

# Module 2: Abnormal ECGs

## Introduction

*12-Lead electrocardiogram (ECG)* was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *12-lead ECG* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, educators should, where appropriate, adapt content to reflect their local policies, procedures and protocols. This will ensure the relevancy of the package content to your learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed in a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages may also be combined into a one- or two-day course.

*12-lead ECG* should be used as an educational tool to assist in the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the *Clinical Skills in Hospitals Project* (Train-the-Trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate the simulations into the teaching of clinical skills.

## Aims

*12-lead ECG* aims to make participants confident in their recording and interpretation of electrocardiogram (ECG) tracings on adult patients, and when they initiate appropriate therapeutic interventions for patients with common clinical conditions that lead to ECG abnormalities. It is not intended to be a comprehensive textbook on ECG interpretation. In contrast to adult patients, the need to perform an ECG on a paediatric patient is a rare occurrence outside of specialist paediatric cardiology services. This module does not address the issue of ECGs in children.

## Package structure

*12-lead ECG* contains four modules which provide learning opportunities for health professionals at all levels of experience and from all health disciplines. Modules 1 and 2 are regarded as fundamental. Modules 3 and 4 are more difficult, and are regarded as intermediate.

Level of complexity	Package structure
<p><b>Complex</b> For participants with more than 4 years experience or who have completed Modules 1–4</p>	<pre> graph TD     A[Management of arrhythmias] &lt;--&gt; B[Management of acute coronary syndrome]     C[Basic ECG recording and interpretation] &lt;--&gt; D[Abnormal ECGs]     A &lt;--&gt; C     B &lt;--&gt; D     style D stroke:#f00,stroke-width:2px           </pre>
<p><b>Intermediate</b> For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</p>	
<p><b>Fundamental</b> For participants in postgraduate years 1–2</p>	

*12-lead ECG* was designed to develop participants' knowledge, skills and behaviours in ECG interpretation, and to expose them to increasingly complex scenarios aimed at testing their ability to combine these skills, work as a team and problem solve in more difficult situations.

Educators delivering these modules should be aware of participants' level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from a fundamental knowledge of anatomy and physiology for the fundamental modules, up to detailed knowledge of arrhythmia and acute coronary syndrome management for the more complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have the prior knowledge and skills. Individual educators are responsible for assessing each participant's baseline knowledge and determining which modules they need to complete. While the intermediate modules contain considerable medical detail, non-medical participants can still gain valuable experience from these modules by focusing on their roles and expectations in these scenarios. If the group contains no medical staff, facilitators may need to play the medical roles. More specific descriptions of presumed knowledge are outlined in each module.

The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice regarding the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with the Department of Human Services' basic and advanced Train-the-Trainer Programs. Clinical educators are encouraged to refer to Department of Human Services' *Clinical Skills Facilitators Manual* for theory on:

1. Peyton's model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.



# Module 2: Abnormal ECGs

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## Aims

The purpose of this module is for participants to learn or consolidate their ability to interpret abnormal electrocardiograms (ECG).

## Presumed knowledge

This module is targeted to health professionals with some experience in acquiring and interpreting normal ECGs. They may have some theoretical knowledge of common arrhythmias, but little clinical exposure to these ECGs. However, they are expected to have a basic knowledge of:

1. common cardiac arrhythmias: atrial fibrillation, atrial flutter (AF), supraventricular tachycardia (SVT) and ventricular tachycardia (VT)
2. acute coronary syndromes (ACS), including angina and myocardial infarction
3. pericarditis.

Novice participants are expected to have completed *12-lead ECG—Module 1: Basic ECG recording and interpretation* before undertaking this module.

## Objectives

By the end of this module, participants should have:

1. reviewed the ECG appearances of common cardiac conditions, including arrhythmias and ACS
2. practised interpreting common ECG abnormalities
3. linked common clinical conditions to abnormal ECGs using case scenarios
4. practised reporting ECG appearances to facilitators and colleagues.

This module briefly covers the recognition and treatment of ventricular fibrillation (VF), ventricular tachycardia (VT) and asystole. Educators are also referred to *ALS adult* for more educational opportunities to address these particular arrhythmias.

## Background information for educators

The ECG is an important tool used by health professionals to diagnose and monitor a wide array of cardiac abnormalities, including arrhythmias and myocardial damage.

## Tachycardia

'Tachycardia' is an all-encompassing term that refers to a fast heartrate, usually in excess of 100 bpm. Tachycardia may be classified as 'regular' or 'irregular', and may have a 'narrow' or 'wide' complex.

## Regular narrow complex tachycardia

A regular narrow complex tachycardia is usually one of three rhythms:

1. sinus tachycardia (ST)
2. supraventricular tachycardia (SVT)
3. atrial flutter.

### Sinus tachycardia

Sinus tachycardia is common, but usually reflects systemic illness or injury (such as sepsis, trauma or dehydration), rather than a primary cardiac condition. The electrical conduction through the heart is normal, albeit accelerated. The ECG appearances of ST include:

- regular rate, usually less than 120 bpm in an otherwise healthy person
- normal appearance of P, QRS and T waves
- QRS may be widened if an associated conduction defect is present—bundle branch block (BBB).

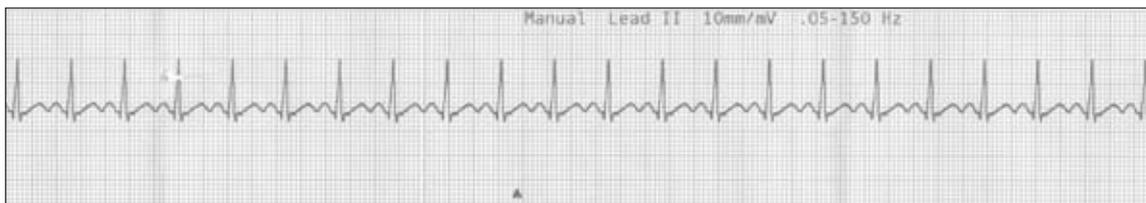


Figure 1: Sinus tachycardia

### Supraventricular tachycardia

SVT includes several tachycardias arising from the AV node or above. The two most common forms are AV node re-entry tachycardia and tachycardia associated with accessory conduction pathways, such as Wolf-Parkinson-White syndrome (WPW)<sup>3</sup>. In both forms, an alternative electrical pathway is present which allows repeated rapid conduction of atrial impulses to the ventricles and subsequent ventricular stimulation.

The ECG appearances of SVT are characterised by:

- hidden or absent P waves
- regular QRS complexes (ventricular rate)—typically 120–180 bpm
- normal QRS complexes in the absence of associated BBB (QRS may be widened in WPW with conduction along the accessory pathway)
- normal T waves.

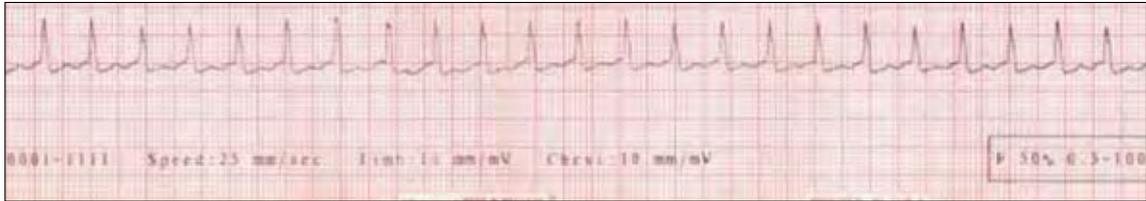


Figure 2: Supraventricular tachycardia

### Atrial flutter

Atrial flutter is a common regular tachycardia more prevalent in older patients. Atrial flutter is often misdiagnosed as SVT, but a rate of 150 bpm with narrow QRS complexes should alert one to the diagnosis. It may be present in association with atrial fibrillation.

The ECG appearances of atrial flutter are characterised by:

- P waves (flutter waves) at a rate of 300 bpm (atrial rate). These are often described classically as 'sawtooth' in appearance.
- Regular QRS complexes (ventricular rate). However, the ventricular rate depends on conduction through the atrio-ventricular (AV) node. If every second P wave (atrial beat) is conducted, the QRS (ventricular) rate will be 150 (2:1 AV block). If every third P wave is conducted, the QRS rate will be 100 (3:1 AV block).
- Normal QRS complexes in the absence of associated BBB.
- Normal T waves.

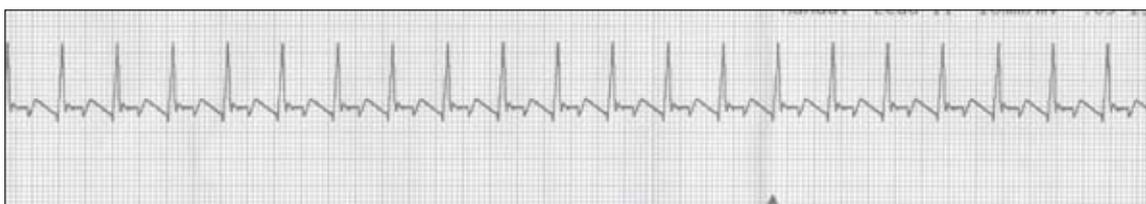


Figure 3: Atrial flutter 2:1

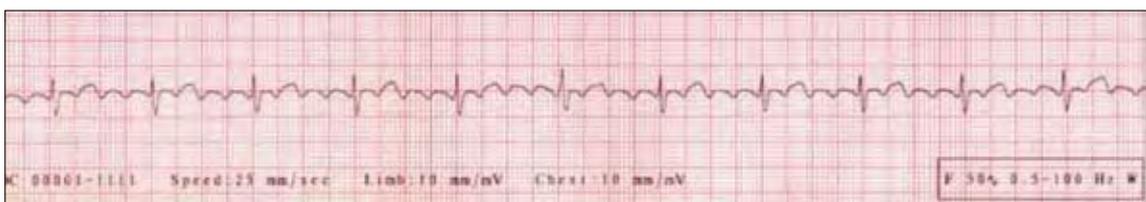


Figure 4: Atrial flutter 4:1

## Irregular narrow complex tachycardia

### Atrial fibrillation

An irregular tachycardia in a conscious patient is almost always atrial fibrillation (AF).

AF is the result of chaotic electrical current flow in the atria resulting in independent muscle fibre contraction (fibrillation), rather than a synchronous contraction of all muscle fibres. The sino-atrial (SA) node no longer acts as a pacemaker for the heart.

The ECG appearances of AF are characterised by:

- variable ventricular rate (QRS complexes)
- absence of P waves
- erratic baseline between QRS complexes
- narrow QRS complexes in most cases, but these may be wide if an associated BBB is present (aberrant conduction)
- normal T waves.



Figure 5: Atrial fibrillation

### Regular wide complex tachycardia

Wide complex tachycardia should always be regarded as being ventricular tachycardia (VT) until proven otherwise.

The differential diagnosis includes any of the narrow complex regular tachycardias (ST, SVT, atrial flutter) with an associated interventricular conduction defect (BBB). If these rhythms are confirmed, they can be managed as above. However, treatment of VT with calcium channel or beta blocking drugs may cause death of the patient.

### Ventricular tachycardia

VT consists of at least three consecutive ventricular complexes with a rate of more than 100 bpm. Patients may or may not be conscious as a result of their VT.

The ECG appearances of VT are characterised by:

- no P waves
- regular QRS complexes 120–200 bpm
- wide QRS complexes > 120 ms
- no identifiable T waves.



Figure 6: Ventricular tachycardia

Torsade de pointes, or polymorphic VT, is a variation of VT, where the amplitude of the waveform varies quickly over time, resulting in a twisted (torsade) appearance of the rhythm strip.

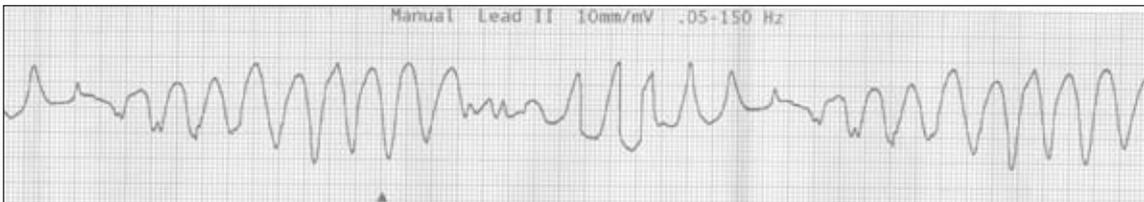


Figure 7: Torsade de pointes

### Ventricular fibrillation

VF is an asynchronous chaotic ventricular rhythm that follows no regular pattern and produces no cardiac output. The patient will be unconscious.

The ECG appearances of VF are characterised by:

- irregular undulations
- no clear-cut ventricular complexes
- varying ECG amplitude.



Figure 8: Ventricular fibrillation

### Asystole

Asystole is the term used to describe a lack of cardiac activity and contraction as a result of a lack of any detectable electrical activity. It is usually a prelude to death.

The ECG appearances of asystole are:

- lack of any P, QRS or T waves
- lack of any irregular undulations
- a 'flat line' appearance.

Fine VF may be mistaken for asystole, so clinicians should check the rhythm in several ECG leads before concluding that asystole has occurred.



Figure 9: Asystole

### Atrio-ventricular block

AV block is the term used to describe delayed conduction or non-conduction of an atrial impulse through the AV node. It may be intermittent or persistent, and is traditionally divided into three categories: first- second- and third-degree block.

