation
Heart Block: First Degree
Heart Block: Second Degree

Möbitz Type I (Wenckebach) Block

Möbitz Type II Block
Heart Block: Third Degree

- Site of pacemaker:
  - AV node: 40 - 50 min\(^{-1}\)
  - Ventricular myocardium: 30 - 40 min\(^{-1}\)
Any Questions?