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

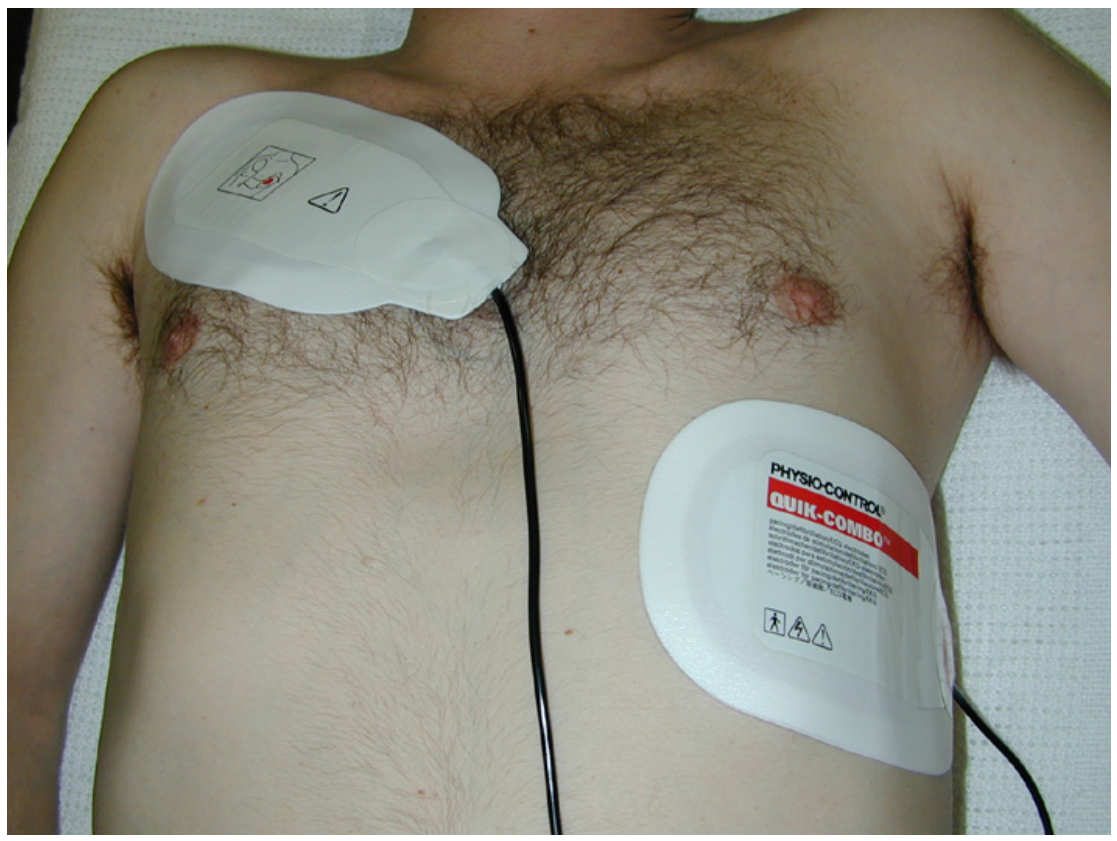
How to monitor the ECG (1): Monitoring leads

