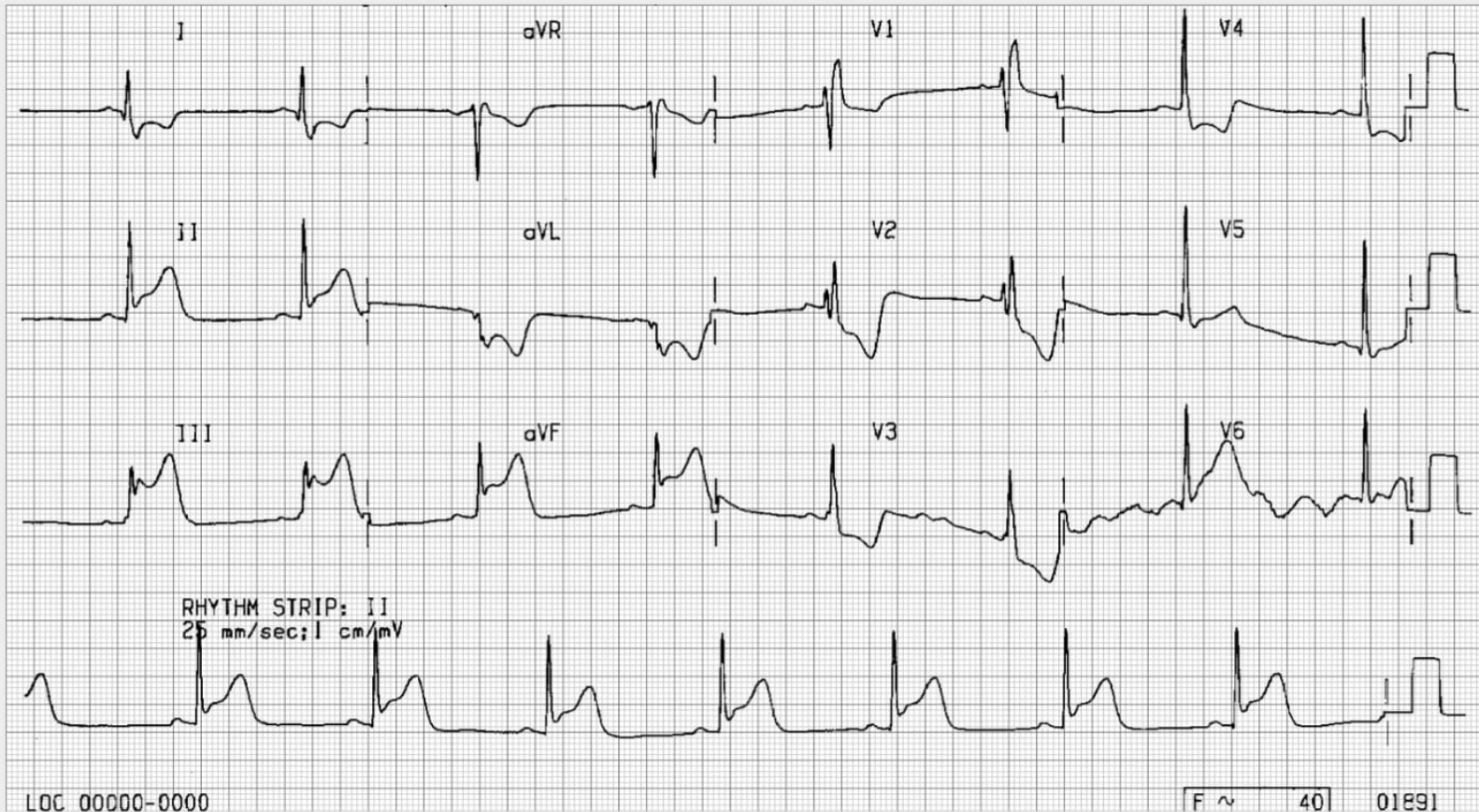


A 55 year old man with 4 hours of 'crushing' chest pain.



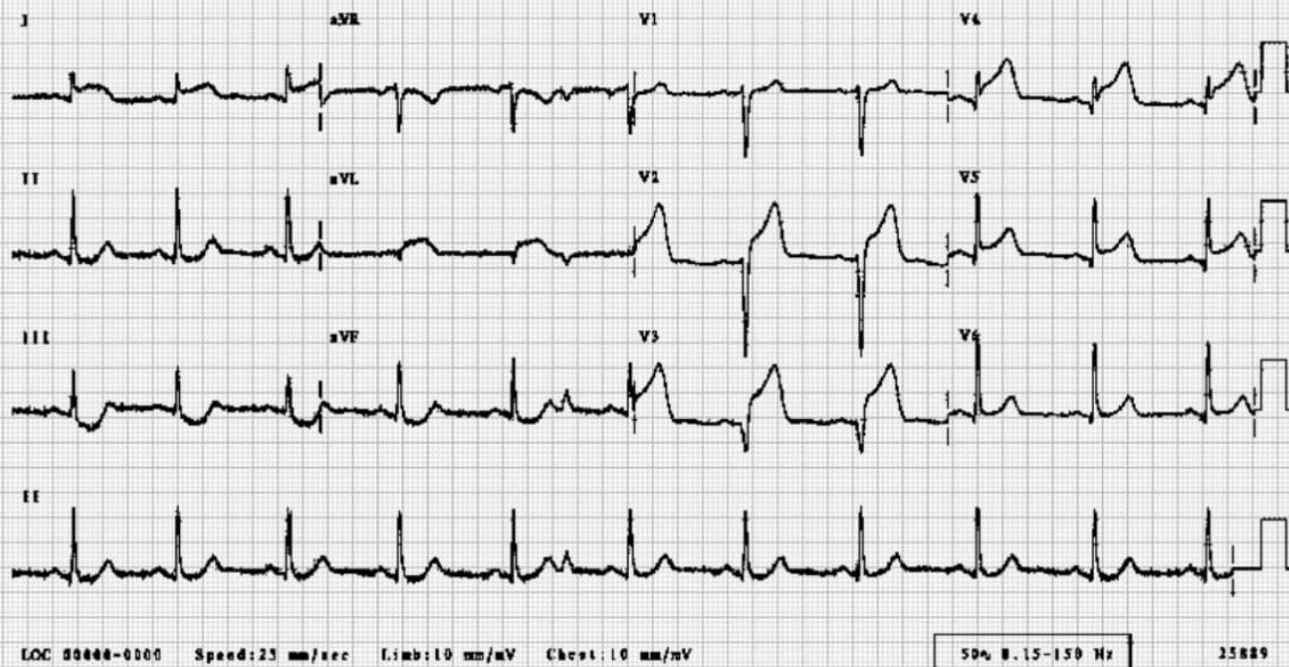
Inferior myocardial infarction

- ST elevation in the inferior leads II, III and aVF
- reciprocal ST depression in the anterior leads

See also [acute anterior MI](#).

[Right Bundle Branch Block](#) and [sinus bradycardia](#) are also present.

A 63 year old woman with 10 hours of chest pain and sweating.



Acute anterior myocardial infarction

- ST elevation in the anterior leads V1 - 6, I and aVL
- reciprocal ST depression in the inferior leads

A 53 year old man with Ischaemic Heart Disease.