#### First-degree heart block

In first-degree heart block, conduction through the AV node is delayed, but all impulses are conducted. The ECG in first-degree heart block is characterised by:

- normal P waves
- prolonged PR interval > 20 ms (5 mm)
- normal QRS complexes and T waves.



Figure 10: First-degree heart block

#### Second-degree heart block

In second-degree heart block, some—but not all—impulses are conducted through the AV node. Second-degree heart block may be either Mobitz Type 1 (Wenckebach) or Mobitz Type 2.

##### Mobitz Type 1 (Wenckebach)

The ECG in Type 1 second-degree heart block is characterised by:

- normal P waves
- progressive lengthening of the PR interval until one P wave is no longer conducted and the sequence begins again
- normal QRS complexes and T waves.



Figure 11: Second-degree heart block, Mobitz Type 1 (Wenckebach)

### Mobitz Type 2

The ECG in Type 2 second-degree heart block is characterised by:

- normal P waves
- fixed, identical PR intervals before a long pause with no conduction
- variable QRS response:
  - if the block is 2:1, ventricular rate (QRS) will be half the atrial rate (P)
  - if the block is 3:1, the ventricular (QRS) will be one-third the atrial rate (P).



Figure 12: Second-degree heart block, Mobitz Type 2

### Third-degree (complete) heart block

Third-degree heart block is characterised by complete failure of atrial impulses to be conducted through the AV node to the ventricles. The ECG in complete heart block is characterised by:

- normal regular P waves present, unless AF present
- lack of association between P waves and QRS complexes (AV dissociation)
- regular ventricular rate (QRS) 30–50 bpm
- QRS complexes may be narrow or broad, depending on the level of block and origin of ventricular pacemaker focus.



Figure 13: Third-degree (complete) heart block

## ST segment/T wave abnormalities

ST segment and T wave abnormalities on the ECG may be caused by several processes (ACS, pericarditis, ventricular aneurysm).

The most important of these abnormalities is acute coronary syndrome (ACS) (angina and myocardial infarction). Myocardial tissue damaged by ischaemia has a lower negative membrane potential compared with normal myocardium. This results in flow of current from normal to abnormal myocardium and produces characteristic features on the ECG.

The ECG features of ACS are variable and depend on the extent and acuity of the ischaemia. Common ECG patterns of ACS include ST segment elevation. This is the classical feature of acute myocardial infarction (AMI) or ST elevation myocardial infarction (STEMI). ST segment elevation occurs early in transmural infarction.



Figure 14: ST segment elevation

ST segment depression: this is the classical feature of acute angina and usually resolves with the patient's symptoms. It may also be present acutely in non-ST elevation myocardial infarction (non-STEMI).



Figure 15: ST segment depression

T wave inversion: this feature may be seen after the initial phases of an STEMI, as the only feature in a non-STEMI, or as an indicator of ischaemia without infarction (angina).

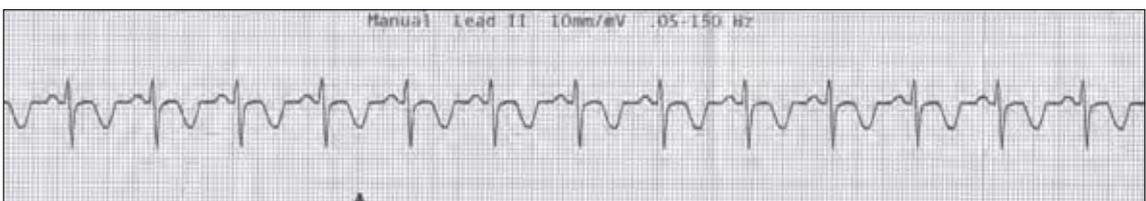


Figure 16: T wave inversion

Q waves: pathological Q waves develop after the acute phase of myocardial infarction, as the ST segments and T waves return to normal.



Figure 17: Q waves

The ECG appearances of pericarditis can be very similar to those of an STEMI. In both conditions there is ST elevation. Along with clinical assessment, the ST elevation of pericarditis usually differs from STEMI in the following ways:

- the ST elevation is very widespread, sometimes involving all ECG leads
- the ST elevation is classically concave, rather than the convex appearance in STEMI
- there may be associated depression of the PR interval below the isoelectric line.

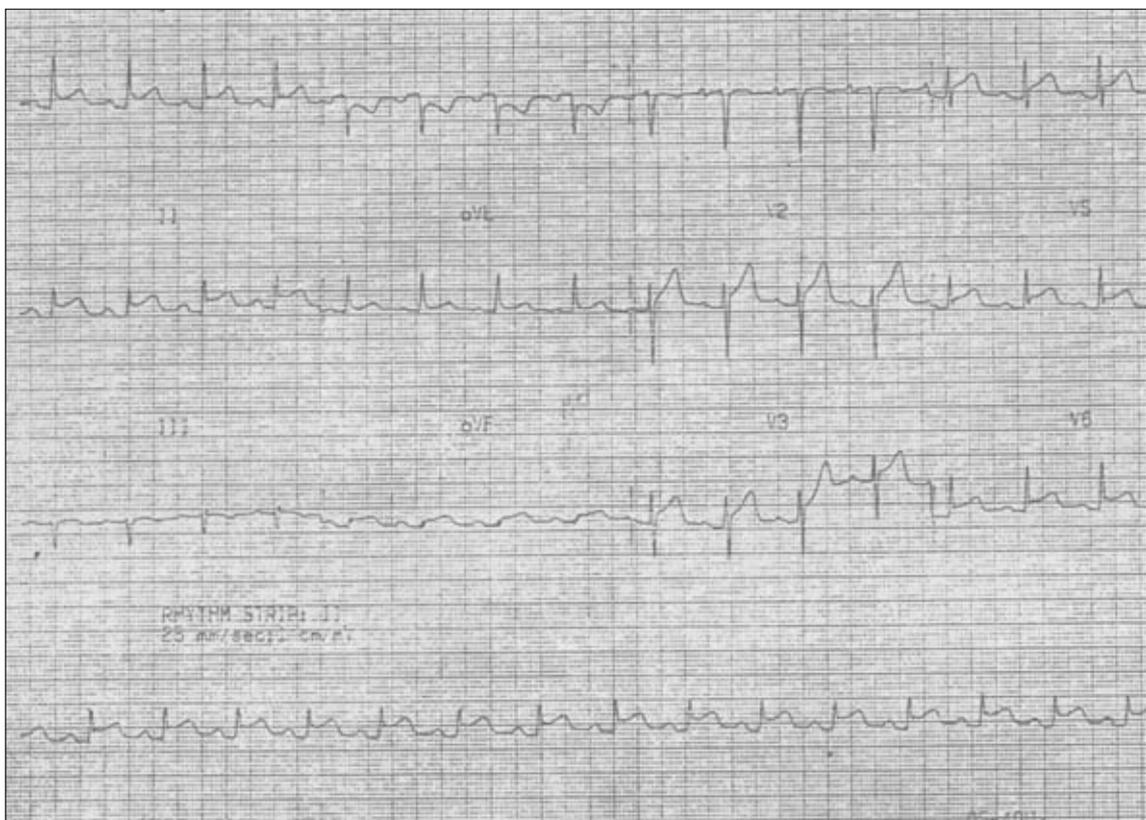


Figure 18: Pericarditis

## QRS abnormalities

The normal QRS has four characteristics:

1. its duration is  $< 120$  ms (3 mm)
2. in V1, the S wave is greater than the R wave
3. in V5 or 6, the R wave is  $< 2.5$  mV (25 mm)
4. left ventricle leads (V5 or 6) may show Q waves, but these are  $< 1$  mm across and  $< 2$  mm deep.

The QRS is abnormally wide when electrical conduction and depolarisation of the ventricles do not follow the normal conduction pathway. Circumstances when this occurs include:

1. left bundle branch block (LBBB) or right bundle branch block (RBBB)
2. artificial pacemaker-initiated ventricular contraction
3. abnormal ventricular focus generating ventricular escape beats, extra systoles or tachycardia.

### Bundle branch block (BBB)

When LBBB is present, the ventricular complex in the ECG classically shows an RSR pattern in the lateral leads (V5 and 6). In RBBB, there is an RSR pattern in the right-sided leads (V1 and 2).

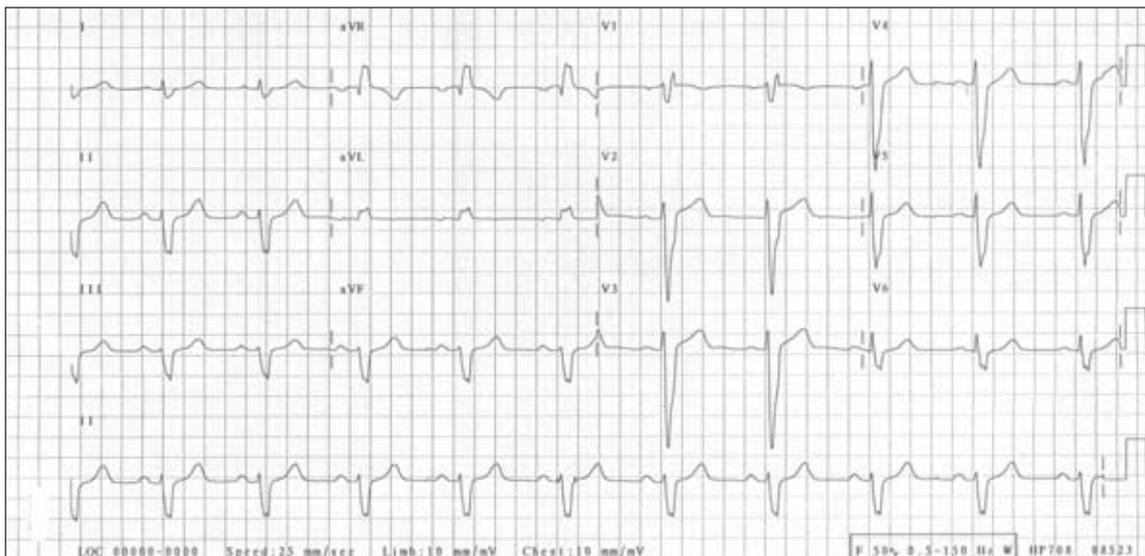


Figure 19: Left bundle branch block

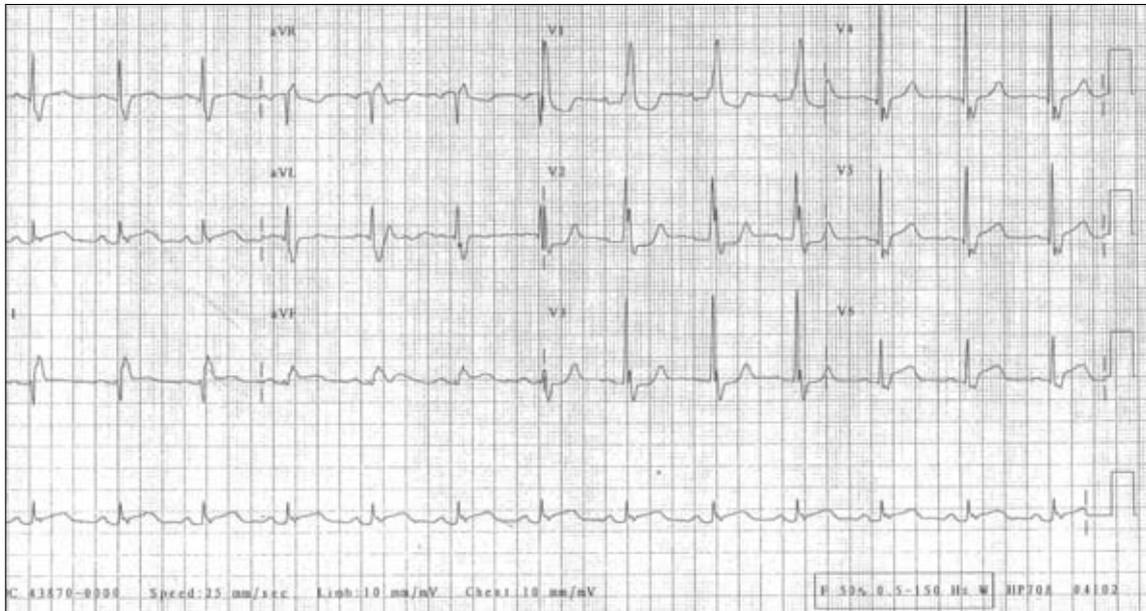


Figure 20: Right bundle branch block

### Artificially paced cardiac rhythm

The presence of a paced cardiac rhythm can be identified on the ECG by the presence of a sharp pacing 'spike', which may precede the P wave if the atrium is paced, or the QRS complex if the ventricle is paced, or both. When the ventricles are paced, the pacing wire is in the right ventricle. Depolarisation of the ventricles is abnormal, hence the QRS is widened. ECGs may show a mixture of normal heart beats and paced beats, hence the QRS may appear narrow and wide on the same ECG.



Figure 21: Paced rhythm

## Learning activities

Suggested learning activities and timetable are outlined below.

Timing	Activity	Objective
40 minutes	Facilitated discussion	1
60 minutes	Skills stations (two): <ul style="list-style-type: none"> <li>■ arrhythmias</li> <li>■ ST/QRS abnormalities</li> </ul>	2, 3, 4
10 minutes	Summary	All
10 minutes	Evaluation	

**Total time = 1 hour 20 minutes**

### Facilitated discussion

The facilitator should lead a discussion amongst participants about the issues covered in the background information, for example, the recognition of common cardiac problems readily identified on ECG. The facilitator should not give a didactic lecture, but instead promote open discussion and knowledge sharing amongst participants. Participants should be encouraged to describe any real-life experiences they have encountered.