- 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

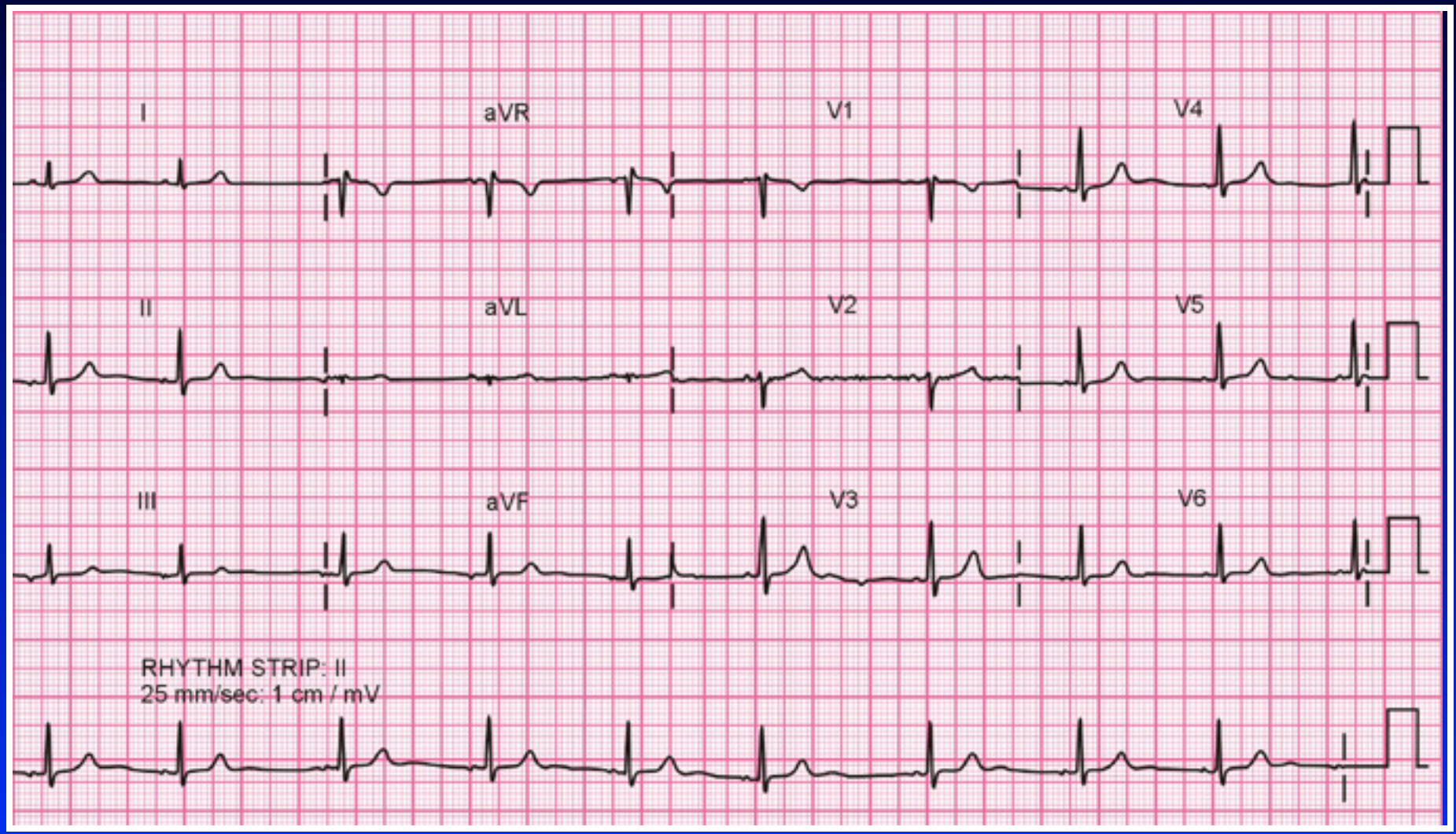
- Suitable for “quick-look”
- Movement artefact
- Risk of spurious asystole