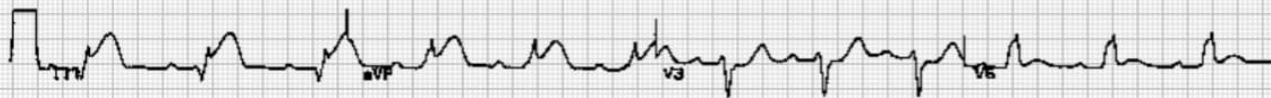
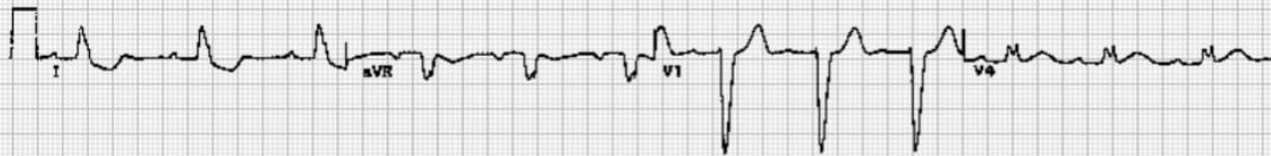


Old inferior myocardial infarction

- a Q wave in lead III wider than 1 mm (1 small square) and
- a Q wave in lead aVF wider than 0.5 mm and
- a Q wave of any size in lead II

[Go back to ECG homepage](#)

A 79 year old man with 5 hours of chest pain.



Acute myocardial infarction in the presence of left bundle branch block

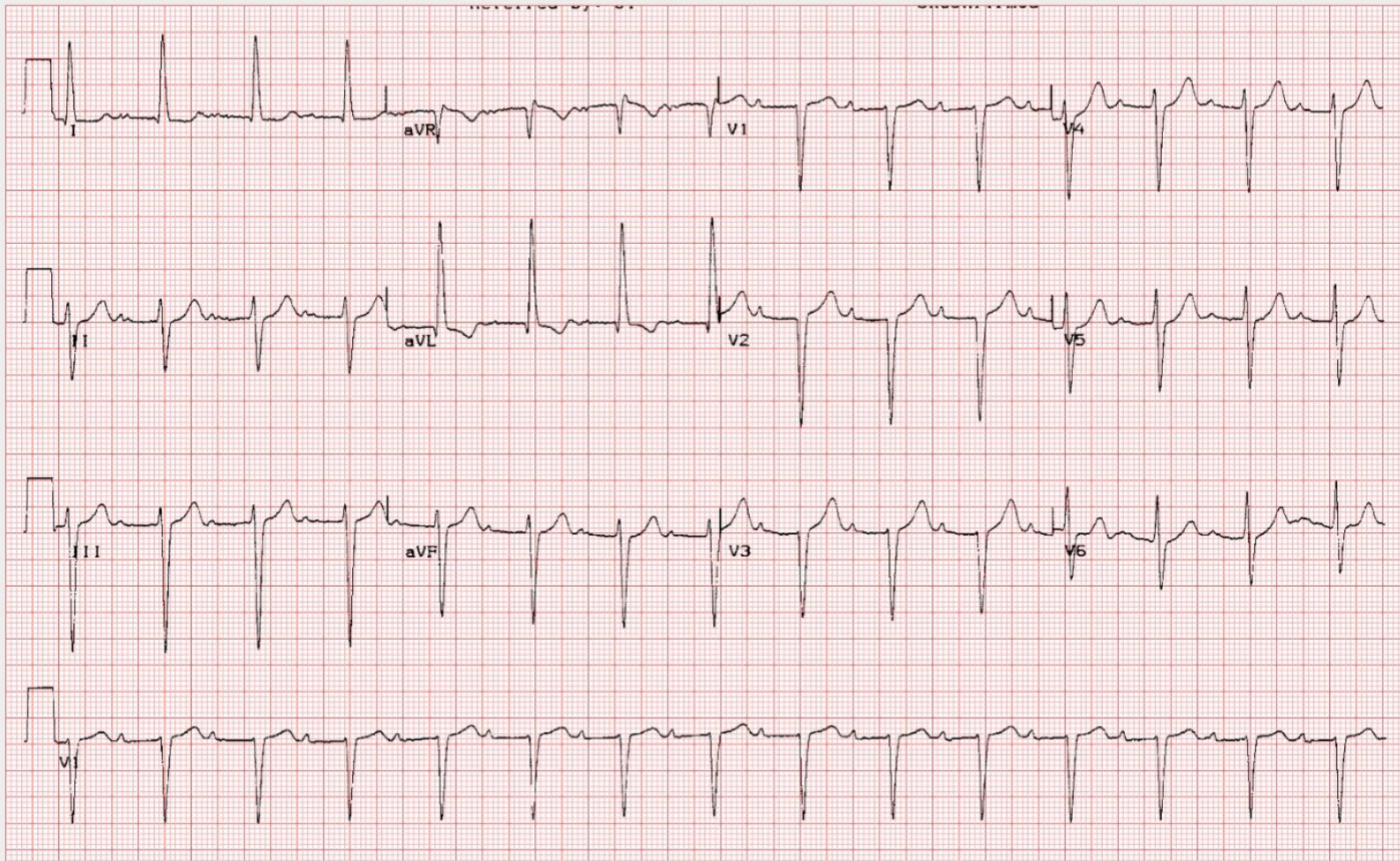
Features suggesting acute MI

- ST changes in the *same* direction as the QRS (as shown here)
- ST elevation more than you'd expect from LBBB alone (e.g. > 5 mm in leads V1 - 3)
- Q waves in two consecutive lateral leads (indicating anteroseptal MI)

(ref. Sgarbossa EB et al, N Engl J Med 1996;334:481-7)

[Go back to ECG homepage](#)

An 84 year old lady with hypertension.



Left anterior hemiblock, LVH, LAH, and long PR

There are a number of abnormalities here.

- left anterior hemiblock
 - QRS axis more left than -30 degrees
 - initial R wave in the inferior leads (II, III and aVF)
 - absence of any other cause of left axis deviation
- left ventricular hypertrophy
 - In the presence of left anterior hemiblock the diagnostic criteria of LVH are changed. Rosenbaum suggested that an S wave in lead III deeper than 15 mm as predictive of LVH.
- long PR interval (also called first degree heart block)
 - PR interval longer than 0.2 seconds
- left atrial hypertrophy
 - M shaped P wave in lead II
 - P wave duration > 0.11 seconds
 - terminal negative component to the P wave in lead V1

A 73 year old woman with dizziness.



2 to 1 AV block

- every other P wave is conducted to the ventricles
 - 2 to 1 AV block starts after the 5th QRS in this 3 channel recording. The first non-conducted P wave is indicated with an arrow.
- the PR interval of conducted P waves is constant
 - in this lady there is a **long PR interval** (and **left bundle branch block**)
- 2 to 1 AV block cannot be classified into Mobitz type I or II as we do not know if the 2nd P wave would be conducted with the same or longer PR interval.

A 70 year old man with exercise intolerance.



Complete Heart Block

- P waves are not conducted to the ventricles because of block at the AV node. The P waves are indicated below and show no relation to the QRS complexes. They 'probe' every part of the ventricular cycle but are never conducted.
- The ventricles are depolarised by a ventricular escape rhythm.