Major issues which the facilitator should ensure are covered include:

- differentiation of regular narrow complex tachycardia (ST, SVT, atrial flutter)
- differentiation of AF from regular tachycardias
- heart block and conduction defects
- recognition of VT, VF and asystole
- the importance of assuming wide complex regular tachycardia to be VT
- the important clinical causes of QRS and ST changes on the ECG.

PowerPoint slides are available for the facilitator to use to summarise these main points at the end of the discussion, or as triggers if participants have not identified the major issues.

### Skills stations

The skills stations allow participants to practise interpreting and communicating the appearance of abnormal ECGs, while receiving feedback in a structured format from peers and/or facilitators. A series of clinical scenarios and appropriate ECGs is provided with the module. Educators should encourage participants to assess and describe the ECG appearances for each scenario while highlighting the diagnostic differences between the ECGs provided for each scenario.

Health professionals must frequently convey the appearance of a patient's ECG to a colleague remotely, so it is important that this information is reported efficiently and accurately. Checking the ECG and communicating its findings requires a systematic approach. The following features should be observed and described:

1. **Cardiac rate.** This can be estimated by dividing 300 by the number of large squares between QRS complexes.
2. **Underlying cardiac rhythm.** The presence of P waves indicates normal sinus rhythm. Each P wave should be followed by a QRS complex. Sinus rhythm should be regular.
3. **PR interval.** This is normally less than 200 ms (5 mm), and indicates normal conduction through the AV node.
4. **A description of the QRS complexes.** This is normally less than 120 ms (3 mm), and indicates normal conduction through the bundle of His and bundle branches.
5. **A description of the ST segment and T waves.** The ST segment should be isoelectric (that is, at the baseline), and T waves should be upright in most leads (except for aVR, and occasionally V1, III).

The program and resources required assume two facilitators for every eight participants, a ratio of 1:4. Four participants start at each of the two stations and change over after 30 minutes.

## Arrhythmias

The purpose of this station is to give the participants an opportunity to review a series of ECGs in the setting of common clinical scenarios and report the findings according to the standard procedure described.

Each participant should be given the opportunity to describe the findings of at least one ECG, and as a group, discuss the ECG appearances that led them to that diagnosis.

### Scenario 1: Narrow complex tachycardia

A 50-year-old man presents to the emergency department complaining of shortness of breath and rapid heartrate. He has no past history of cardiac disease and is taking no medication. Physical examination reveals a rapid heartrate and a blood pressure of 120/70 mmHg. The treating nurse has performed a 12-lead ECG for you to review and comment on.

Facilitators should assist participants in identifying the important differences in the four ECGs provided for use with this scenario:

1. sinus tachycardia
2. supraventricular tachycardia
3. atrial flutter
  - a. atrial flutter (rapid 1:2)
  - b. atrial flutter (slow 1:5)
4. atrial fibrillation.

#### Scenario 2: Wide complex tachycardia

A 68-year-old woman on the orthopaedic ward complains of palpitations and dizziness two days after a total hip replacement. She denies having any chest pain, though she has suffered angina in the past. Physical examination reveals a rapid heartrate with a blood pressure of 100/60 mmHg. The treating nurse has performed a 12-lead ECG for you to review and comment on.

Facilitators should assist participants in identifying the important differences in the three ECGs provided for use with this scenario:

1. ventricular tachycardia
2. SVT with aberrant conduction
3. atrial fibrillation with aberrant conduction.

#### Scenario 3: Unconscious patient

A 75-year-old man on the rehabilitation ward has collapsed and is unresponsive. The code blue team has been called and cardiac monitoring is being established. The patient does not respond to painful stimuli and no cardiac output/pulse/BP can be detected. An ECG rhythm strip has been printed for you to review and comment on.

Facilitators should assist participants in identifying the important differences in the two ECGs provided for use with this scenario:

1. ventricular fibrillation
2. asystole.

#### Scenario 4: Missed beats

A 60-year-old woman presents to the general medicine outpatient clinic because of dizziness and near syncope. She describes intermittent episodes of 'missing heartbeats' and dizziness. She has not had any chest pain and is taking no medication. A 12-lead ECG has been obtained by the clinic nurse and is provided to you to assess and comment on. Her husband has a pacemaker in situ and wonders if his wife might need something similar.

Facilitators should assist participants in identifying the important differences in the ECGs provided for use with this scenario:

1. first-degree heart block
2. second-degree heart block Type 1
3. second-degree heart block Type 2
4. third-degree heart block
5. ventricular paced rhythm.

### ST/QRS abnormalities

This station allows participants to review a series of ECGs in the setting of common clinical scenarios and report the findings according to the standard procedure described.

Each participant should be given the opportunity to describe the findings of at least one ECG, and as a group, discuss the ECG appearances which led them to that diagnosis.

#### Scenario 5: ST elevation

A 48-year-old male smoker presents to the emergency department with six hours of retro-sternal chest pain. He has a family history of ischaemic heart disease and diabetes. The pain radiates to the jaw and left arm. A 12-lead ECG has been obtained by the resus nurse and is provided to you to assess and comment on.

Facilitators should assist participants in identifying the important differences in the ECGs provided for use with this scenario:

1. anterior ST elevation myocardial infarction
2. inferior ST elevation myocardial infarction
3. pericarditis.

#### Scenario 6: ST depression/T inversion

A 48-year-old male smoker presents to the emergency department with six hours of retro-sternal chest pain. He has a family history of ischaemic heart disease and diabetes. The pain radiates to the jaw and left arm. A 12-lead ECG has been obtained by the resus nurse and is provided to you to assess and comment on.

The vignette provided for case six is deliberately the same as that given for case five. The reason for this is to allow facilitators to demonstrate to participants that patients may present with very similar symptoms, but that they may have different ECG findings and require different management as a result. Facilitators should assist participants in identifying the important differences in the ECGs provided for use with this scenario:

1. non-STEMI—inferior T wave inversion
2. myocardial ischaemia—ST segment depression.

### Scenario 7: Bundle branch block

An 80-year-old man presents to the pre-admission clinic for assessment before hip replacement surgery. He does not recall any past cardiac history. A pre-operative 12-lead ECG has been acquired for you to assess and comment on.

Facilitators should assist participants in identifying the important differences in the ECGs provided for use with this scenario:

1. left bundle branch block
2. right bundle branch block.

### Summary

The summary session reinforces content covered in the learning activities, and is an opportunity for participants to reflect on what they have covered. No new material should be introduced.

Major points to recap in the summary include:

- the differential diagnosis of narrow complex regular tachycardia
- the importance of assuming wide complex tachycardia to be VT
- the significance of ST segment and T wave abnormalities on the ECG.

Participants should be encouraged to read from the reference list to consolidate their understanding of abnormal ECGs. They should be offered access or directed to appropriate ECG libraries and educators in the future for them to practise these skills if they need to improve their skill level or confidence.

### Resource list

The following resource list assumes two facilitators for every eight participants, a ratio of 1:4. As a minimum, the following resources are needed to conduct this module.

Resource	Quantity	Additional comments
PowerPoint presentation	1	For use in facilitated discussion Provided with module
ECG sample set	2 sets	One for each of the two skills stations
Evaluation sheets	8	One for each participant

## Evaluation

A formal evaluation has been specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services' *Clinical Skills Facilitators Manual* from the basic course conducted in 2007.

## References

1. Hampton J. 2003 *The ECG made easy* (6th ed.) Churchill Livingstone, Edinburgh
2. Hampton J. 2003 *The ECG in practice* (4th ed.) Churchill Livingstone, Edinburgh
3. Orejarena L., Vidaillet H., DeStefano F. et al. 1998 Paroxysmal supraventricular tachycardia in the general population. *J Am Coll Cardiol*, 31: 150–157



## Module 2: Abnormal electrocardiograms—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

### 1. Overall

How would you rate this module?

poor     fair     good     very good     outstanding

### 2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<i>12-lead ECG</i> Learning objectives of Module 2: Abnormal electrocardiograms	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
Reviewed the ECG appearances of common cardiac conditions, including arrhythmias and ACS	<input type="checkbox"/>				
Practised interpreting common ECG abnormalities	<input type="checkbox"/>				
Linked common clinical conditions to abnormal ECGs using case scenarios	<input type="checkbox"/>				
Practised reporting ECG appearances to facilitators and colleagues	<input type="checkbox"/>				

### 3. Important learning outcomes

What are the three most important things you have learned from this module?

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#### 4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
The facilitator respected my experience	<input type="checkbox"/>				
The facilitator encouraged my participation	<input type="checkbox"/>				
I was able to ask the facilitator questions	<input type="checkbox"/>				
The facilitator was able to answer my questions	<input type="checkbox"/>				
The feedback I received was clear	<input type="checkbox"/>				
The feedback I received will assist me my future performance	<input type="checkbox"/>				
There was adequate time for the skills stations	<input type="checkbox"/>				
There was adequate time for the facilitated discussions	<input type="checkbox"/>				
There was adequate time for the simulations	<input type="checkbox"/>				
I have increased my confidence in interpreting 12-lead ECGs	<input type="checkbox"/>				
I have identified future learning needs in this topic area	<input type="checkbox"/>				

#### 5. Future module implementation

Do you think the module should be altered in any way?  yes  no

If yes, what recommendations do you have?

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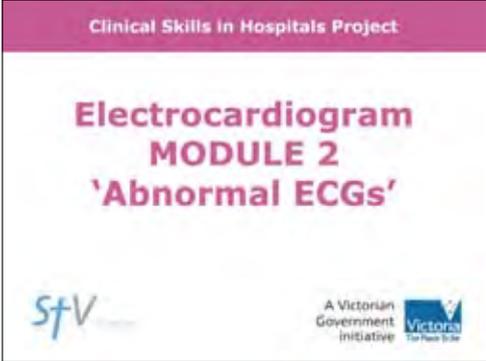
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**Thank you**

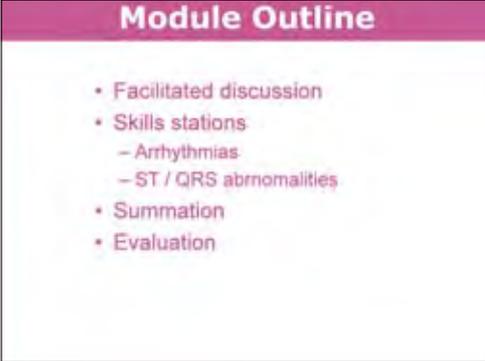
## PowerPoint Presentation

1. 

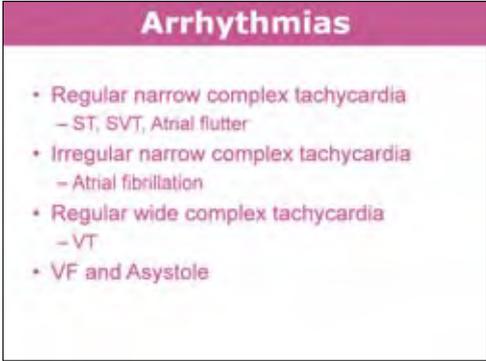
Clinical Skills in Hospitals Project

**Electrocardiogram**  
**MODULE 2**  
**'Abnormal ECGs'**

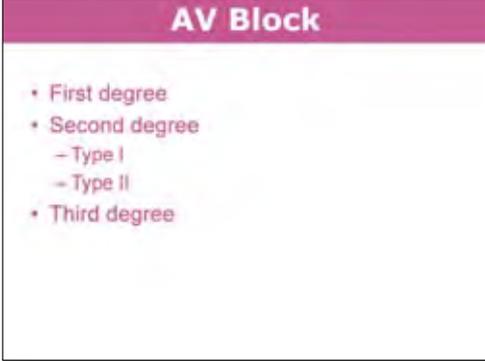
StV

A Victorian Government initiative
2. 

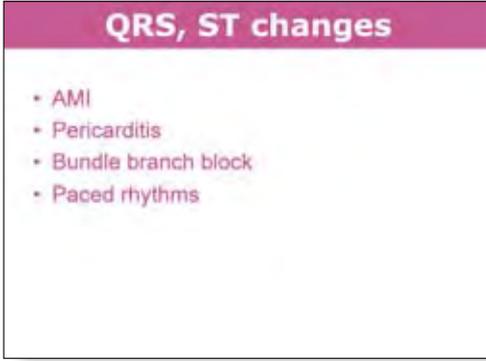
**Module Outline**

  - Facilitated discussion
  - Skills stations
    - Arrhythmias
    - ST / QRS abnormalities
  - Summation
  - Evaluation
3. 

**Arrhythmias**

  - Regular narrow complex tachycardia
    - ST, SVT, Atrial flutter
  - Irregular narrow complex tachycardia
    - Atrial fibrillation
  - Regular wide complex tachycardia
    - VT
  - VF and Asystole
4. 

**AV Block**

  - First degree
  - Second degree
    - Type I
    - Type II
  - Third degree
5. 

**QRS, ST changes**

  - AMI
  - Pericarditis
  - Bundle branch block
  - Paced rhythms



# Appendix 1: Scenario sheets

## Narrow complex tachycardia

### Scenario 1

A 50 year old man presents to the Emergency Department complaining of shortness of breath and rapid heart rate. He has no past history of cardiac disease and is taking no medication. Physical examination reveals a rapid heart rate and a blood pressure of 120/70 mmHg. The treating nurse has performed a 12-lead ECG for you to review and comment on.