How to monitor the ECG (3): Adhesive monitoring electrodes



- "Hands-free" monitoring and defibrillation

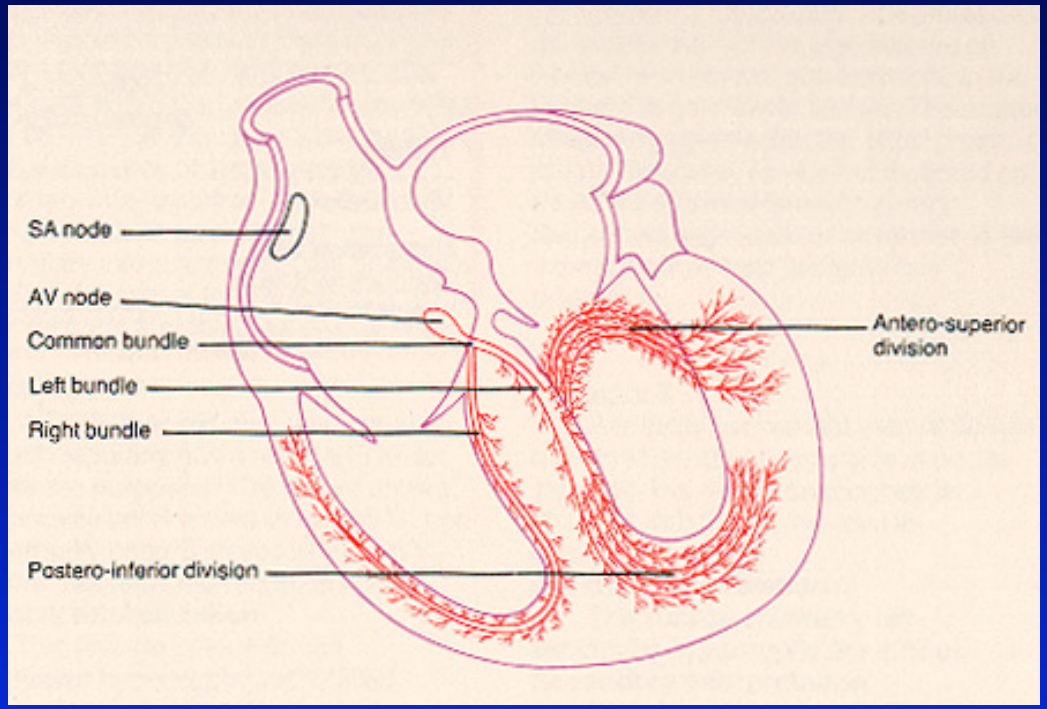
12-lead ECG


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
RHYTHM STRIP: II
25 mm/sec; 1 cm / mV

12-lead ECG

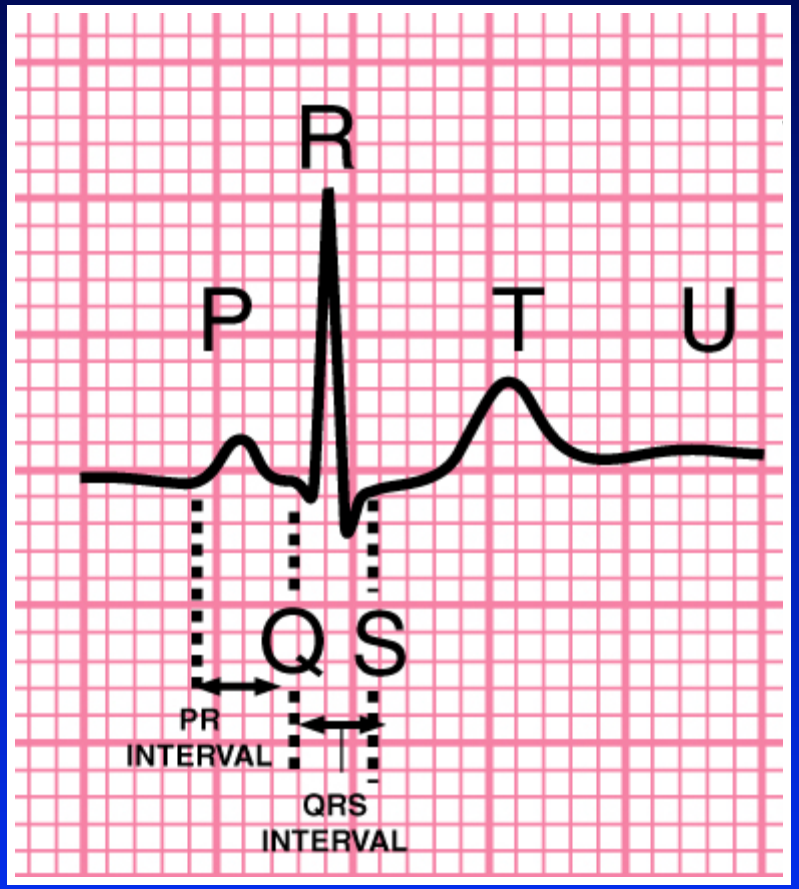
- 3D electrical activity from heart
- More sophisticated ECG interpretation
- ST segment analysis