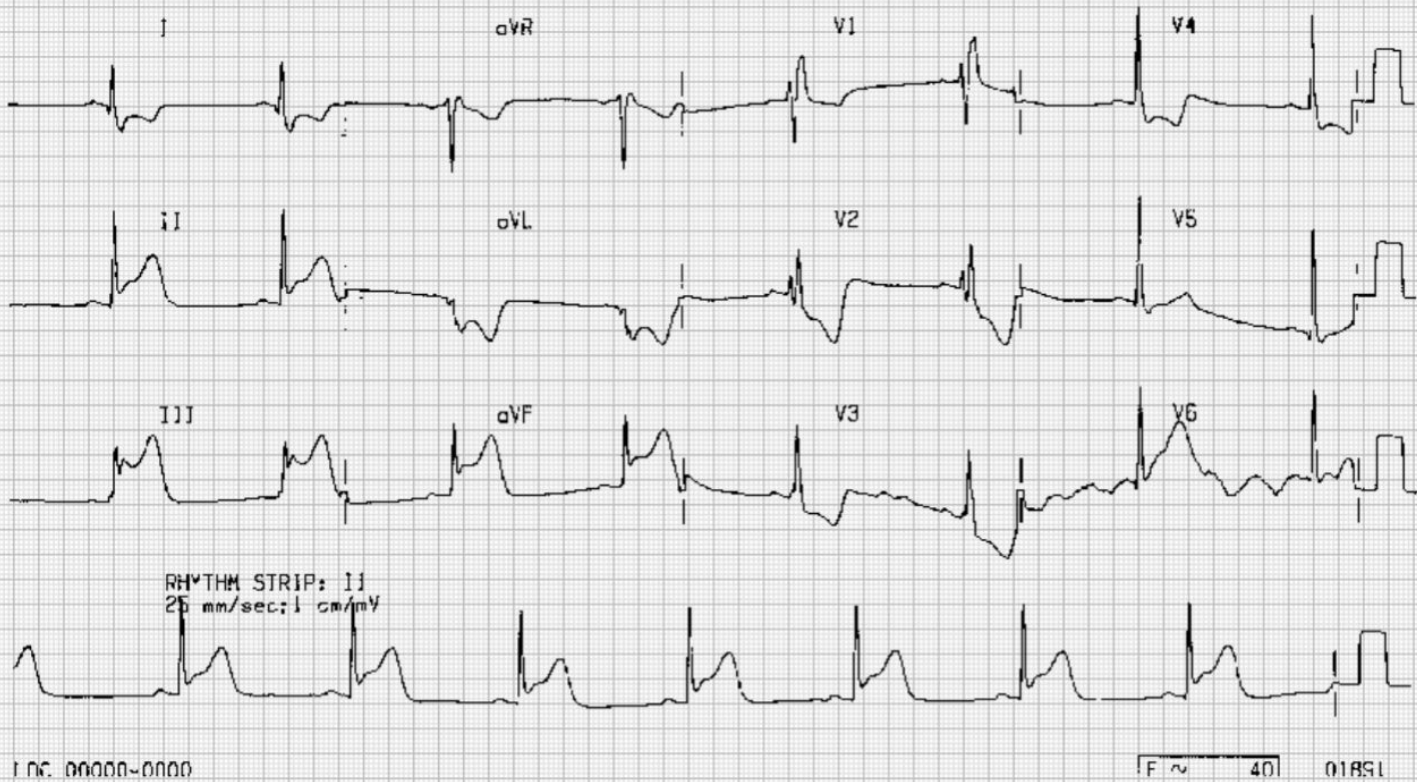
An 82 year old lady with dizzy spells.



Atrial fibrillation and complete heart block

- Fibrillatory waves of atrial fibrillation and no P waves.
- Regular ventricular rhythm
- The wider the QRS of the ventricular escape rhythm the less reliable the escape mechanism.
- AF with complete heart block can be easily missed and is an indication for a permanent pacemaker.

A 55 year old man with 4 hours of "crushing" chest pain.



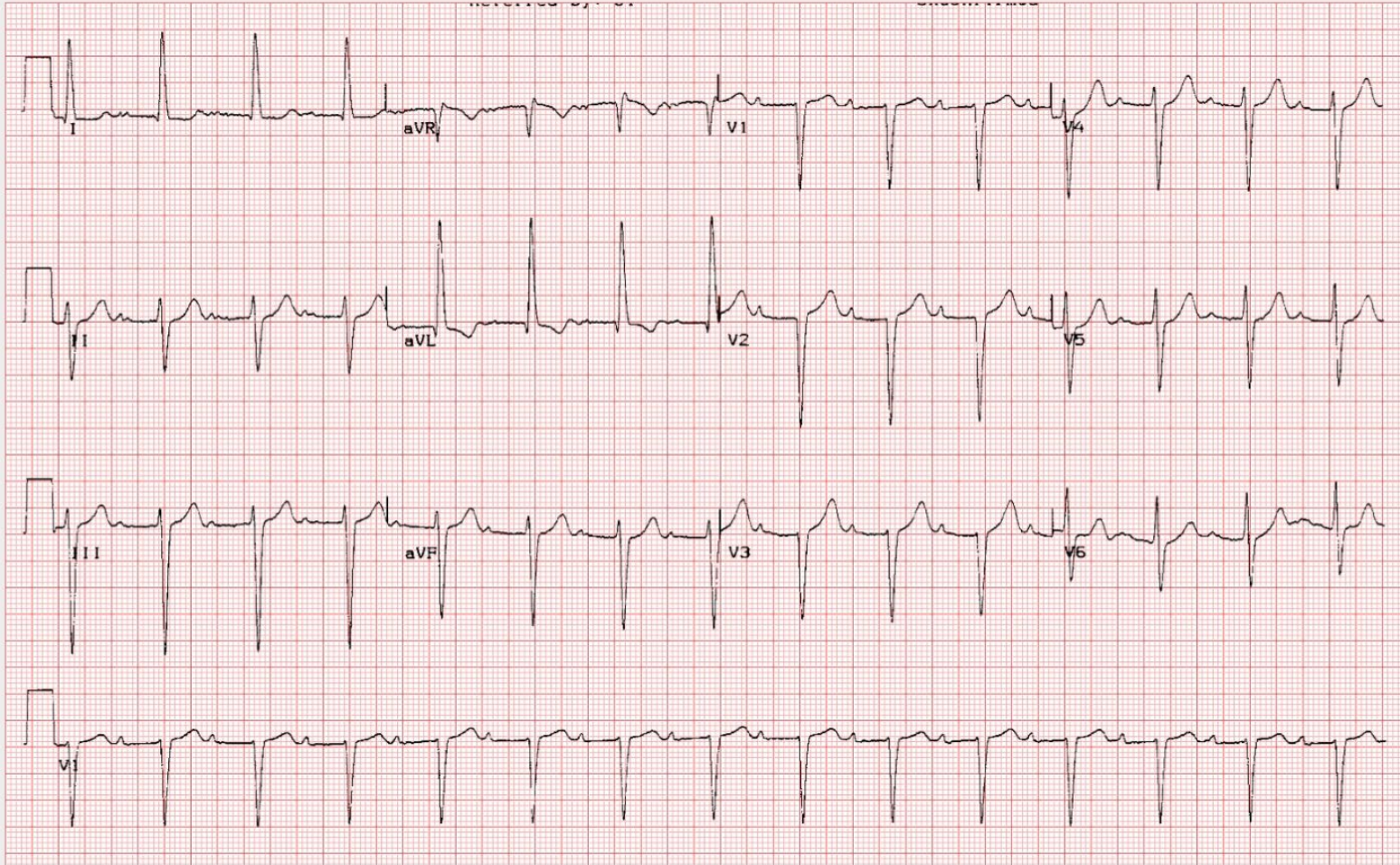
Right Bundle Branch Block

- wide QRS, more than 120 ms (3 small squares)
- secondary R wave in lead V1
- other features include slurred S wave in lateral leads and T wave changes in the septal leads

See also [Left Bundle Branch Block](#).