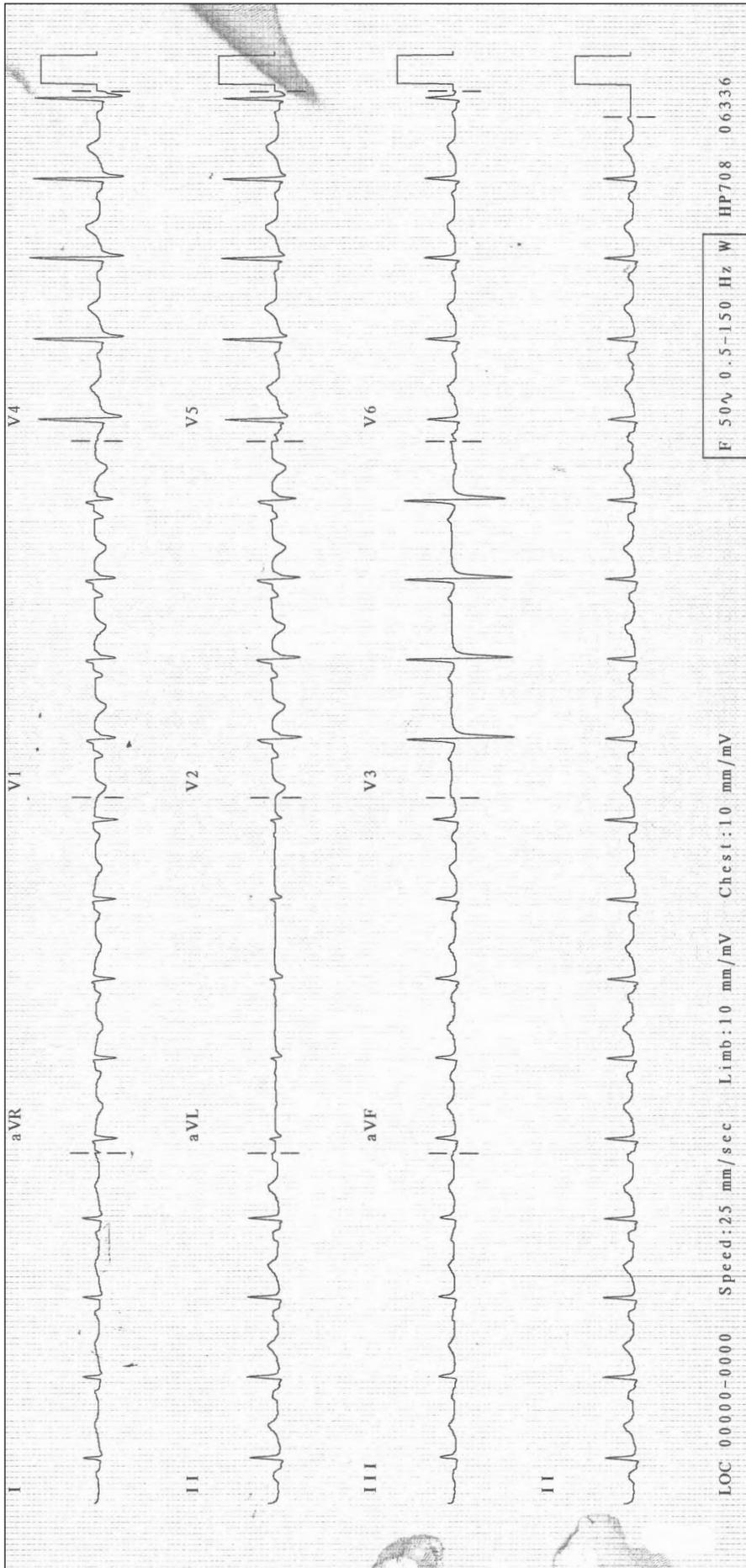


Figure 22: Scenario 1 ECG 1

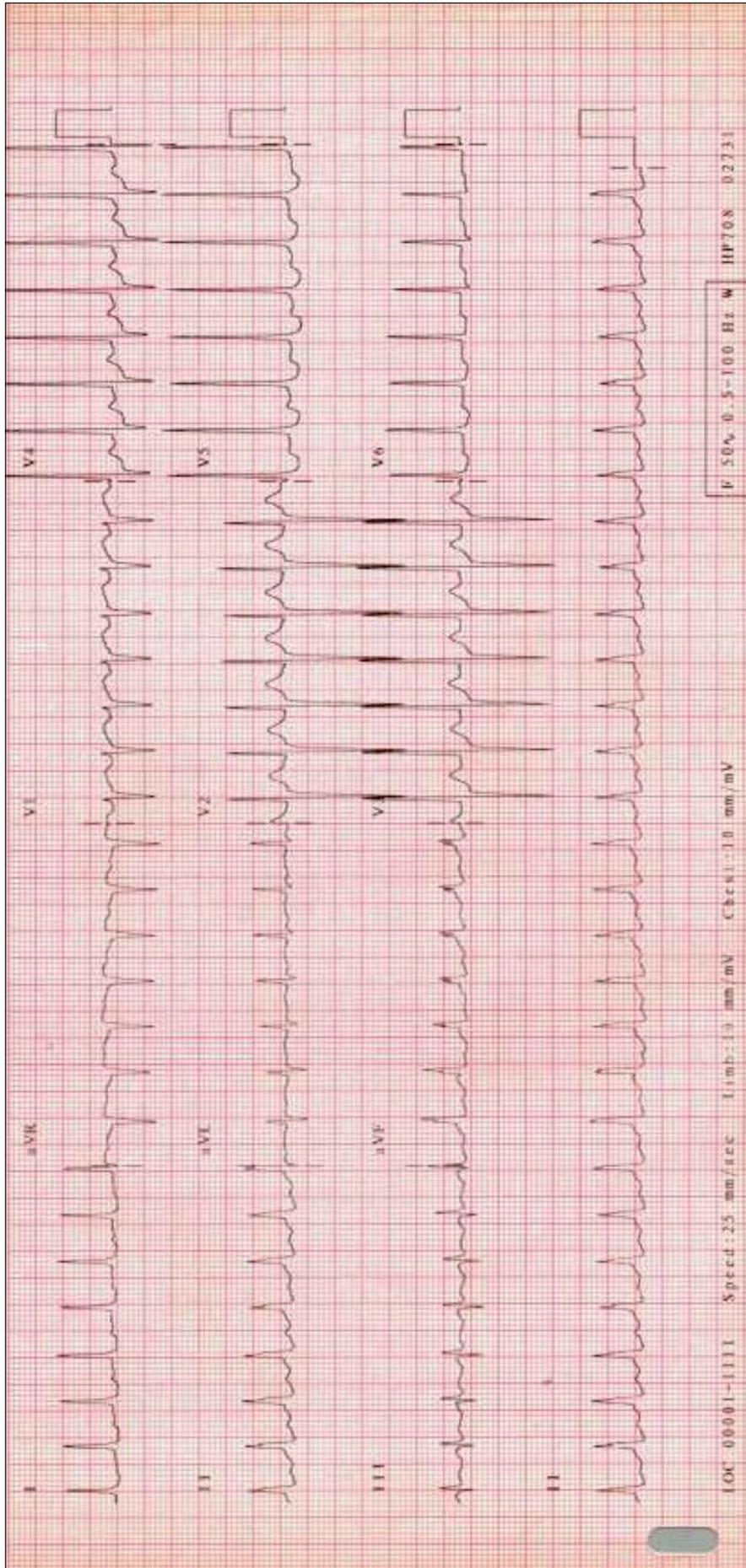


Figure 23: Scenario 1 ECG 2

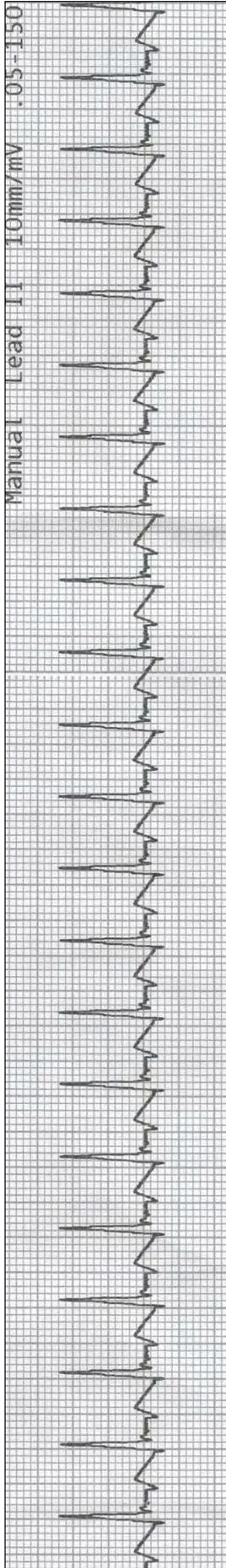


Figure 24: Scenario 1 ECG 3a

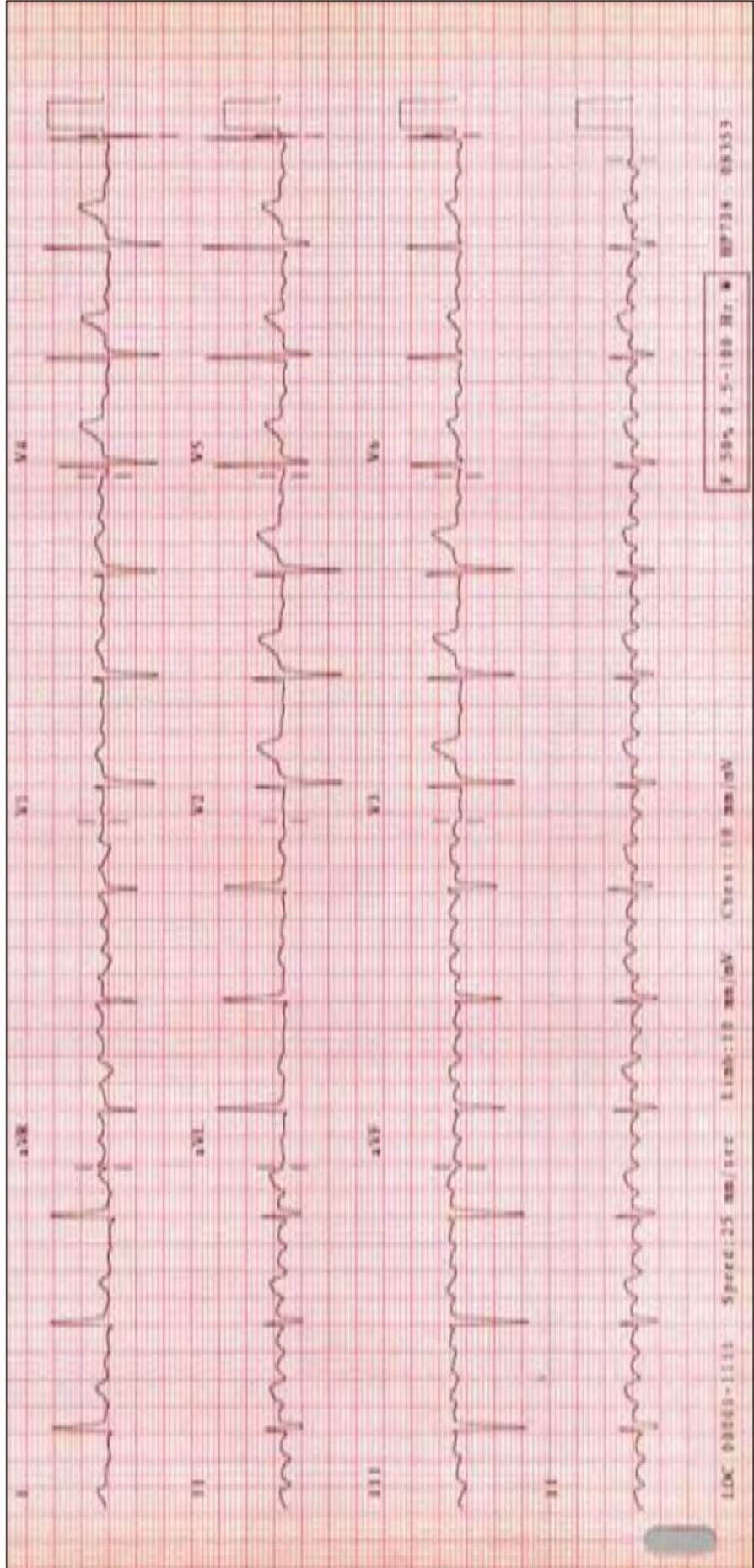


Figure 25: Scenario 1 ECG 3b

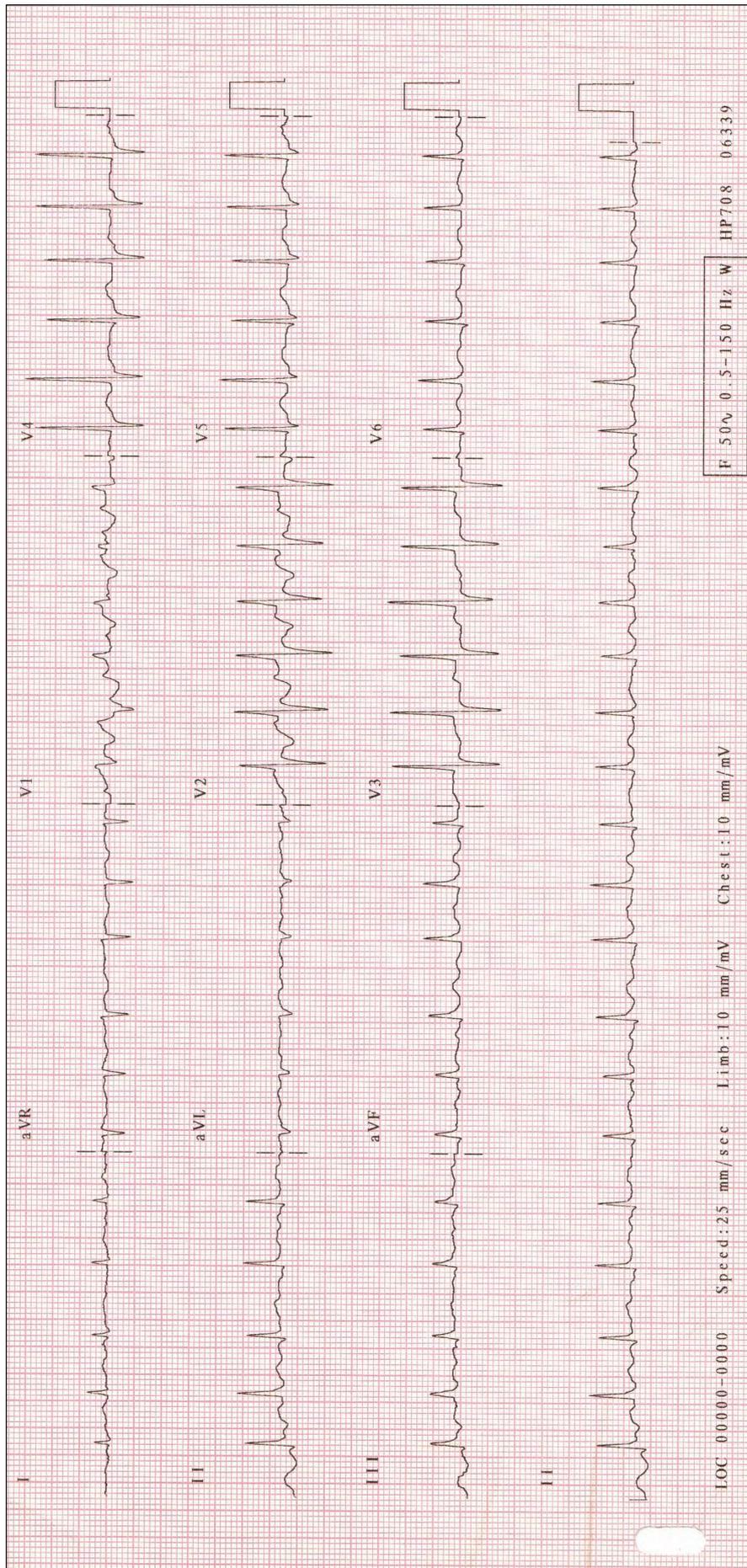


Figure 26: Scenario 1 ECG 4



## Wide Complex Tachycardia

### Scenario 2

A 68-year-old woman on the orthopaedic ward complains of palpitations and dizziness two days post total hip replacement. She denies any chest pain, though she has suffered angina in the past. Physical examination reveals a rapid heart rate with a blood pressure of 100/60 mmHg. The treating nurse has performed a 12 lead ECG for you to review and comment on.

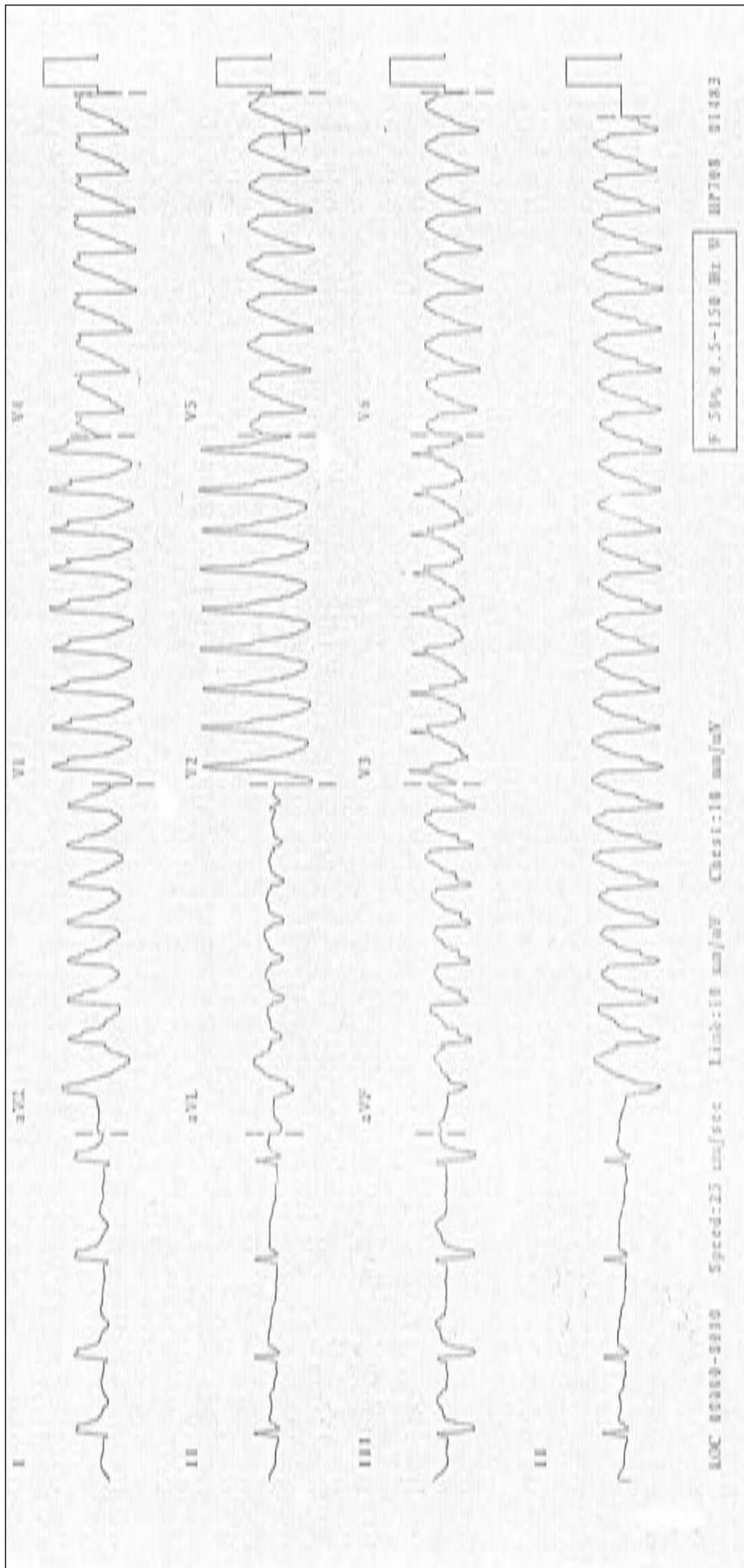


Figure 27: Scenario 2 ECG 1

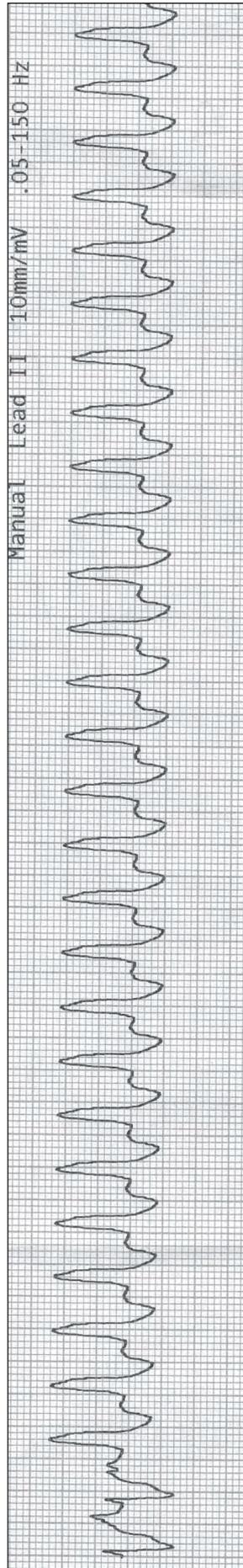


Figure 28: Scenario 2 ECG 2

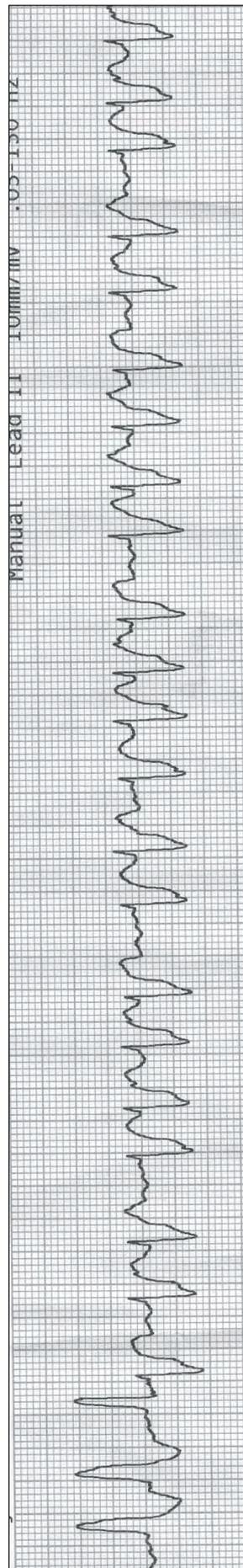


Figure 29: Scenario 2 ECG 3