Basic electrocardiography (1)



- Depolarisation initiated in SA node
- Slow conduction through AV node
- Rapid conduction through Purkinje fibres

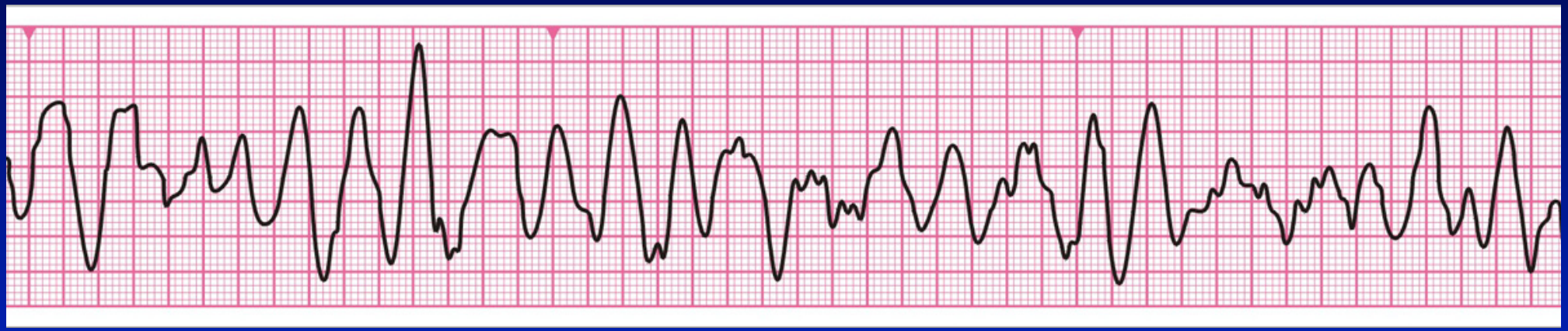
Basic electrocardiography (2)



- 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)

