MANAGEMENT OF ARRHYTHMIAS

The types of arrhythmias you are likely to encounter in the ICU can be broadly divided into bradyarrhythmias and tachyarrhythmias.

Tachyarrhythmia
Heart rate > 100 bpm
Supraventricular
- Paroxysmal supraventricular tachycardias
- Atrial fibrillation
- Atrial flutter
- Multifocal atrial tachycardia
- Junctional tachycardia
- Sinus tachycardia
Ventricular
- Ventricular tachycardia (>5 beats at >/=120 bpm; non-sustained <30s, sustained >30s; monomorphic, polymorphic; with pulse, pulseless)
- Ventricular fibrillation

Diagnosis
Rhythm strip is easily accessible in ICU. However, must obtain a 12-lead ECG as much as is possible.
How to differentiate between SVT vs VT will not be mentioned in this manual.
Echo may be necessary to exclude structural heart disease.
Invasive electrophysiological study

Acute treatment
If in doubt, treat as VT. If patient is haemodynamically unstable, immediate DC cardioversion
Active seek out and treat reversible causes
- acute coronary syndrome
- acute respiratory failure: hypoxia, hypercapnea
- electrolytes imbalance
- drug: especially those prolong QTc. Commonly used in ICU: macrolide antibiotics, haloperidol, quetiapine, metoclopramide
In this ICU, our first line anti-arrhythmic is amiodarone unless contraindicated
Correct electrolytes: keep serum K > 4 mmol/L and Mg > 2 mmol/L
**Narrow complex tachyarrhythmias**

- **Haemodynamic unstable**
  - Immediate DC cardioversion as per ACLS protocol
- **Haemodynamic stable**
  - Vagal manoeuvres
  - IV Amiodarone (loading dose of 150mg over 10 mins, may repeat if failed to rate control; followed by infusion 30 mg/hour)
    - Check with senior if failed to rate-control with amiodarone – may consider other anti-arrhythmics eg
  - Diltiazem (0.25 to 0.35 mg/kg loading followed by infusion 5-15 mg/hour) – caution hypotension
  - IV Beta-blockers (metoprolol titrate 0.5-1mg, esmolol 0.5mg/kg/min for one min followed by 0.05-0.2mg/kg/min) – caution hypotension
  - IV Digoxin (1 mg over 24 hours in increments of 0.25 to 0.5 mg, followed by 0.125 mg to 0.25 mg daily)

**Wide complex tachyarrhythmias**

- **Haemodynamic unstable**
  - Immediate DC cardioversion as per ACLS protocol
- **Haemodynamic stable**
  - SVT (see above)
  - VT
    - IV Amiodarone (loading dose of 150mg over 10 mins, may repeat if failed to rate control; followed by infusion 30 mg/hour)

Note: for tachyarrhythmias postoperative cardiac surgery – the surgeons prefer their protocol which is 300 mg amiodarone IV over the first hour and 900 mg infusion over the next 23 hours (600 mg if small patient)

**Atrial Fibrillation**

Deserves a separate mention as it is very commonly encountered in the ICU

Can be classified into

- **Recurrent**: when AF occurs on 2 or more occasions
- **Paroxysmal**: episodes that generally last \( \leq 7 \) days (most last \( <24h \))
- **Persistent**: AF that last \( \geq 7 \) days
Permanent: paroxysmal or persistent AF with failure to cardiovert or not attempted

Causes (refers to those seen in ICU, list not exhaustive)
Acute and temporary (alcohol, post-operative esp cardiac or thoracic surgery, electrocution, myocarditis, pulmonary embolism, other pulmonary diseases, hyperthyroidism, post-operative AMI)
Underlying CVS diseases (valvular heart esp mitral, coronary artery disease, hypertension esp if LV hypertrophy present)
Neurogenic – heightened vagal or adrenergic tone
Note: PAF can be a non-specific sign of failed weaning, acute respiratory pathology, sepsis, acute coronary syndrome