## Unconscious patient

### Scenario 3

A 75-year-old man on the rehab ward has collapsed and is unresponsive. The Code Blue team has been called and cardiac monitoring is being established. The patient does not respond to painful stimuli and no cardiac output / pulse / BP can be detected. An ECG rhythm strip has been printed for you to review and comment on.

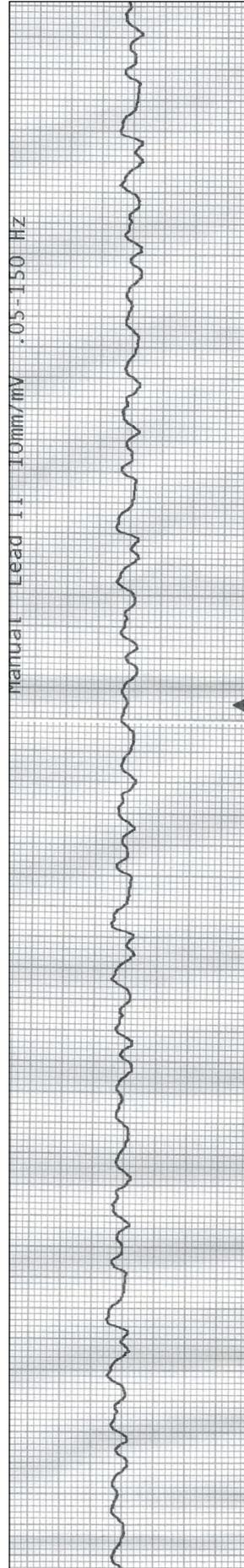


Figure 30: Scenario 3 ECG 1

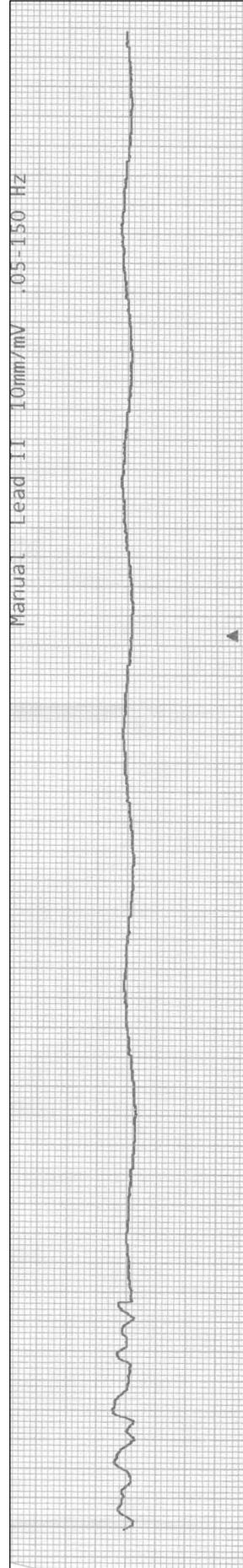


Figure 31: Scenario 3 ECG 2

## Missed beats

### Scenario 4

A 60-year-old woman presents to the general medicine outpatient clinic because of dizziness and near syncope. She describes intermittent episodes of “missing heart beats” and dizziness. She has not had any chest pain and is taking no medication. A 12-lead ECG has been obtained by the clinic nurse and is provided to you to assess and comment on. Her husband has a pacemaker in situ and wonders if his wife might need something similar.