[Acute inferior MI](#) and [sinus bradycardia](#) are also present.

An 84 year old lady with hypertension.

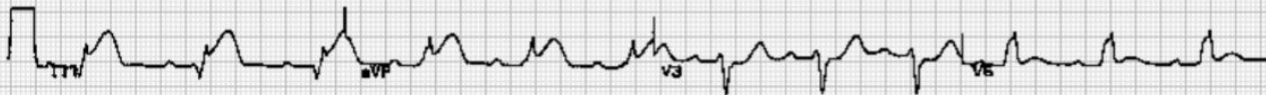
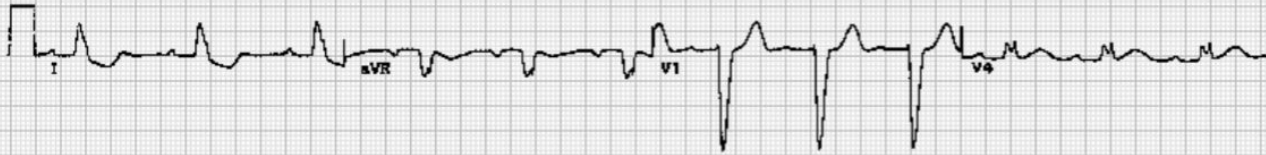


Left anterior hemiblock, LVH, LAH, and long PR

There are a number of abnormalities here.

- left anterior hemiblock
 - QRS axis more left than -30 degrees
 - initial R wave in the inferior leads (II, III and aVF)
 - absence of any other cause of left axis deviation
- left ventricular hypertrophy
 - In the presence of left anterior hemiblock the diagnostic criteria of LVH are changed. Rosenbaum suggested that an S wave in lead III deeper than 15 mm as predictive of LVH.
- long PR interval (also called first degree heart block)
 - PR interval longer than 0.2 seconds
- left atrial hypertrophy
 - M shaped P wave in lead II
 - P wave duration > 0.11 seconds
 - terminal negative component to the P wave in lead V1

A 79 year old man with 5 hours of chest pain.



Acute myocardial infarction in the presence of left bundle branch block

Features suggesting acute MI

- ST changes in the *same* direction as the QRS (as shown here)
- ST elevation more than you'd expect from LBBB alone (e.g. > 5 mm in leads V1 - 3)
- Q waves in two consecutive lateral leads (indicating anteroseptal MI)

(ref. Sgarbossa EB et al, N Engl J Med 1996;334:481-7)

[Go back to ECG homepage](#)

A 90 year old lady with syncope.

13-Jul-1999 09:44:10

Female

MHS TRUST

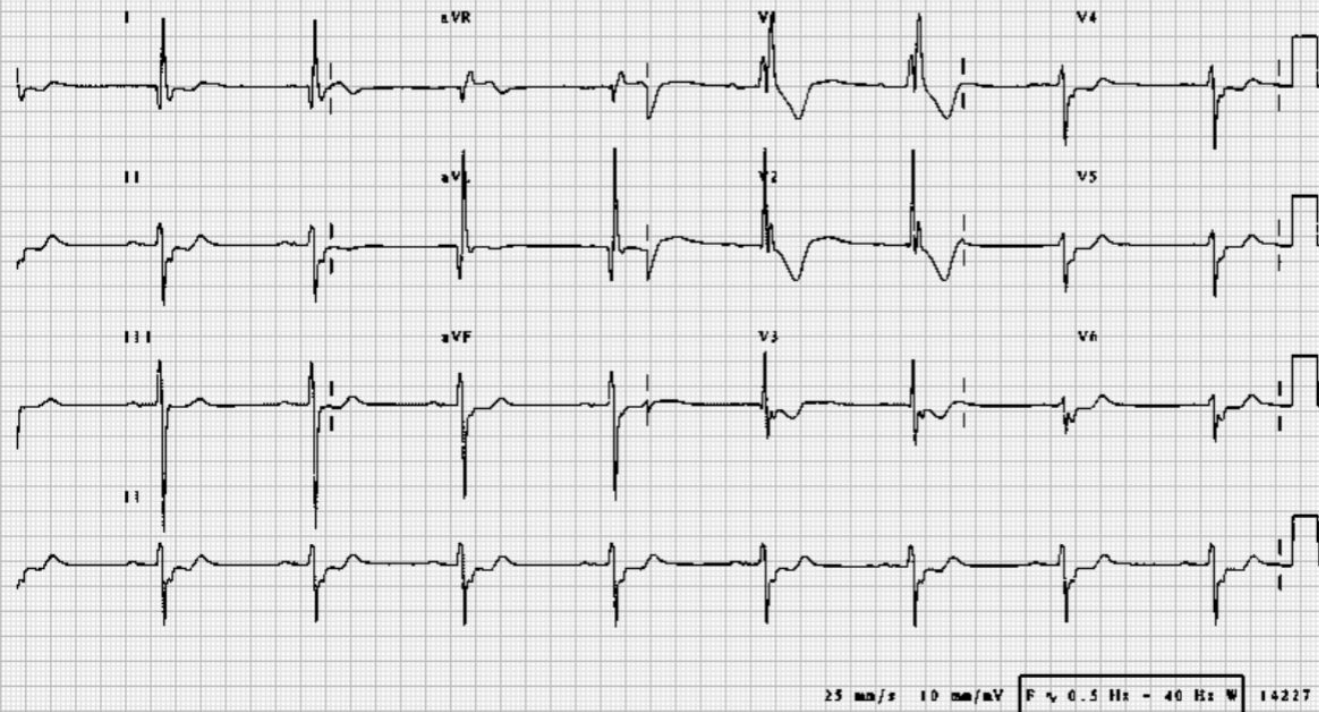
Department: BI

Operator: JLR

DOB

14-09-08

Requested by:

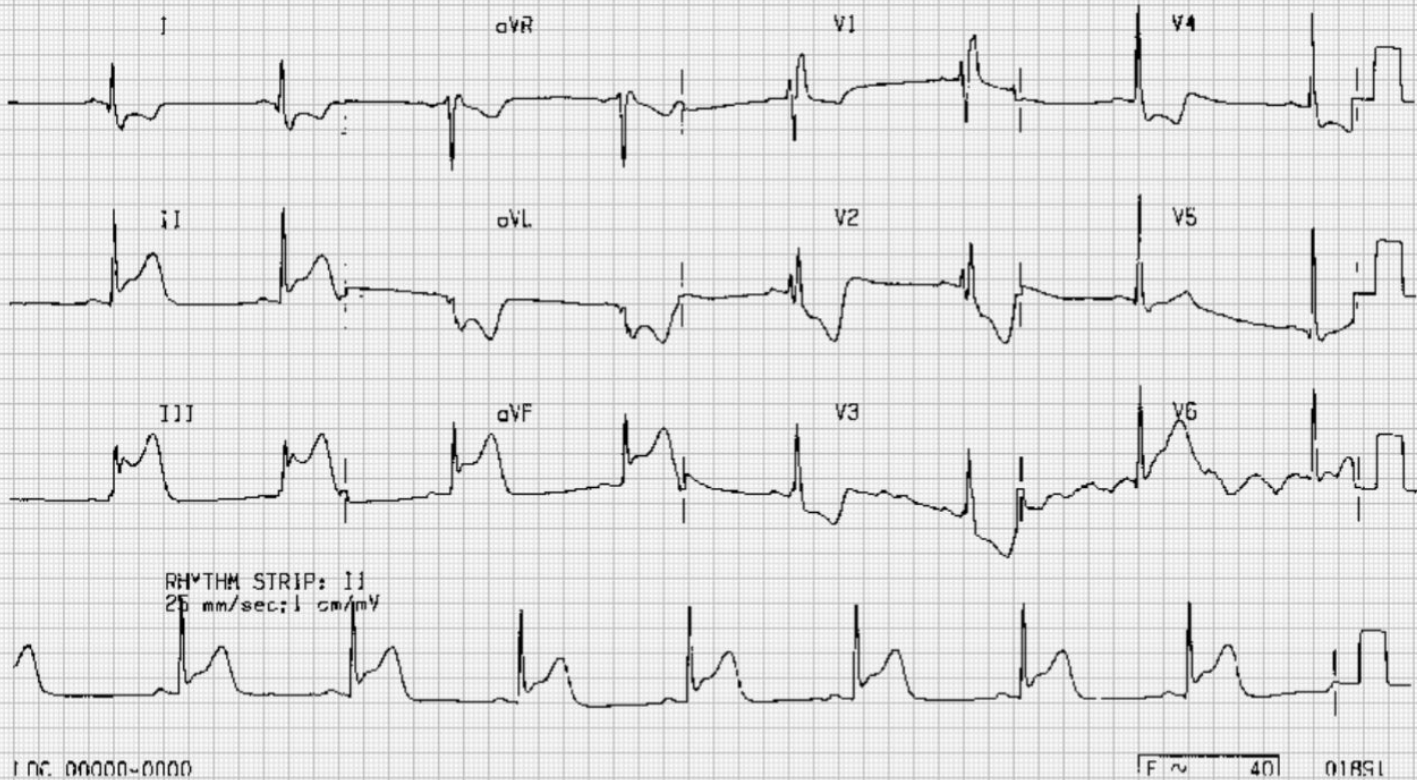


'Trifascicular' block

- Complete [Right Bundle Branch Block](#)
- [Left Anterior Hemiblock](#)
- [Long PR interval](#)

The combination of RBBB, LAFB and long PR interval has been called 'trifascicular' block and implies that conduction is delayed in the third fascicle (in this case the left posterior fascicle) and a permanent pacemaker may be needed. However there are other causes of a long PR interval such as delayed conduction in the AV node or atrium so 'trifascicular block' is not a true ECG diagnosis.

A 55 year old man with 4 hours of "crushing" chest pain.



Sinus bradycardia

- P wave rate of less than 60 bpm
- the rate in this example is about 45 bpm

See also [Sinus Tachycardia](#).

[Acute inferior MI](#) and [Right Bundle Branch Block](#) are also present.

A 34 year old lady with asthma.

Referred by:

Uncont frang



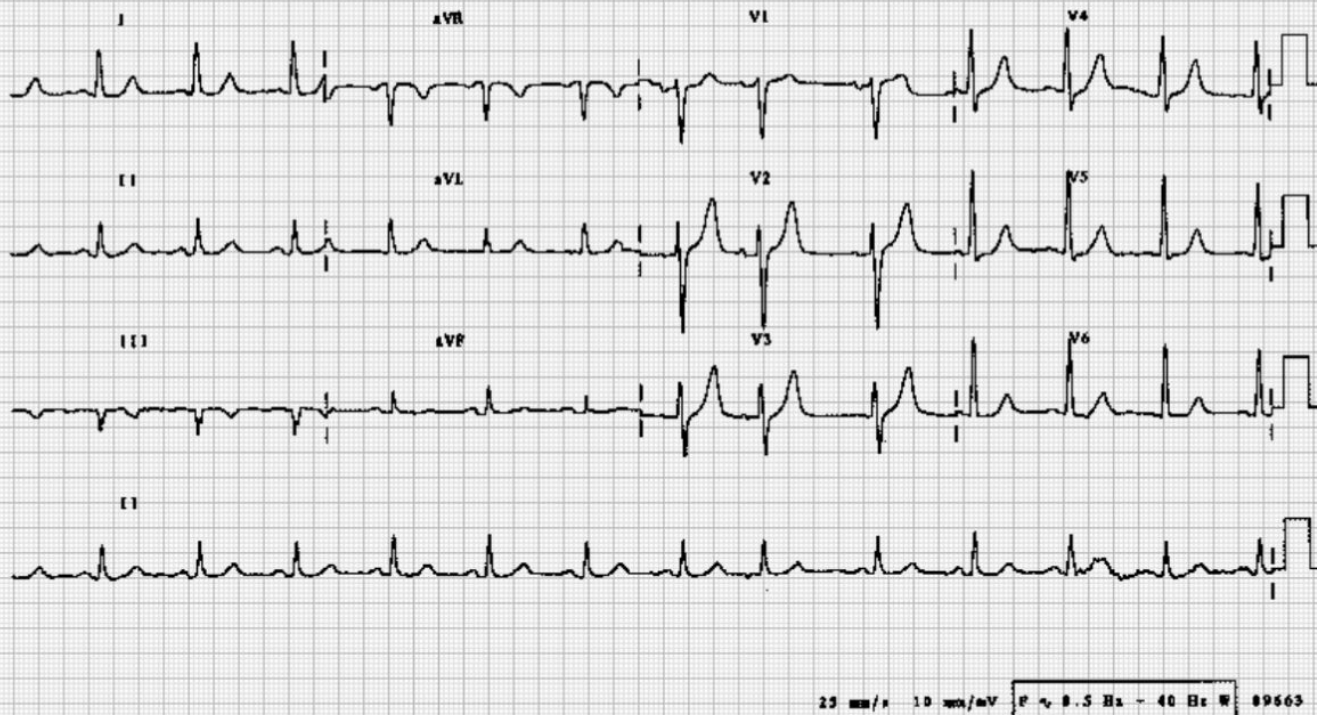
Sinus tachycardia

- P wave rate greater than 100 bpm

See also [sinus bradycardia](#).

[Go back to ECG homepage](#)

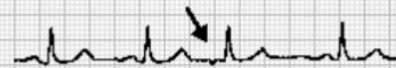
A 48 year old man with thumping sensations in his chest.



Atrial Premature Beat (APB)

- an abnormal P wave (arrowed in figure below)
 - As P waves are small and rather shapeless the difference in an APB is usually subtle. The one shown here is a clear example.
- occurs earlier than expected
- followed by a compensatory pause - but not a full compensatory pause (see [ventricular premature beat](#))

[Go back to ECG homepage](#)



A 76 year old man with breathlessness.



Atrial fibrillation with rapid ventricular response

- Irregularly irregular ventricular rhythm.
- Sometimes on first look the rhythm may appear regular but on closer inspection it is clearly irregular.