Assessment
What nature and symptoms associated with AF, clinical type, previous treatment received, underlying heart or pulmonary diseases or other reversible causes
Investigations – 12 lead ECG looking for LV hypertrophy, BBB, AMI
CXR – acute pneumonia, heart failure
Echo
Thyroid function test

Management
Unstable – DC cardioversion as per ACLS protocol
Stable – rate control (antiarrhythmics, cardioversion), anticoagulation
Anticoagulate if AF present >/= 48 hours and if persistent (LMWH bd dose or UH to APTT 1.5 -2 times)
Long term antiarrhythmic agent not necessary unless AF>3 months’ duration
Antiarhythmics commonly used in ICU for AF
Amiodarone (loading dose of 150mg over 10 mins, may repeat if failed to rate control; followed by infusion 30 mg/hour) – caution long term side effects
Check with senior if failed to rate-control with amiodarone – may consider other anti-arrhythmics eg
Diltiazem (0.25 to 0.35 mg/kg loading followed by infusion 5-15 mg/hour) – caution hypotension
Beta- blockers (metoprolol IV, esmolol)

Bradyarrhythmia
Heart rate < 60 bpm
Sinus node dysfunction (sinus bradycardia, sinus pause)
AV node dysfunction (1\textsuperscript{st}, 2\textsuperscript{nd}, 3\textsuperscript{rd} degree AV block)

Actively seek and eliminate causes (ICU mediated, extrinsic)

ICU vagally mediated causes
- Intubation, suctioning, increased intracranial pressure, urination, defaecation, vomiting, retching

Extrinsic causes
- Drugs (antiarrhythmic agents, Dexmedetomidine)
- Electrolytes (K, Mg, Ca)
- Hypothyroidism
- Hypothermia
- Sepsis
- Specific infection (eg. endocarditis)
- AMI (inferior AMI related AV blocks often transient; Anterior AMI related AV blocks often irreversible)

**Acute treatment**
May not need immediate treatment if haemodynamically stable
Correct electrolytes
Treat if
- Symptomatic sinus bradycardia (hypotension, ischaemia, escape ventricular arrhythmia)
- Ventricular asystole
- Symptomatic AV block (2\textsuperscript{nd} degree Type I or 3\textsuperscript{rd} degree with narrow-complex escape rhythm)

Give
- Atropine: IV 0.6 mg (max 3 mg)
- Isoprenaline: Infusion at 0.5 – 10 mcg/min (caution in ischaemic heart disease)

Pacing: for symptomatic bradycardia. Types including transcutaneous/epicardial/transvenous/permanent. Inform ICU senior if pacing required

**Pacing**

Indications for urgent transcutaneous pacing
1. Sinus bradycardia with symptoms (SBP <80mmHg) unresponsive to drug therapy
2. Mobitz type II 2\textsuperscript{nd} degree AV block
3. 3\textsuperscript{rd} degree heart block
4. Bilateral BBB (alternating BBB or RBBB with alternating LAFB/LPFB)

5. Newly acquired or age indeterminate bifascicular block (LBBB, RBBB with LAFB or LPFB) with 1st degree AV block

Because transcutaneous pacing may be uncomfortable, especially when prolonged, it is intended to be prophylactic and temporary. Refer to cardiologist for transvenous pacing in patients who require ongoing pacing and in those with a very high probability of requiring pacing.

Indications for temporary transvenous pacing

1. Asystole
2. Symptomatic bradycardia (includes sinus bradycardia with hypotension and Type I 2nd degree AV block with hypotension not responsive to atropine)
3. Mobitz type II 2nd degree AV block
4. 3rd degree heart block
5. Bilateral BBB (alternating BBB or RBBB with alternating LAFB/LPFB)
6. Newly acquired or age indeterminate bifascicular block (LBBB, RBBB with LAFB or LPFB) with 1st degree AV block

Monitor to ensure appropriate pacing and sensing functions and absence of dislodgment (CXR)

Frequent (at least once per 24 hours) testing of pacing thresholds (pacing energy is usually set at more than 3 times the threshold)