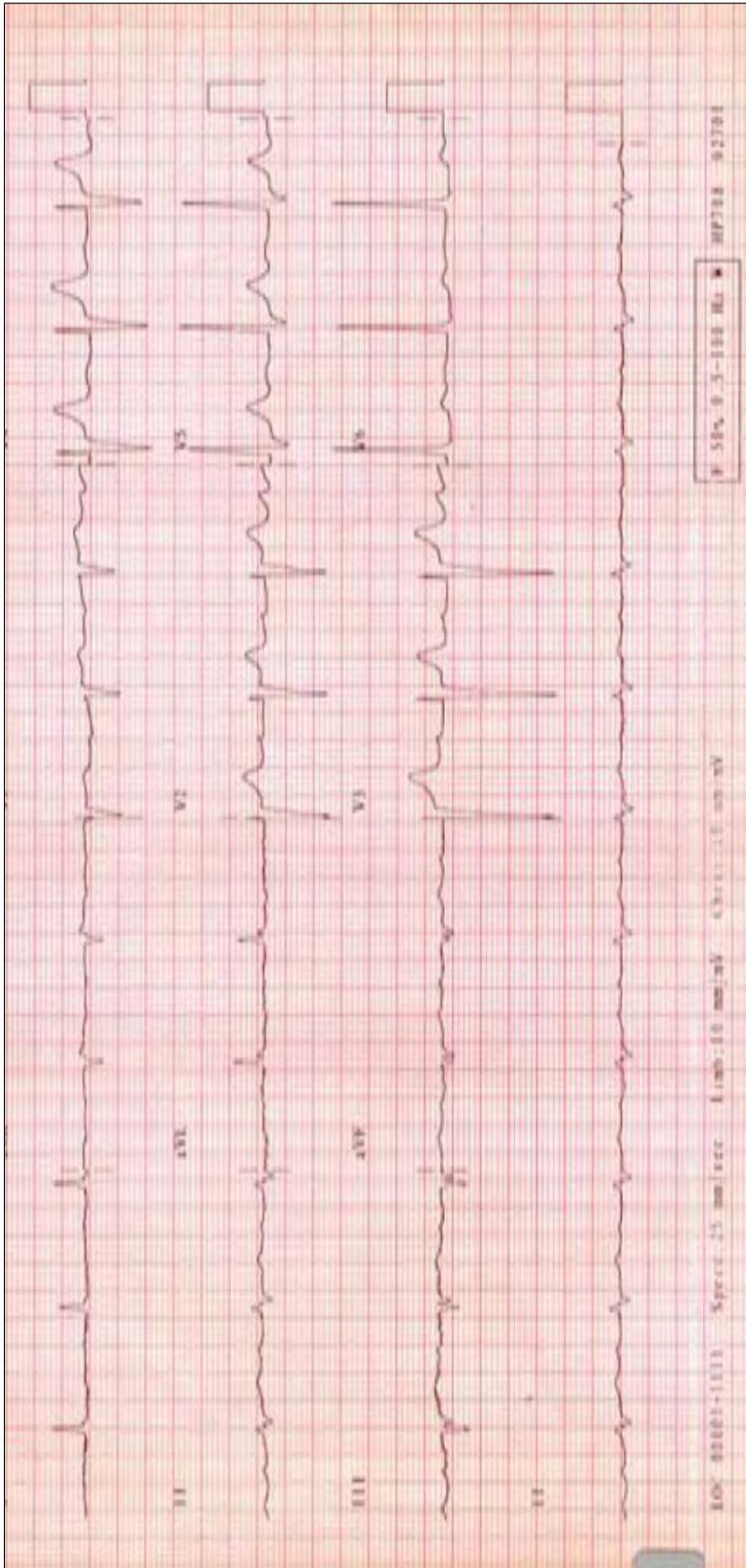


Figure 32: Scenario 4 ECG 1

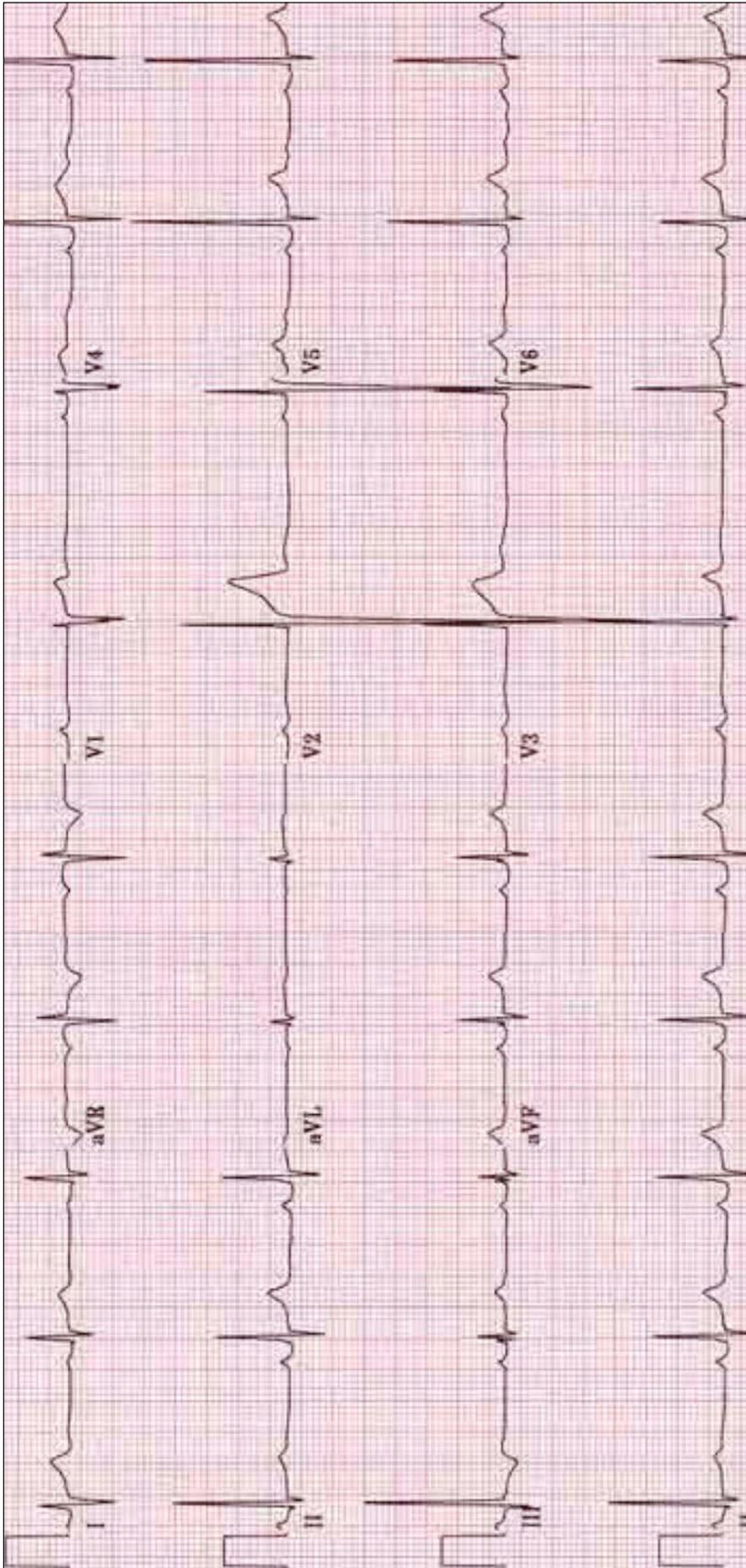


Figure 33: Scenario 4 ECG 2

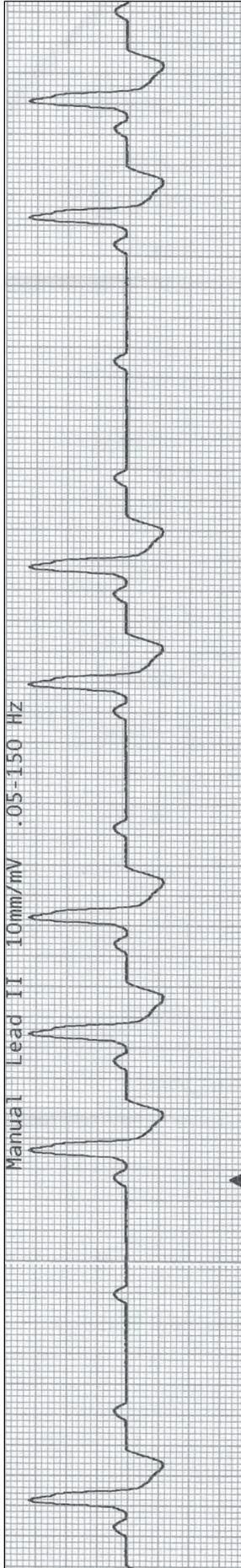


Figure 34: Scenario 4 ECG 3

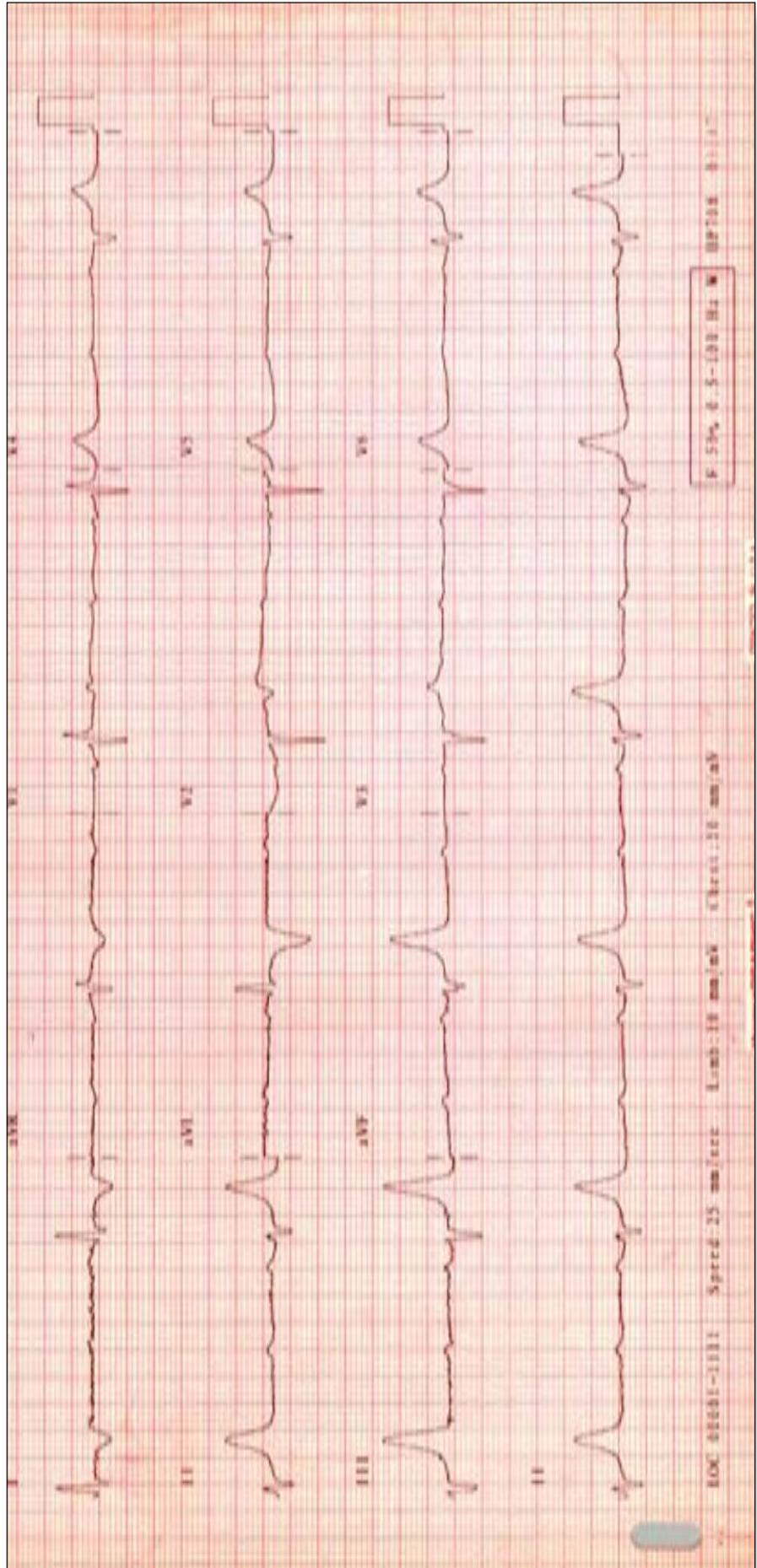


Figure 35: Scenario 4 ECG 4

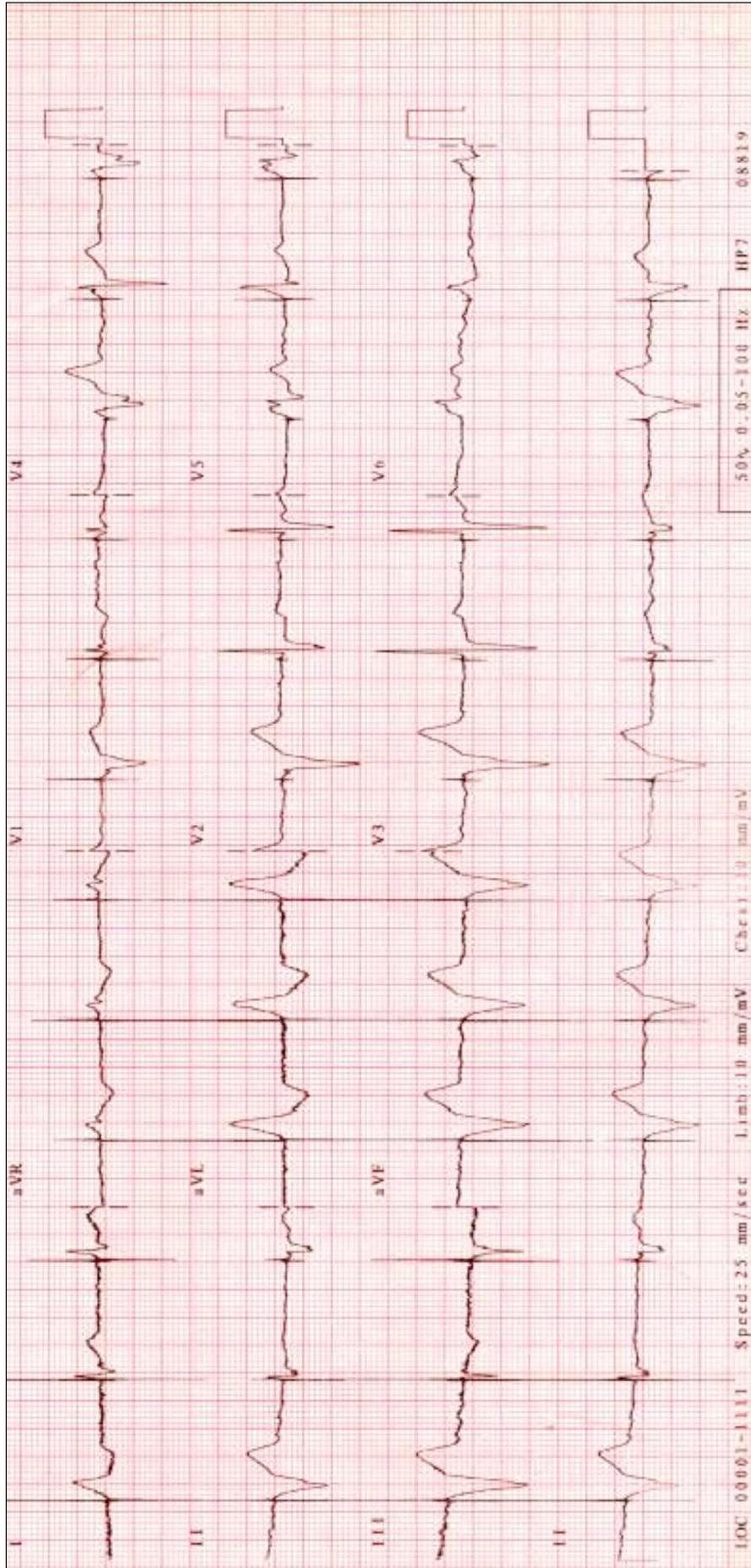


Figure 36: Scenario 4 ECG 5



## ST / QRS Abnormalities

The purpose of this station is to give the participants an opportunity to review a series of ECGs in the setting of common clinical scenarios and report the findings according to the standard procedure described.

Each participant should be given the opportunity to describe the findings of at least one ECG, and as a group, discuss the ECG appearances that have led them to that diagnosis.

