PERI-ARREST ARRHYTHMIAS
Peri-arrest arrhythmias

To understand:

• The importance of arrhythmias that occur in the peri-arrest period
• The principles of management of these arrhythmias
Peri-arrest arrhythmias

Principles of treatment

• How is the patient?

• What is the arrhythmia?
Adverse signs (1)

- **Low cardiac output**
  - Chest pain, pallor, cool peripheries, hypotension, reduced level of consciousness

- **Excessive tachycardia**
  - Narrow complex $>200$ beats min$^{-1}$
  - Broad complex $>150$ beats min$^{-1}$
Adverse signs (2)

• Excessive bradycardia
  – < 40 beats min\(^{-1}\) or < 60 beats min\(^{-1}\) if poor cardiac reserve

• Heart failure
  – Pulmonary oedema, raised JVP, hepatic enlargement
Treatment options

Bradycardias
• Cardiac pacing

Tachycardias
• Cardioversion

All Arrhythmias
• Antiarrhythmic and other drugs
Cardiac pacing

• Reliable method of treating bradycardias
• Requires expert help to insert transvenous pacing system
• Used in presence of adverse signs or when drugs have failed
Cardioversion

• Effective at converting tachyarrhythmias to sinus rhythm

• Used when adverse signs
  – Drugs are relatively ineffective

• May cause VF!
  – Must use a synchronised shock
  – Need for sedation / anaesthesia
Antiarrhythmic and other drugs

- May convert a tachyarrhythmia to sinus rhythm
  - Less reliable than cardioversion
  - Use when no adverse signs
- Used to treat bradycardias initially
  - Less effective if cardiac output reduced

All drugs that are used to treat arrhythmias can cause arrhythmias!
Bradycardia

• Are there any adverse signs?
  – Systolic blood pressure < 90 mmHg
  – Heart rate < 40 beats min\(^{-1}\)
  – Ventricular arrhythmias requiring suppression
  – Heart failure

If YES – give atropine 500 µg i.v. and assess response
Bradycardia

• If there is a satisfactory response to atropine, and -
• There are NO adverse signs

Determine the risk of asystole:

• Recent episode of asystole?
• Mobitz type II heart block?
• Complete heart block with wide QRS?
• Ventricular pause > 3 seconds?
Bradycardia

• There is a risk of asystole, or
• If there is NO response to atropine

1. Further doses of atropine, 3 mg maximum
2. External pacing
3. Epinephrine infusion, 2-10 \( \mu g \) min\(^{-1}\)
4. Arrange transvenous pacing

SEEK EXPERT HELP!
Bradycardia

• If there is a response to atropine, and:
• There is NO risk of asystole

Observe the patient
BRADYCARDIA
(Rate <40 beat min\(^{-1}\) or inappropriately slow for haemodynamic state)

Adverse signs?
- Systolic BP <90 mm Hg
- Rate < 40 beat min\(^{-1}\)
- Ventricular arrhythmias requiring suppression
- Heart failure

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

YES

NO

Atropine 500 µg i.v.

Satisfactory response?

YES

NO

Interim measures:
- Atropine 500 µg i.v.
  repeat to maximum of 3 mg
- External pacing
- Epinephrine 2-10 µg min\(^{-1}\)

Seek expert help
Arrange transvenous pacing

Observe

YES

NO
Broad complex tachycardia

- Does the patient have a pulse?

  NO! – follow the VF protocol

  YES – are there any adverse signs?
Broad complex tachycardia

- **Adverse signs**
  - Systolic blood pressure < 90 mmHg
  - Chest pain
  - Heart failure
  - Rate > 150 beats min\(^{-1}\)

- **NO**
  - Antiarrhythmics
  - Seek expert help
  - Cardioversion

- **YES**
  - Seek expert help
  - Cardioversion
  - Antiarrhythmics

Correct hypokalaemia, give magnesium
Broad complex tachycardia

(Treat as sustained ventricular tachycardia)

If not already done, give oxygen and establish i.v. access

Pulse?