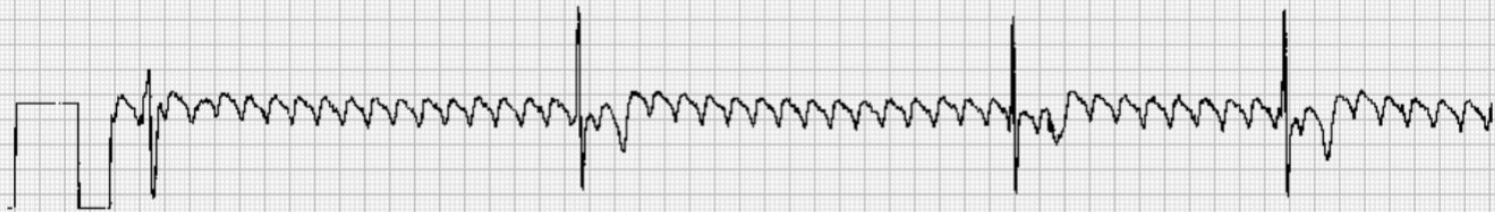
A 60 year old woman with hypertension.



Atrial fibrillation with pre-existing left bundle branch block

- Sometimes this can be confused with [ventricular tachycardia](#) but closer inspection can identify the irregularity.
- Irregularly irregular rhythm - suggesting AF.
- Features of typical [left bundle branch block](#)
 - wide QRS >120 ms (3 small squares)
 - no secondary R wave in lead V1
 - no lateral Q waves

A 68 year old lady on digoxin complaining of lethargy.



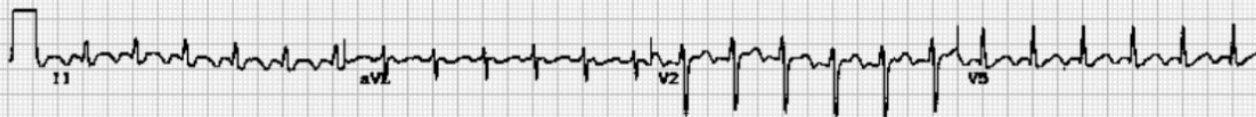
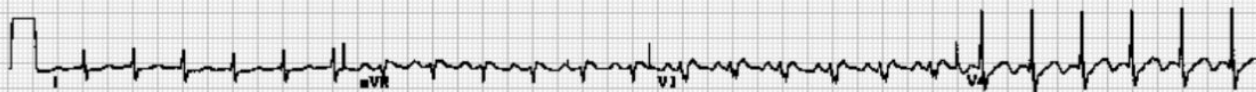
Atrial flutter

- A characteristic 'sawtooth' or 'picket-fence' waveform of an intra-atrial re-entry circuit usually at about 300 bpm.

This lady was taking rather too much digoxin and has a very slow ventricular response.

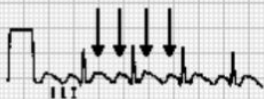
[Go back to ECG homepage](#)

An 57 year old lady with palpitations.

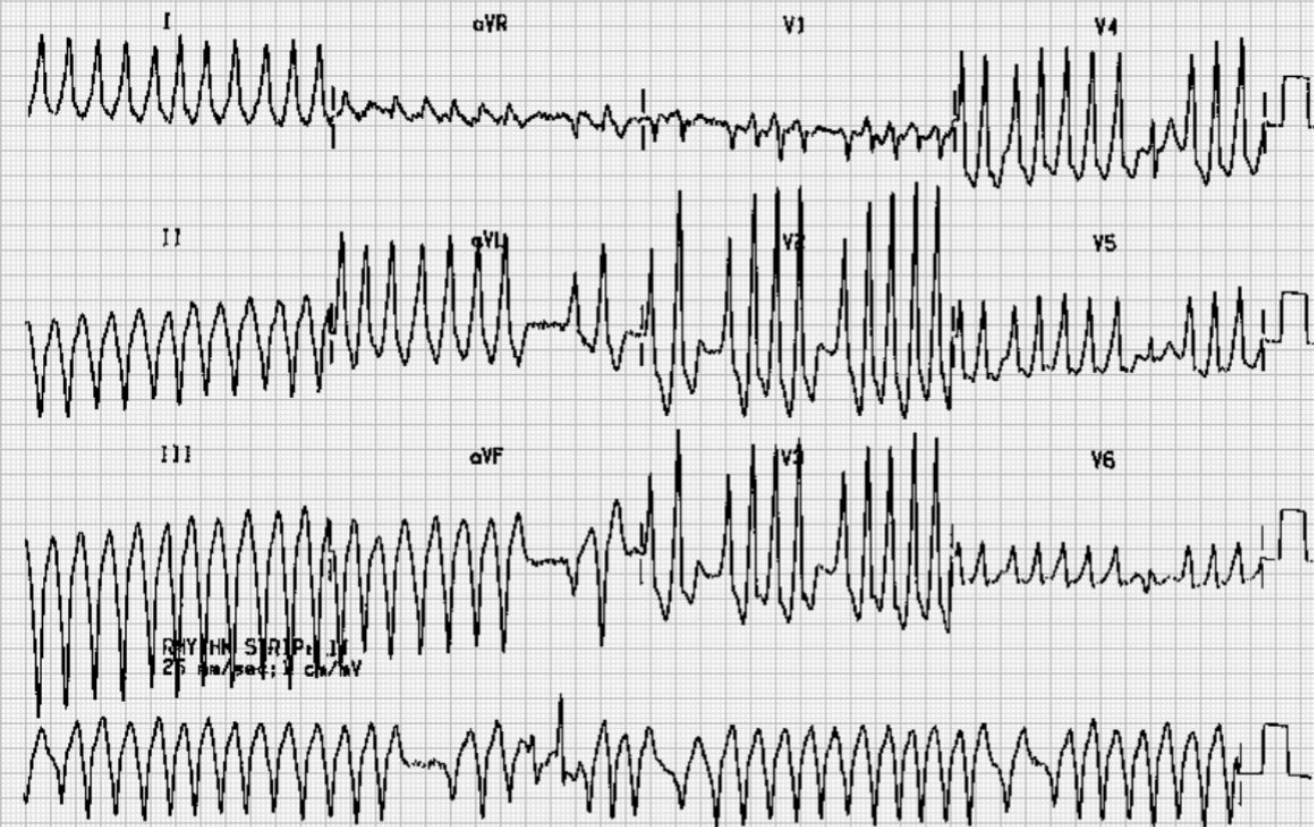


Atrial flutter with 2:1 AV conduction

- The sawtooth waveform of atrial flutter can usually be seen in the inferior leads II, III and aVF if one looks closely. Sometimes the rapid atrial rate can be seen in V1.
- Suspect atrial flutter with 2:1 block when you see a rate of about 150 bpm. The atrial rate is shown to be twice the ventricular rate in the figure below.
- See also [atrial flutter with slow ventricular response](#).