## ST elevation

### Scenario 5

A 48-year-old male smoker presents to the Emergency Department with 6 hours of retro-sternal chest pain. He has a family history of ischaemic heart disease and diabetes. The pain radiates to the jaw and left arm. A 12-lead ECG has been obtained by the resus nurse and is provided to you to assess and comment on.

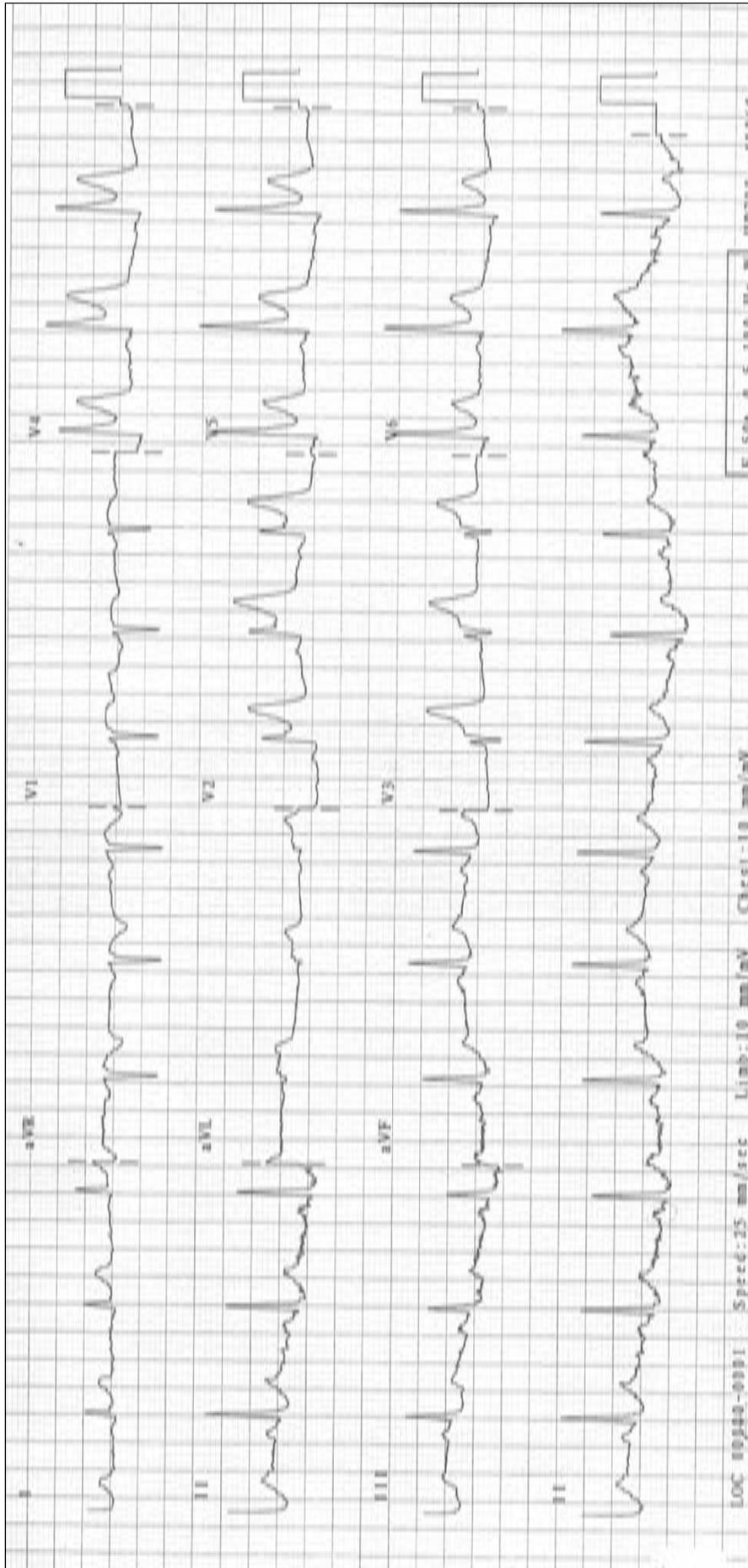


Figure 37: Scenario 5: ECG 1

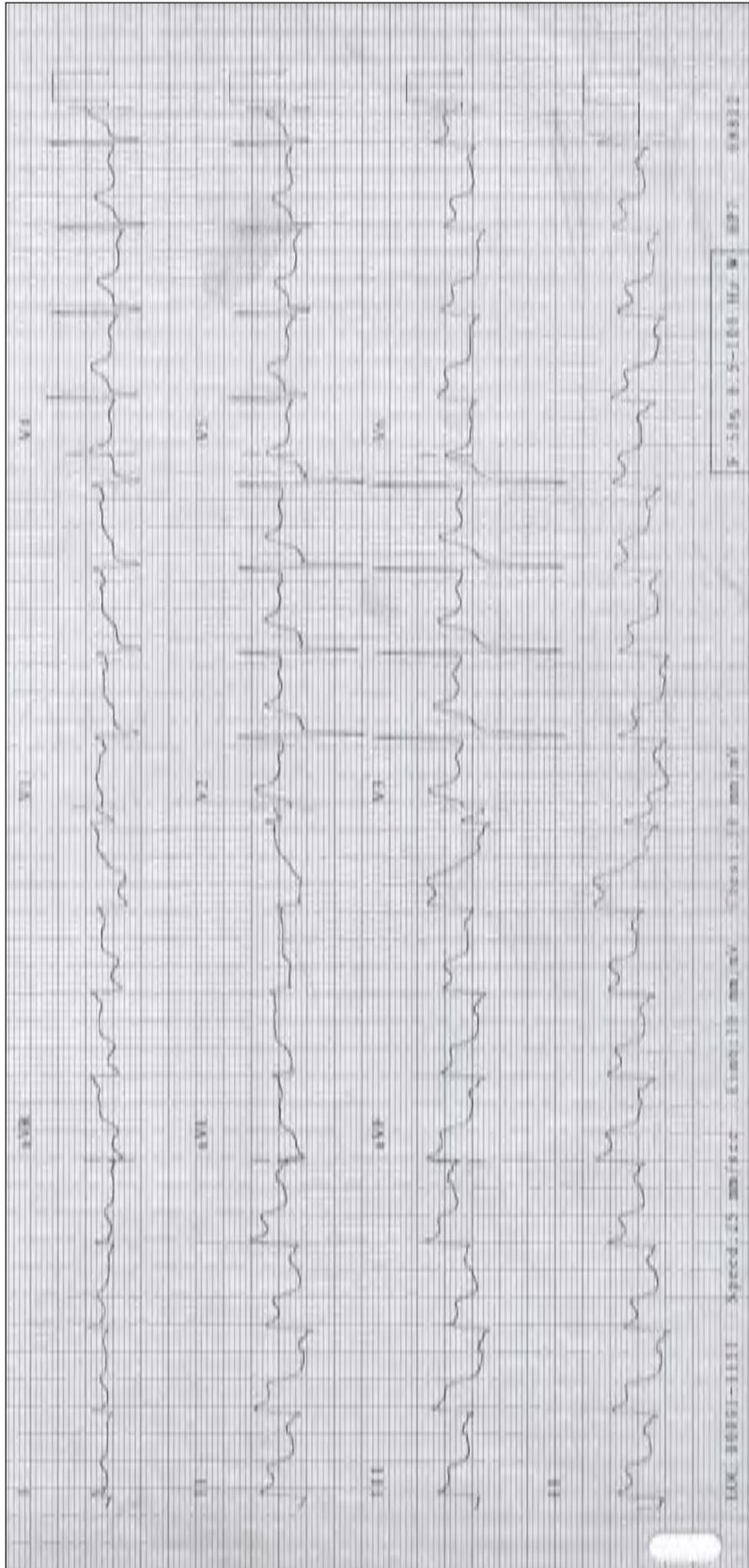


Figure 38: Scenario 5: ECG 2

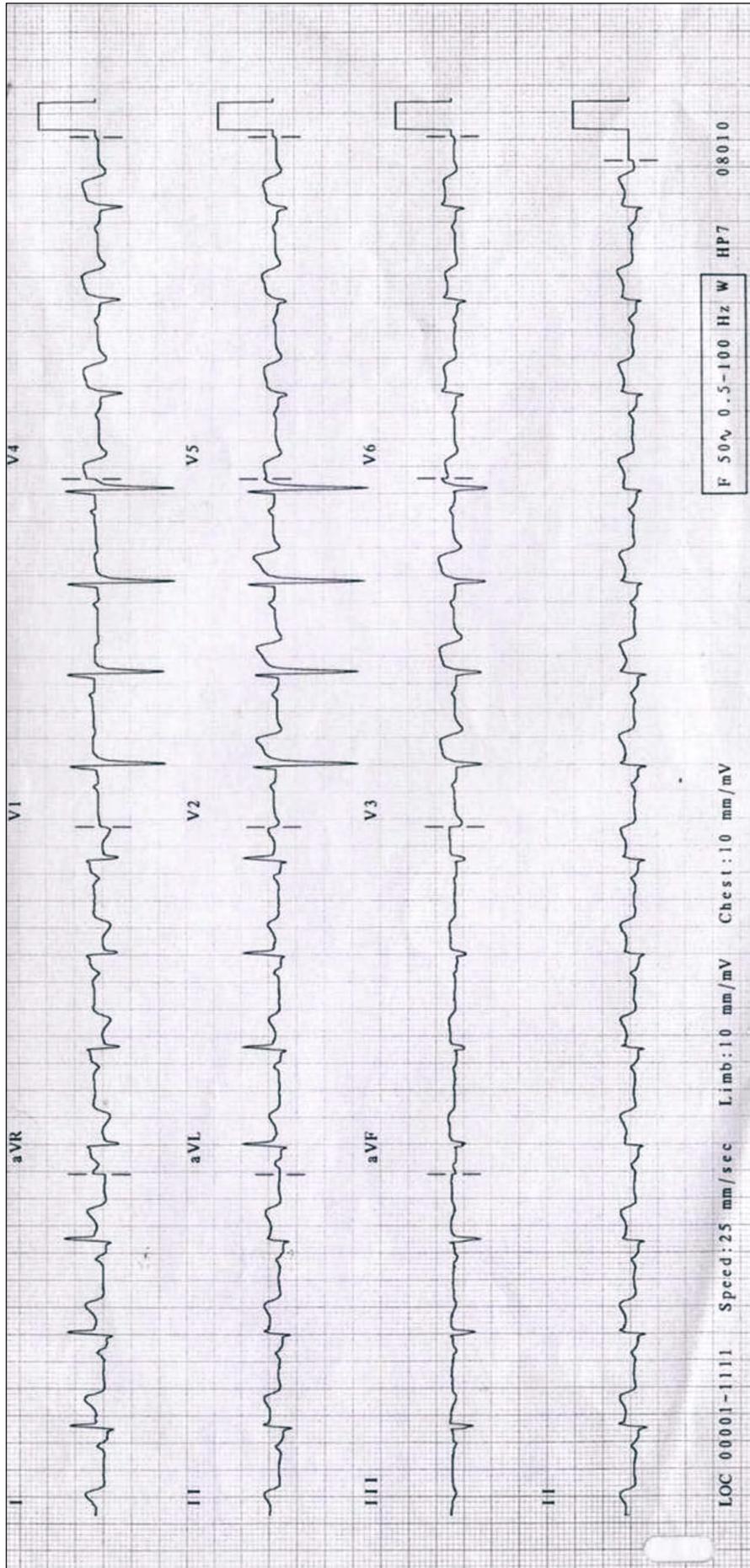


Figure 39: Scenario 5: ECG 3

## ST Depression / T Inversion

### Scenario 6

A 48-year-old male smoker presents to the Emergency Department with 6 hours of retro-sternal chest pain. He has a family history of ischaemic heart disease and diabetes. The pain radiates to the jaw and left arm. A 12-lead ECG has been obtained by the resus nurse and is provided to you to assess and comment on.