NO → Use VF protocol

YES

Adverse signs?
• Systolic BP <90 mm Hg
• Chest pain
• Heart failure
• Rate >150 beat min⁻¹

NO

YES
Adverse signs?
- Systolic BP < 90 mm Hg
- Chest pain
- Heart failure
- Rate > 150 beat min\(^{-1}\)

If potassium known to be low see panel
- Amiodarone 150 mg i.v. over 10 mins
  or
  Lidocaine i.v. 50 mg over 2 mins
  repeated every 5 mins to maximum dose of 200mg;

Seek expert help

Synchronised DC shock 100 J: 200 J: 360 J
  or equivalent biphasic energy

If necessary, further amiodarone 150 mg i.v. over 10 mins, then 300 mg over 1 hour

- Give potassium chloride up to 60 mmol, max rate 30 mmol h\(^{-1}\)
- Give magnesium sulphate i.v. 5ml 50% in 30min
Adverse signs?
- Systolic BP < 90 mm Hg
- Chest pain
- Heart failure
- Rate > 150 beat min\(^{-1}\)

**YES**

Seek expert help

Synchronised DC shock 100 J: 200 J: 360 J or equivalent biphasic energy

If potassium known to be low, *see panel*

Amiodarone 150 mg i.v. over 10 mins

Further cardioversion as necessary

For refractory cases consider additional pharmacological agents:
- amiodarone, lidocaine, procainamide or sotalol
- or overdrive pacing

**Caution drug-induced myocardial depression**

• Give potassium chloride up to 60 mmol, max rate 30 mmol h\(^{-1}\)
• Give magnesium sulphate i.v. 5 ml 50% in 30 min
BROAD COMPLEX TACHYCARDIA
(Treat as sustained ventricular tachycardia)

If not already done, give oxygen and establish i.v. access

**Pulse?**
- **NO**: Use VF protocol
- **YES**: Adverse signs?
  - **NO**: If potassium known to be low see panel
    - Amiodarone 150 mg i.v. over 10 mins or Lidocaine i.v. 50 mg over 2 mins repeated every 5 mins to maximum dose of 200mg;
  - **YES**: Synchronised DC shock 100 J: 200 J: 360 J or equivalent biphasic energy
    - Amiodarone 150 mg i.v. over 10 mins
    - Further cardioversion as necessary
    - For refractory cases consider additional pharmacological agents: amiodarone, lidocaine, procainamide or sotalol or overdrive pacing

Caution drug-induced myocardial depression

If necessary, further amiodarone 150 mg i.v. over 10 mins, then 300 mg over 1 hour
Atrial fibrillation

Treatment based on risk to patient from the arrhythmia

- **High risk**
  - Rate > 150 beats min\(^{-1}\)
  - Chest pain
  - Critical perfusion

- **Intermediate risk**
  - Rate 100-150 beats min\(^{-1}\)
  - Breathlessness
  - Poor perfusion

- **Low risk**
  - Rate < 100 beats min\(^{-1}\)
  - Mild or no symptoms
  - Good perfusion
Atrial fibrillation

• High risk
  – Rate > 150 beats min$^{-1}$
  – Chest pain
  – Critical perfusion

SEEK EXPERT HELP!

1. Heparinisation
2. Synchronised shock 100J, 200J, 360J (or biphasic equivalent)
3. Amiodarone 300mg over 1 hour (may repeat once)
Atrial Fibrillation: high risk

High risk?
- Rate > 150 beats min⁻¹
- Chest pain
- Critical perfusion

YES

Seek expert help

Immediate heparin and synchronised DC shock 100J, 200J:360J or equivalent biphasic energy

Amiodarone 300mg over 1 hour, may be repeated once if necessary
Atrial fibrillation

• Intermediate risk
  – Rate 100-150 beats min\(^{-1}\)
  – Breathlessness
  – Poor perfusion

SEEK EXPERT HELP!