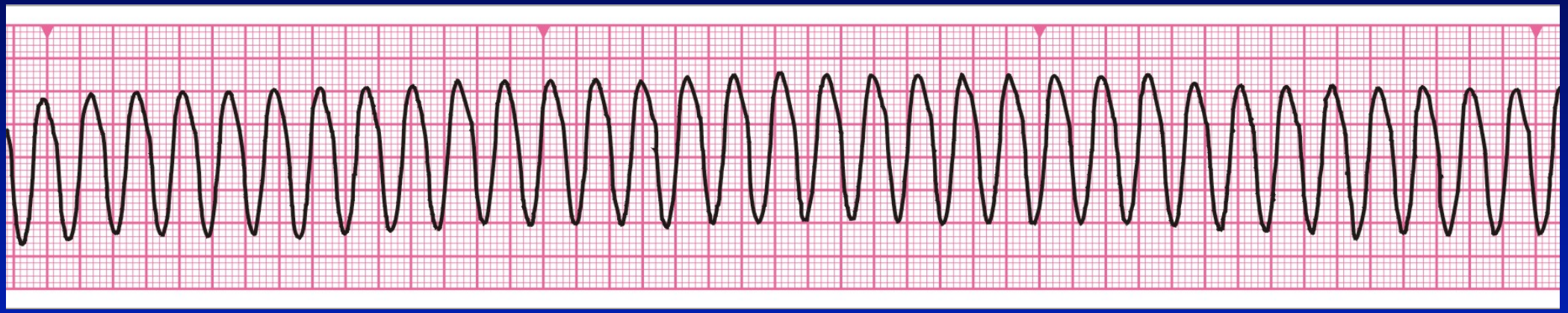


E12

Ventricular fibrillation

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

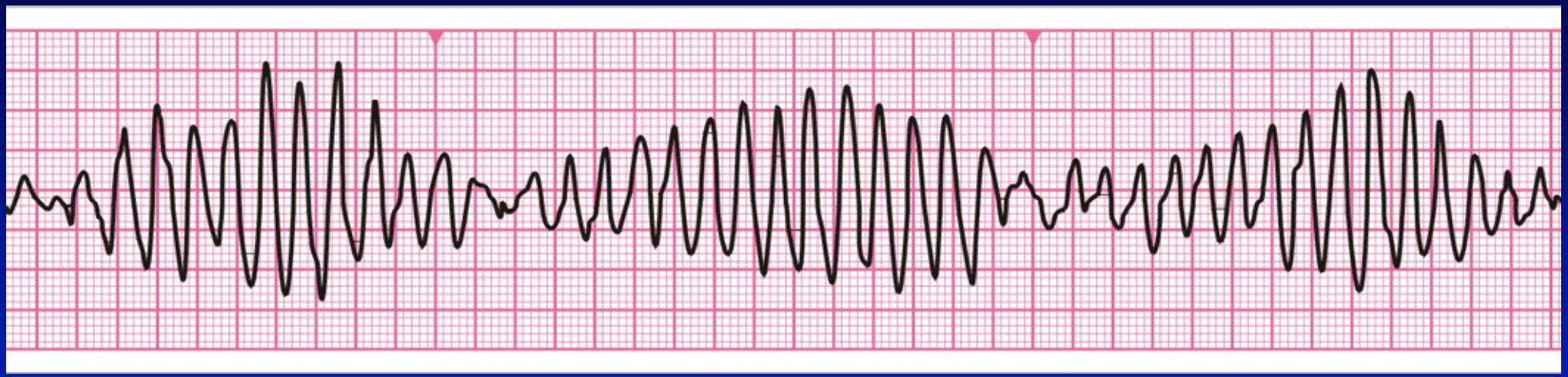
E14



E15

Pulseless ventricular tachycardia

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



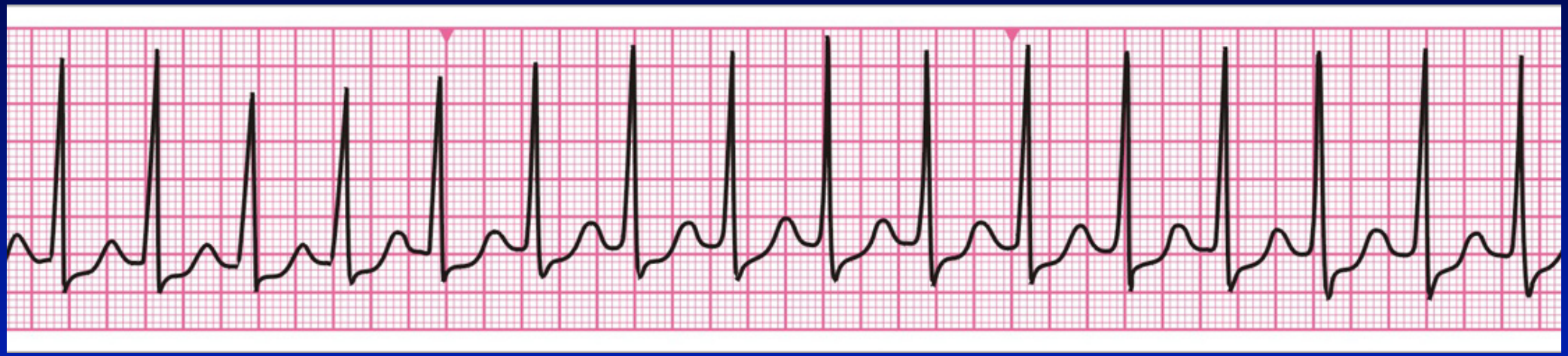
E17

E18

Asystole

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

E20



E21

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?