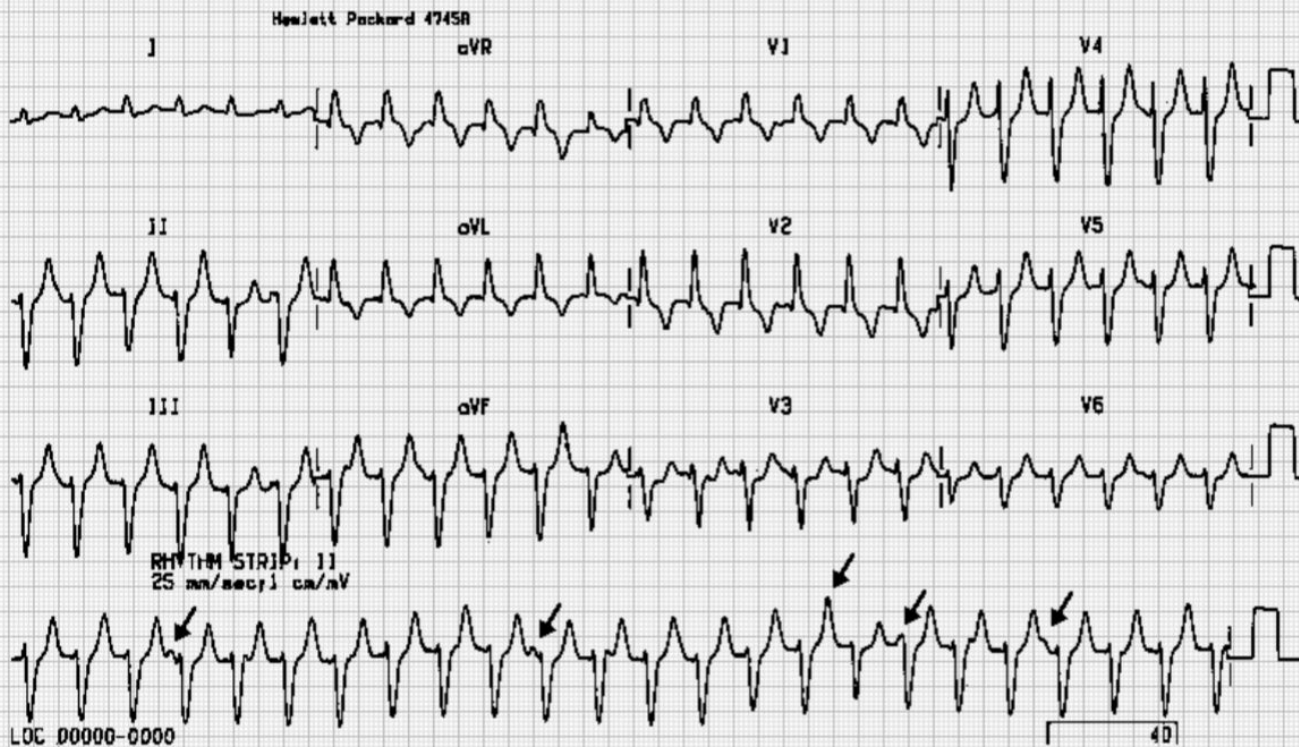
A 47 year old man with a long history of palpitations and, lately, blackouts.



Wolf-Parkinson-White syndrome with atrial fibrillation

- irregularly irregular, wide complex tachycardia
- impulses from the atria are conducted to the ventricles via either
 - both the AV node and accessory pathway producing a broad fusion complex
 - or just the AV node producing a narrow complex (without a delta wave)
 - or just the accessory pathway producing a very broad 'pure' delta wave
- people who develop this rhythm and have very short R - R intervals are at higher risk of VF

A 45 year old lady with palpitations and history of chronic renal failure



Ventricular tachycardia

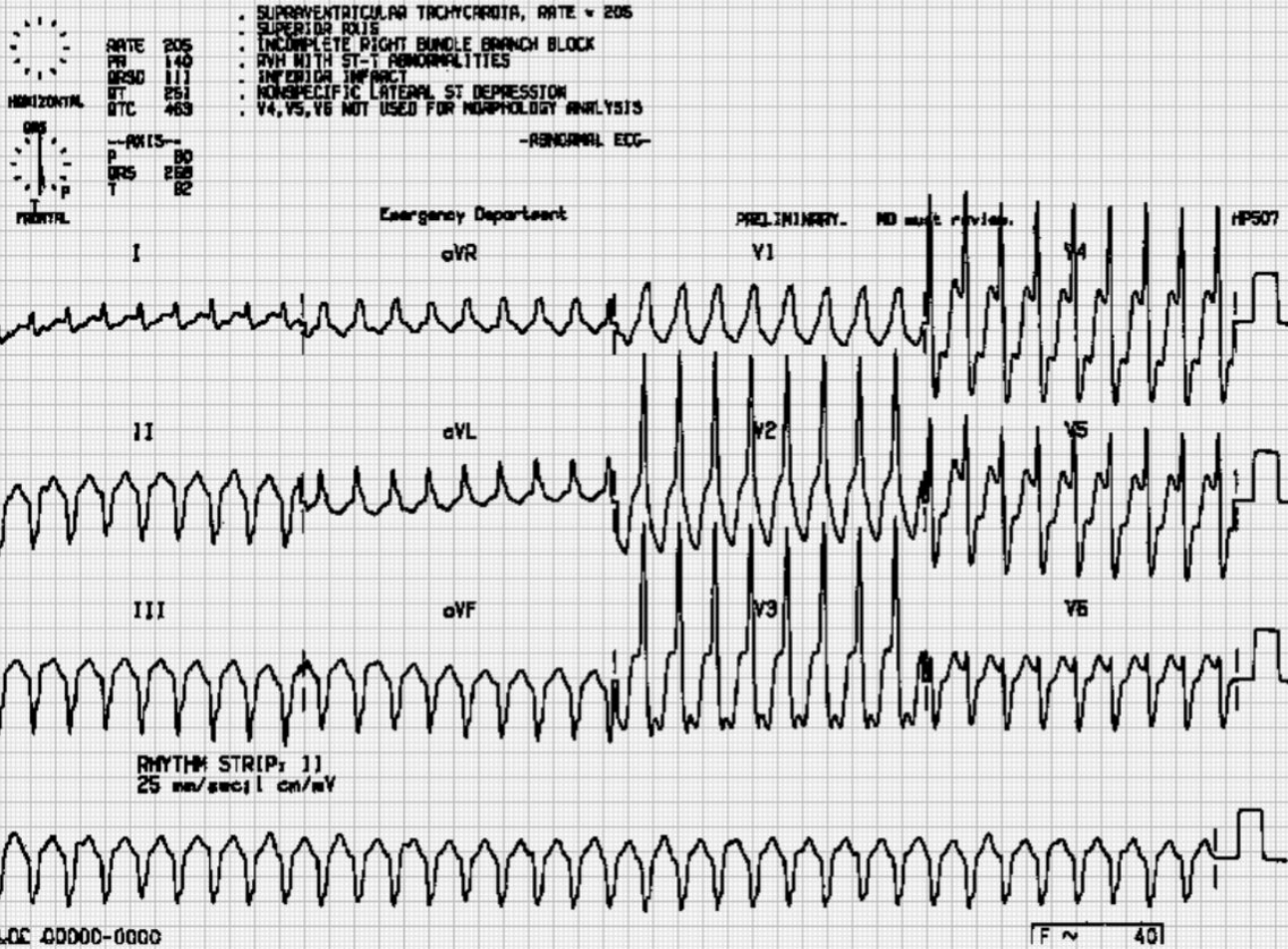
A wide QRS tachycardia is VT until proven otherwise (1). Features suggesting VT include:-

- evidence of AV dissociation
 - independent P waves (shown by arrows here)
 - capture or fusion beats
 - beat to beat variability of the QRS morphology
- very wide complexes (> 140 ms)
- the same morphology in tachycardia as in ventricular ectopics
- history of ischaemic heart disease
- absence of any rS, RS or Rs complexes in the chest leads (2)
- concordance (chest leads all positive or negative)

1) Griffith MJ, Garrat CJ, Mounsey P, Camm AJ. Ventricular tachycardia as the default diagnosis in broad complex tachycardia. *Lancet*. 1994;343:386-