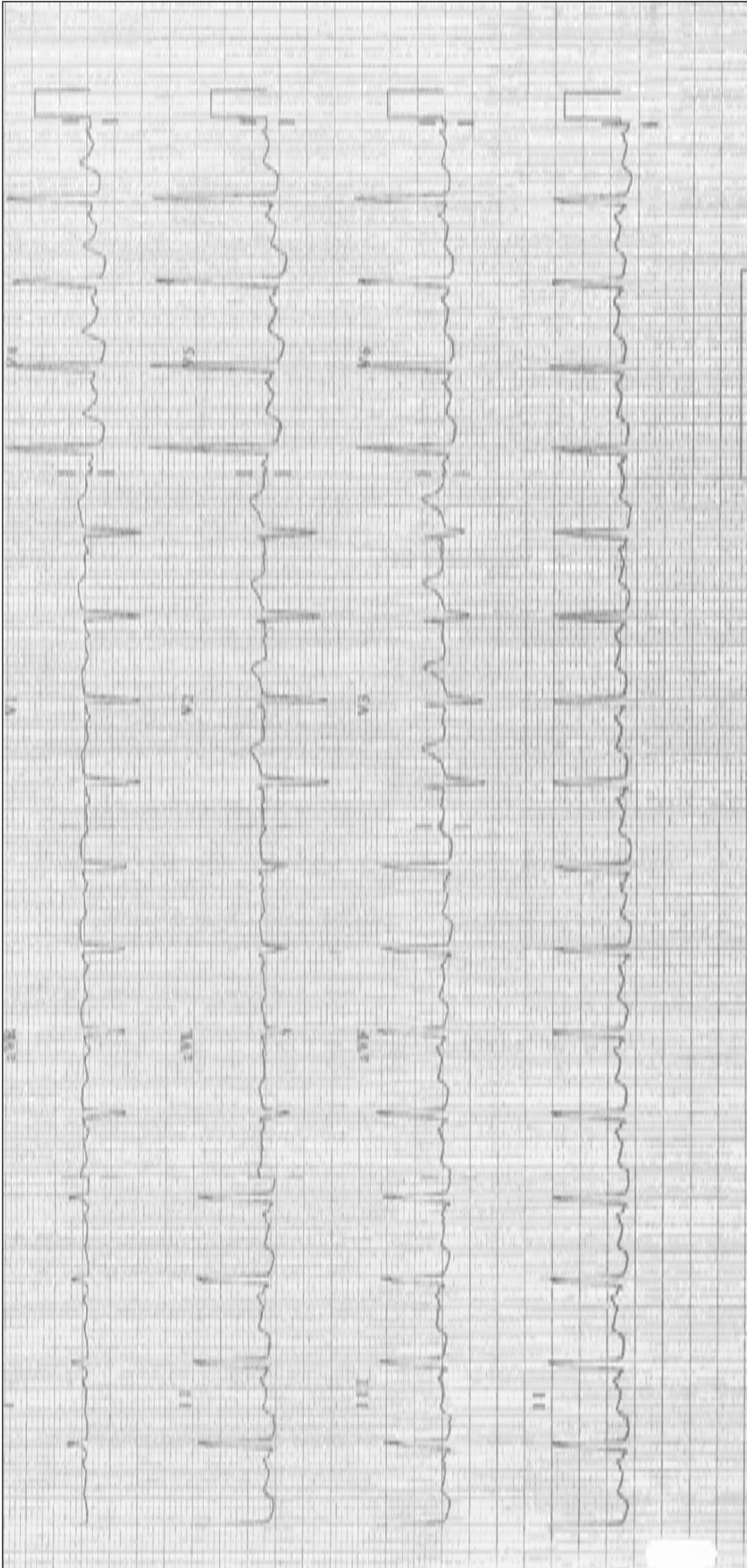


Figure 40: Scenario 6 ECG 1

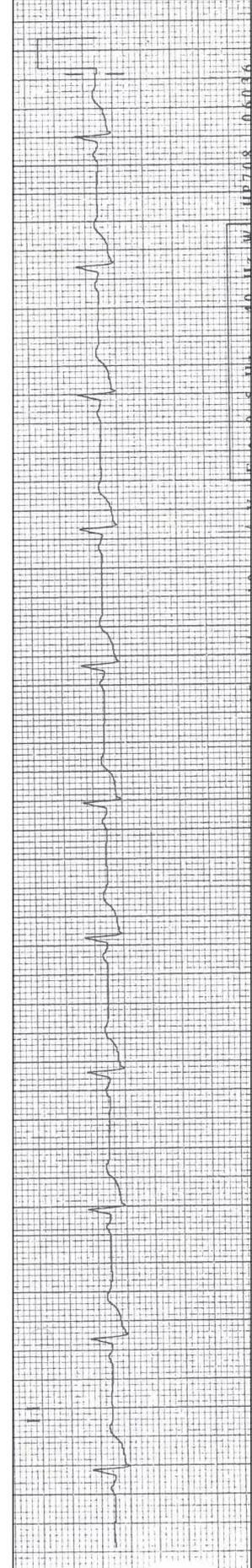


Figure 41: Scenario 6 ECG 2

## Bundle Branch Block

### Scenario 7

An 80-year-old man presents to the pre-admission clinic for assessment prior to hip replacement surgery. He does not recall any cardiac past history. A pre-op 12 lead ECG has been acquired for you to assess and comment on.

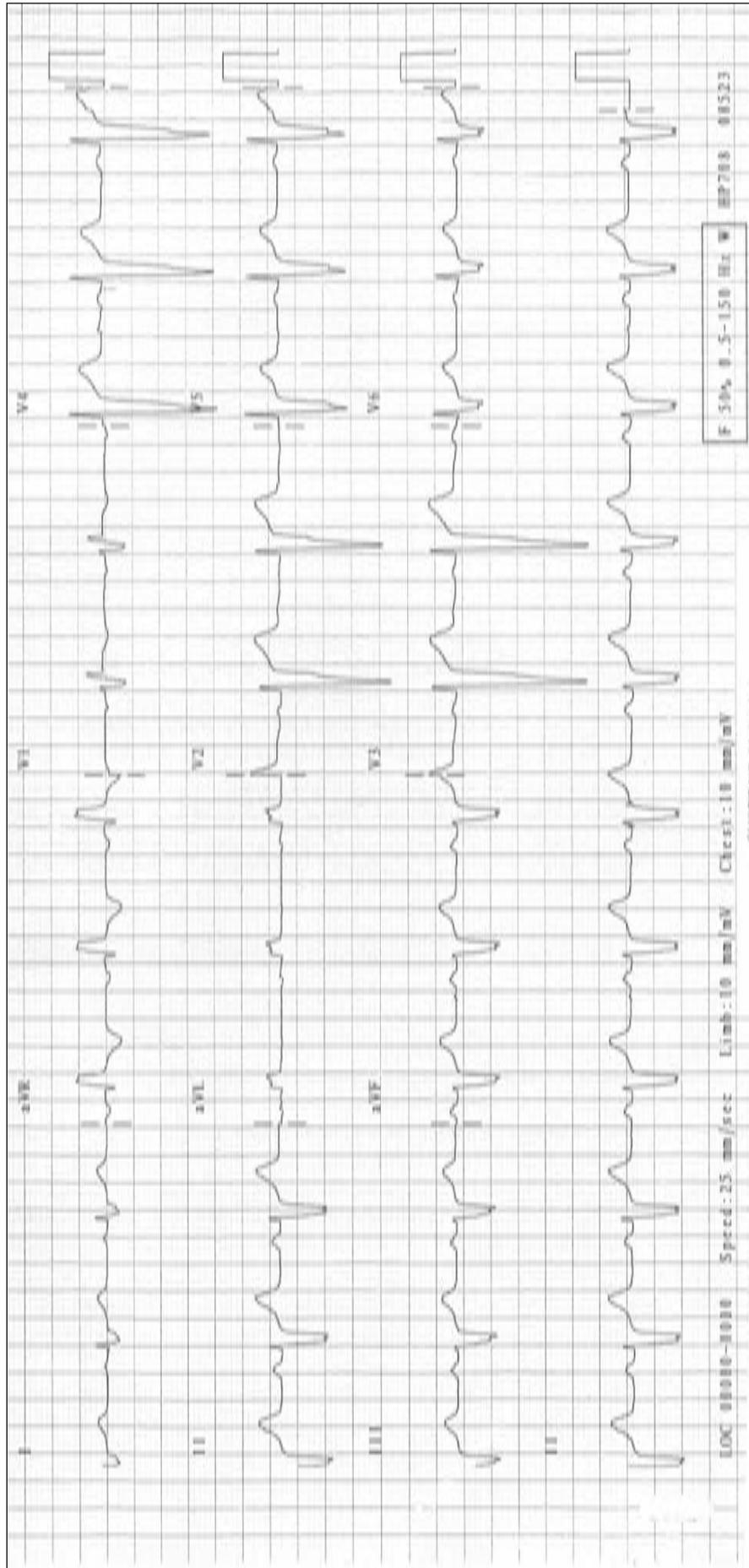


Figure 42: Scenario 7 ECG 1

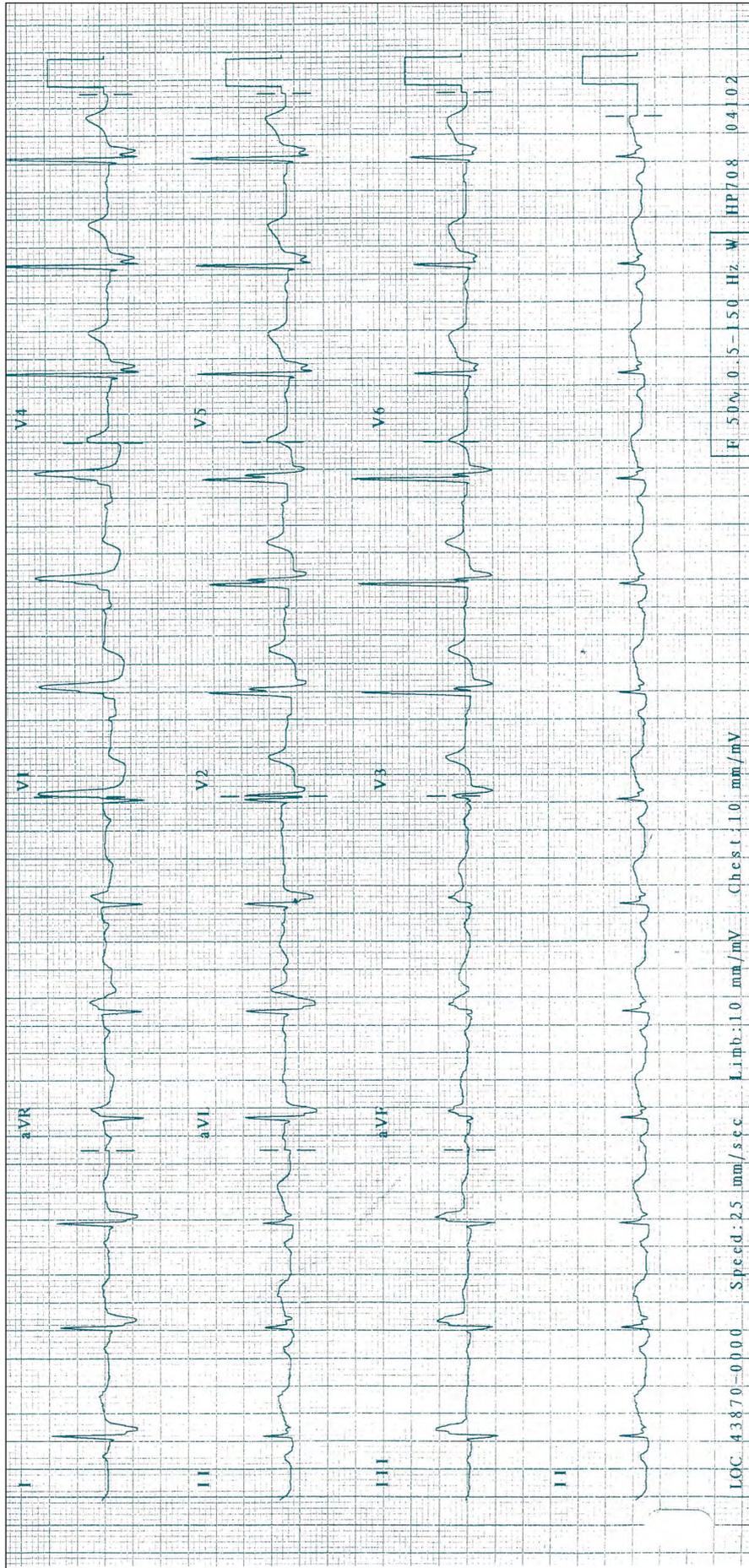


Figure 43: Scenario 7 ECG 2