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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?

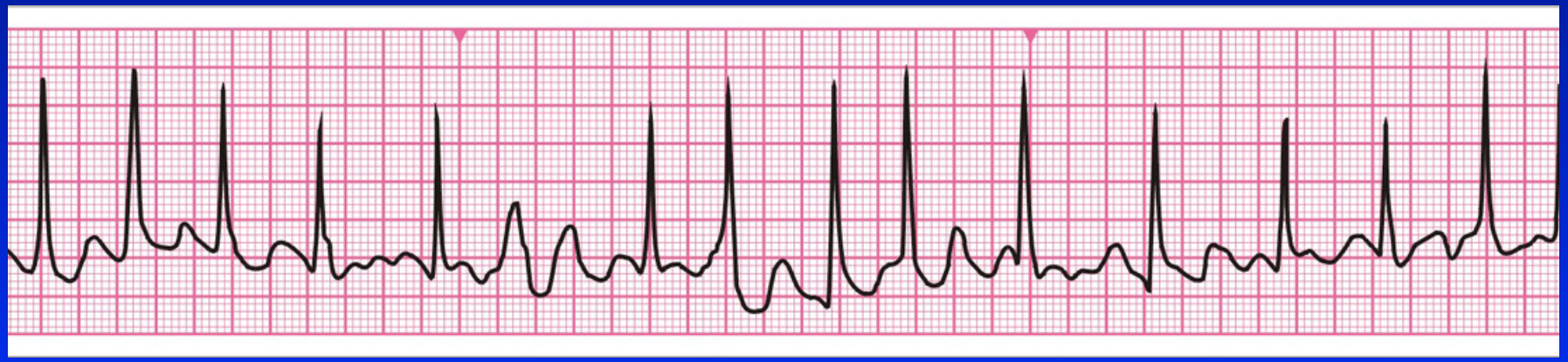
- Normal 60-100 min^{-1}
- Bradycardia < 60 min^{-1}
- Tachycardia > 100 min^{-1}

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

* At standard paper speed of 25 mm sec^{-1}, 5 large squares = 1 second

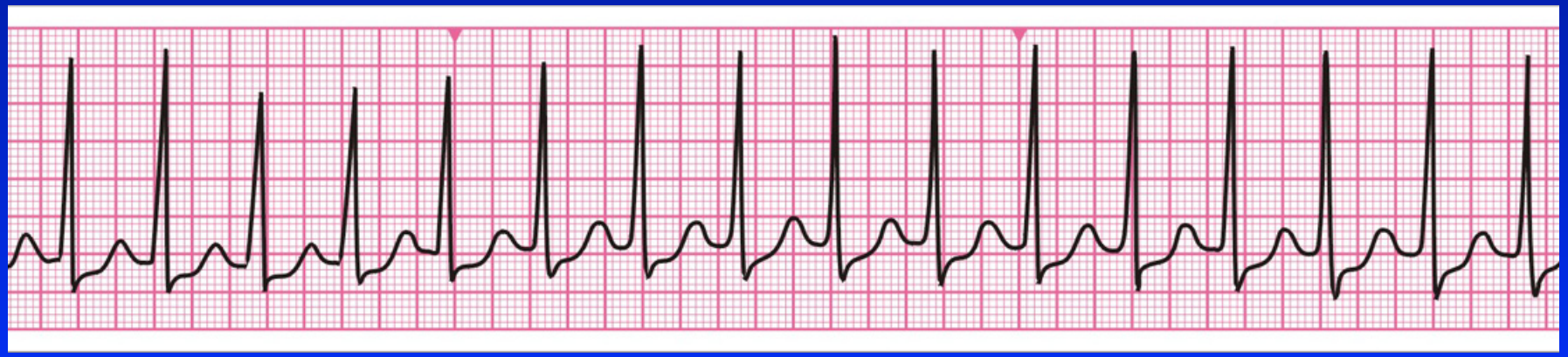
Is the QRS rhythm regular or irregular?