1. Impaired haemodynamics or structural heart disease?
2. Onset within 24 hours?
Atrial fibrillation
Intermediate risk

NO impaired haemodynamics / structural heart disease

Onset > 24 hours ago:
• Control rate with drugs
  OR
• Anticoagulation
• Later synchronised DC shock

Onset < 24 hours ago:
• Heparinisation
• Antiarrhythmics
• Synchronised DC shock if indicated
Atrial fibrillation
Intermediate risk

Impaired haemodynamics / structural heart disease

Onset > 24 hours ago:
• Control rate with amiodarone
• Anticoagulation
• Later synchronised DC shock if indicated

Onset < 24 hours ago:
• Heparinisation
• Synchronised DC shock if indicated
• Amiodarone
Atrial fibrillation

- **Low risk**
  - Rate < 100 beats min$^{-1}$
  - Mild or no symptoms
  - Good perfusion

Onset > 24 hours ago:
- Consider anticoagulation
- Later DC shock if indicated

Onset < 24 hours ago:
- Heparinisation
- Antiarrhythmics
- DC shock if indicated
Atrial Fibrillation

High risk?
- Rate > 150 beats min⁻¹
- Chest pain
- Critical perfusion

Intermediate risk?
- Rate 100-150 beats min⁻¹
- Breathlessness
- Poor perfusion

Low risk?
- Rate < 100 beats min⁻¹
- Mild or no symptoms
- Good perfusion

High risk?
- Rate > 150 beats min⁻¹
- Chest pain
- Critical perfusion

Immediate heparin and synchronised DC shock 100J, 200J:360J or equivalent biphasic energy

Amiodarone 300mg over 1 hour, may be repeated once if necessary

If onset known to be within 24 hours?
- Yes
  - Anticoagulate with: Heparin, Warfarin
  - For later synchronised DC shock if indicated

- No
  - Onset known to be within 24 hours?
    - Yes
      - Heparin
      - Amiodarone: 300mg over 1 hr, repeated once if necessary OR
      - Flecainide 100-150 mg i.v. over 30 mins and/or DC shock if indicated
    - No
      - Heparin
      - Amiodarone 300mg over 1 hour, may be repeated once if necessary

Impaired haemodynamics and/or known structural heart disease?

Initial rate control:
- Amiodarone 300mg over 1 hour,
  - may be repeated once if necessary
- Anticoagulation: Heparin, Warfarin
- Later synchronised DC shock if indicated

Onset known to be within 24 hours?
- Yes
  - Heparin
  - Synchronised DC shock 100J, 200J, 360J or biphasic equivalent

- NO
  - Onset known to be within 24 hours?
    - Yes
      - Heparin
      - Synchronised DC shock 100J, 200J, 360J or biphasic equivalent
    - No
      - Attempt cardioversion
  - Anticoagulation: Heparin, Warfarin
  - Later synchronised DC shock if indicated

Rate control with:
- Beta blockers, or
- Verapamil, or
- Diltiazem, or
- Digoxin, or
- Anticoagulate with:
  - Heparin
  - Warfarin, then later DC shock if indicated

Onset known to be within 24 hours?
- Yes
  - Attempt cardioversion
- NO
  - Initial rate control:
    - Amiodarone 300mg over 1 hour,
      - may be repeated once if necessary
    - Anticoagulation: Heparin, Warfarin
    - Later synchronised DC shock if indicated

Seek expert help
Narrow complex tachycardia
(Presumed supraventricular tachycardia)

1. Rate > 250 beats min$^{-1}$, pulseless
   1. synchronised DC shock
2. Rapid AF
   1. follow AF algorithm
3. Narrow complex, with pulse
   → follow SVT algorithm
Narrow complex tachycardia
(Presumed supraventricular tachycardia)

1. Vagal manoeuvres
   - Valsalva
   - Carotid sinus massage

2. Adenosine i.v.
   - 6mg, rapid bolus
   - 12mg, every 1-2 minutes, (max 3 doses)

If no effect:

SEEK EXPERT HELP!
**NARROW COMPLEX TACHYCARDIA**  
*(Presumed supraventricular tachycardia)*

- **Pulseless (heart rate usually > 250 beats min⁻¹)**
  - Synchronised DC shock 100J, 200 J, 360 J or equivalent biphasic

- **Narrow complex tachycardia**
  - Adenosine 6 mg by rapid bolus injection; if unsuccessful, follow, if necessary, with up to 3 doses each of 12mg every 1-2 mins*
  
  *Caution adenosine with known Wolf-Parkinson-White syndrome

- **Atrial fibrillation**
  - Follow AF algorithm

- If not already done, give oxygen and establish i.v. access
  - Vagal manoeuvres (caution if possible digitalis toxicity, acute ischaemia, or presence of carotid bruit for carotid sinus massage)
Narrow complex tachycardia
(Presumed supraventricular tachycardia)

Adverse signs
• Systolic BP < 90 mmHg
• Chest pain
• Heart failure
• Rate > 200 beats min\(^{-1}\)

NO
• Antiarrhythmics
• (caution drug interactions)

YES
• Synchronised DC shock
• Amiodarone if necessary
NARROW COMPLEX TACHYCARDIA
(Presumed supraventricular tachycardia)

Adverse signs?
• Systolic BP < 90 mm Hg
• Chest pain
• Heart failure
• Rate > 200 beats min\(^{-1}\)

Seek expert help

NO

Choose from:
• Esmolol: 40 mg over 1 min + infusion 4 mg min\(^{-1}\) (i.v. injection can be repeated with increments of infusion to 12 mg min\(^{-1}\) OR
• Verapamil 5-10 mg i.v.
• Amiodarone: 300 mg over 1 hour, may be repeated once if necessary OR
• Digoxin: maximum dose 500 µg over 30 mins x2

YES

Synchronised DC shock 100 J:200J: 360 J or equivalent biphasic energy

If necessary, amiodarone 150 mg over 10 mins then 300 mg over 1 hour, and repeat shock
NARROW COMPLEX TACHYCARDIA
(Presumed supraventricular tachycardia)

If not already done, give oxygen and establish i.v. access

Vagal manoeuvres (caution if possible digitalis toxicity, acute ischaemia, or presence of carotid bruit for carotid sinus massage)

Adenosine 6 mg by rapid bolus injection; if unsuccessful, follow, if necessary, with up to 3 doses each of 12mg every 1-2 mins*

Caution adenosine with known Wolf-Parkinson-White syndrome

Seek expert help

Choose from:
• Esmolol: 40 mg over 1 min + infusion 4 mg min\(^{-1}\)
  (i.v. injection can be repeated with increments of infusion to 12 mg min\(^{-1}\)
  OR
• Verapamil 5-10 mg i.v.
  OR
• Amiodarone: 300 mg over 1 hour, may be repeated once if necessary
  OR
• Digoxin: maximum dose 500 µg over 30 mins x2

Synchronised DC shock 100J, 200 J, 360 J or equivalent biphasic

If necessary, amiodarone 150 mg over 10 mins then 300 mg over 1 hour, and repeat shock

Atrial fibrillation

Follow AF algorithm

Pulseless (heart rate usually > 250 beats min\(^{-1}\))

Synchronised DC shock 100J, 200 J, 360 J or equivalent biphasic

Narrow complex tachycardia

Adverse signs?
• Systolic BP < 90 mm Hg
• Chest pain
• Heart failure
• Rate > 200 beats min\(^{-1}\)

YES

NO

Synchronised DC shock 100J: 200J: 360 J or equivalent biphasic energy

Choose from:
• Esmolol: 40 mg over 1 min + infusion 4 mg min\(^{-1}\)
  OR
• Verapamil 5-10 mg i.v.
  OR
• Amiodarone: 300 mg over 1 hour, may be repeated once if necessary
  OR
• Digoxin: maximum dose 500 µg over 30 mins x2

Pulseless (heart rate usually > 250 beats min\(^{-1}\))
Any Questions?