- Unclear at rapid heart rates
- Compare R-R intervals
- Irregularly irregular = AF



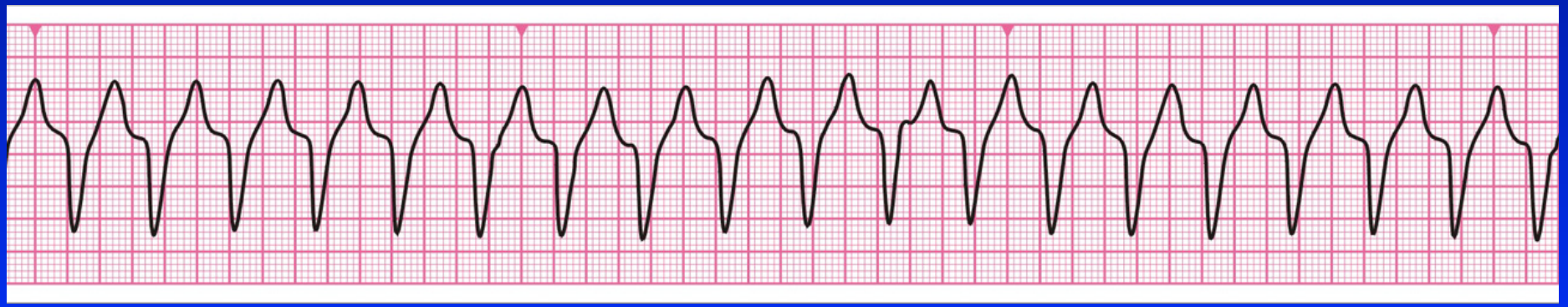
Is the QRS width normal or prolonged?

- Normal QRS:
  - < 0.12 s (< 3 small squares)
  - originates from above bifurcation of bundle of His



Is the QRS width normal or prolonged?

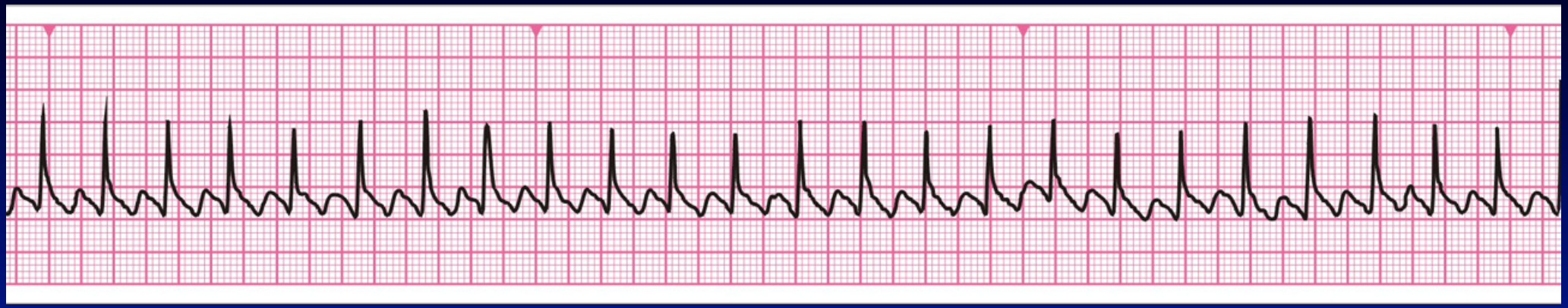
- Prolonged QRS (> 0.12 s) arises from:
  - –ventricular myocardium, or
  - –supraventricular with aberrant conduction



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

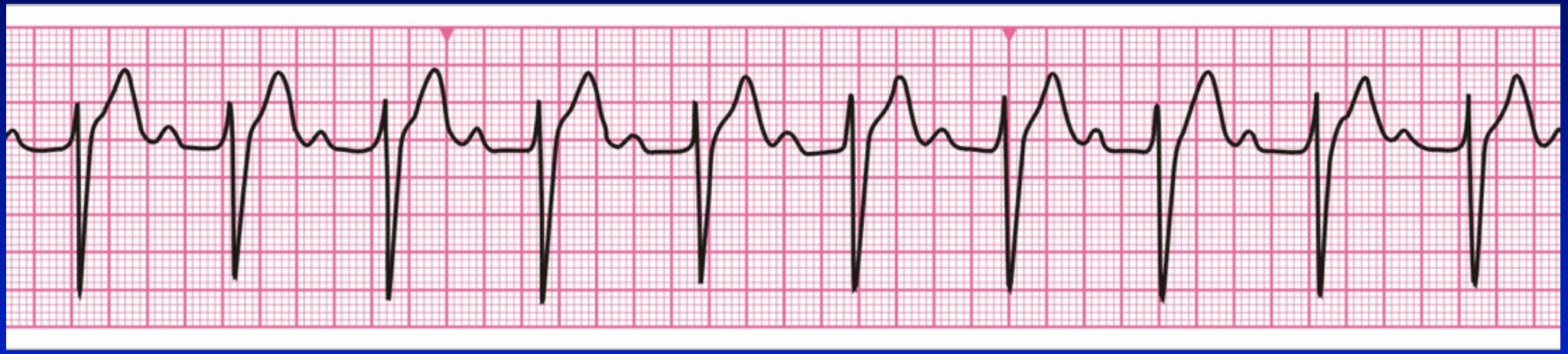


E31

How is atrial activity related to ventricular activity?

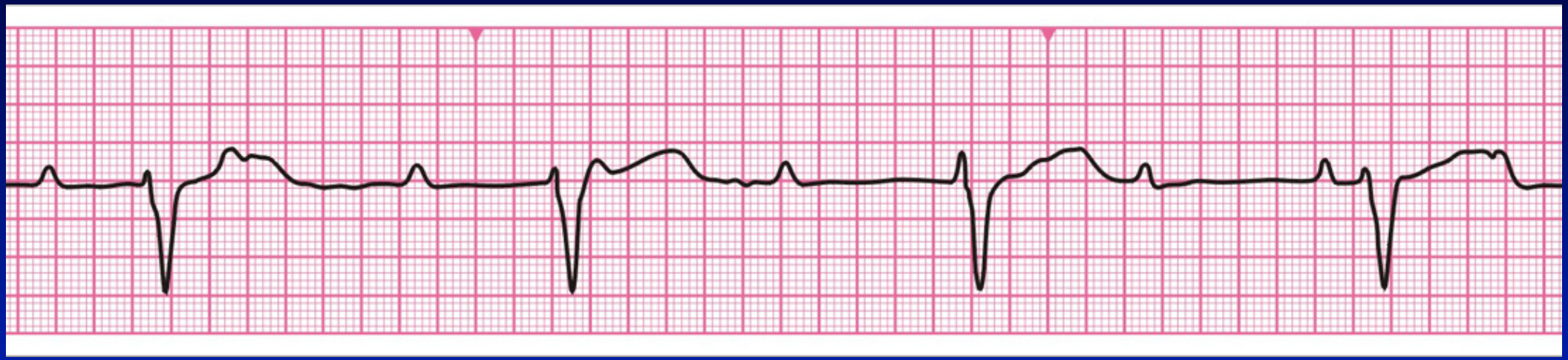
- Consistent, fixed PR interval
- Variable, but recognisable pattern
- No relationship - atrioventricular dissociation

Heart Block: First Degree



Heart Block: Second Degree

Heart Block: Third Degree



- Site of pacemaker:
  - AV node 40 - 50 min^{-1}
  - Ventricular myocardium 30 - 40 min^{-1}

Any Questions?