2) Brugada P, Brugada J, Mont L, et al. A new approach to the differential diagnosis of a regular tachycardia with a wide QRS complex. *Circulation*. 1991;83:1649-1659

A 69 year old man 2 weeks after an inferior myocardial infarction



Ventricular tachycardia

A wide QRS tachycardia is VT until proven otherwise (1). Features suggesting VT include:-

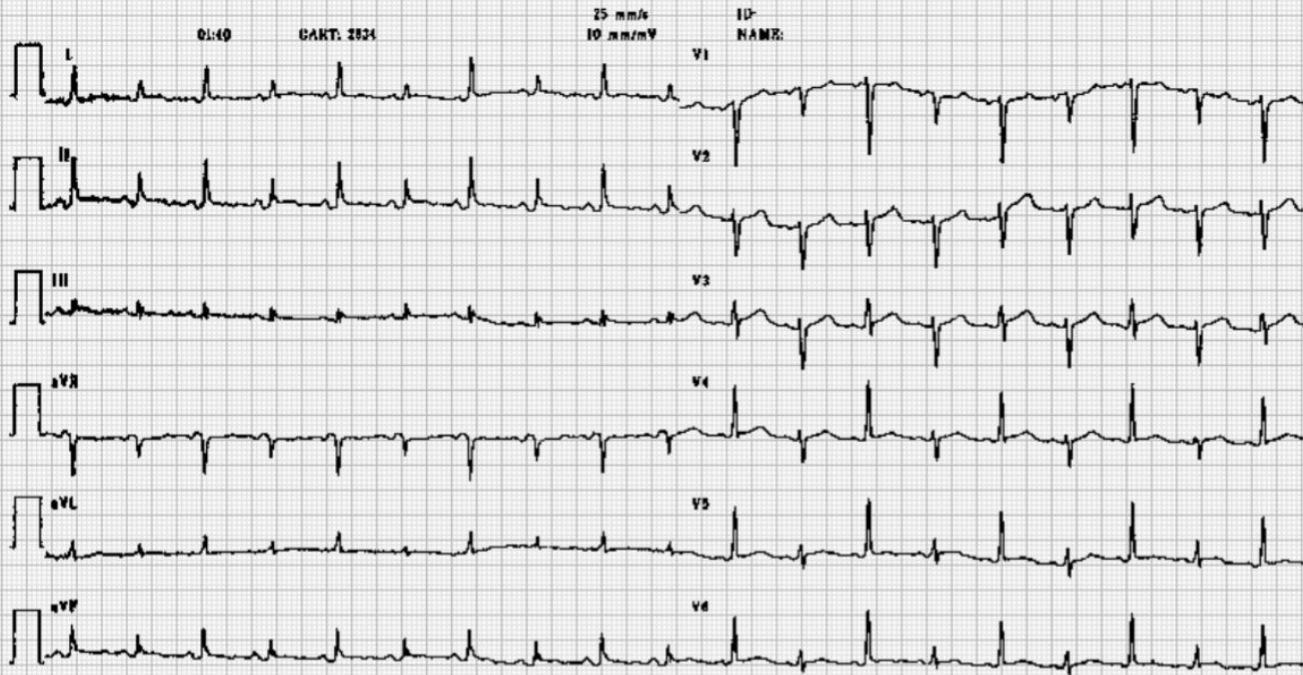
- evidence of AV dissociation
 - independent P waves
 - capture or fusion beats
 - beat to beat variability of the QRS morphology (shown here)
- very wide complexes (> 140 ms)
- the same morphology in tachycardia as in ventricular ectopics
- history of ischaemic heart disease
- absence of any rS, RS or Rs complexes in the chest leads (2)
- concordance (chest leads all positive or negative)

1) Griffith MJ, Garrat CJ, Mounsey P, Camm AJ. Ventricular tachycardia as the default diagnosis in broad complex tachycardia. *Lancet*. 1994;343:386-

2) Brugada P, Brugada J, Mont L, et al. A new approach to the differential diagnosis of a regular tachycardia with a wide QRS complex. *Circulation*. 1991;83:1649-1659

N.B. The computer-aided diagnosis can often be misleading.

A 56 year old man with breathlessness and raised JVP.

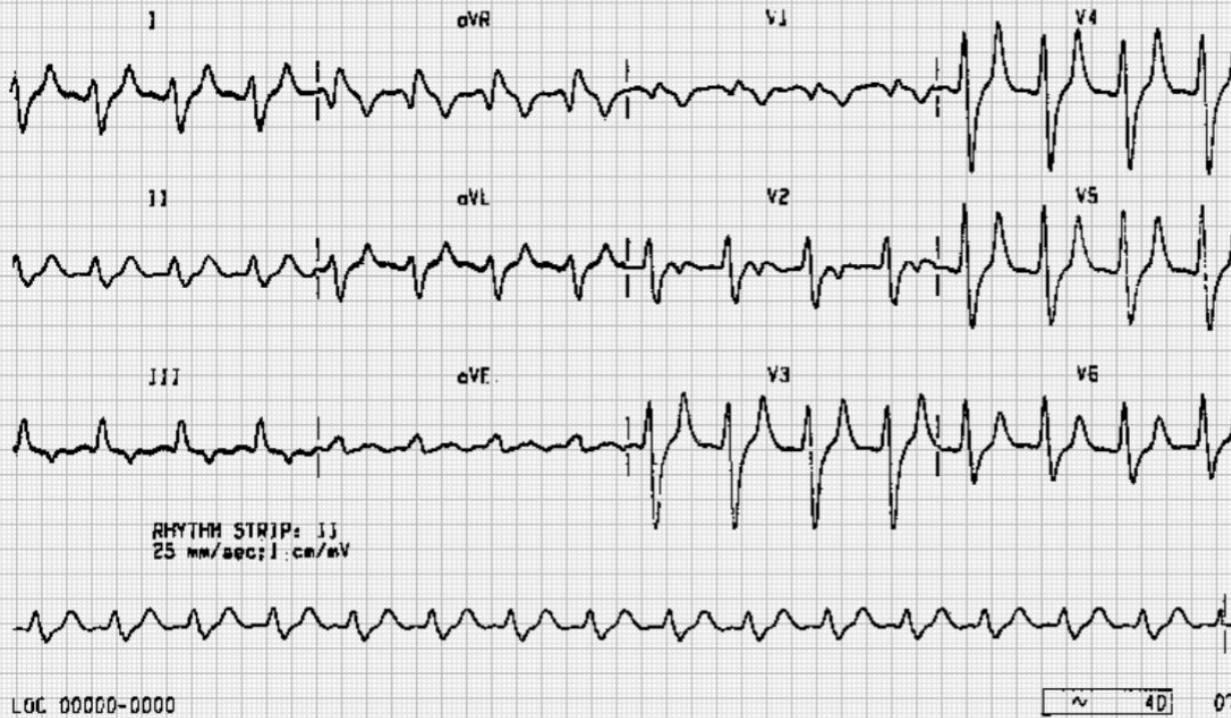


Pericardial effusion with electrical alternans

- The QRS axis alternates between beats. In this example it is best seen in the chest leads where the QRS points in different directions!
- This is rarely seen and is due to the heart moving in the effusion.

Thank you to Dr Mick Bialas of Llandough Hospital for this recording.

A 58 year old man on haemodialysis presents with profound weakness after a weekend fishing trip.



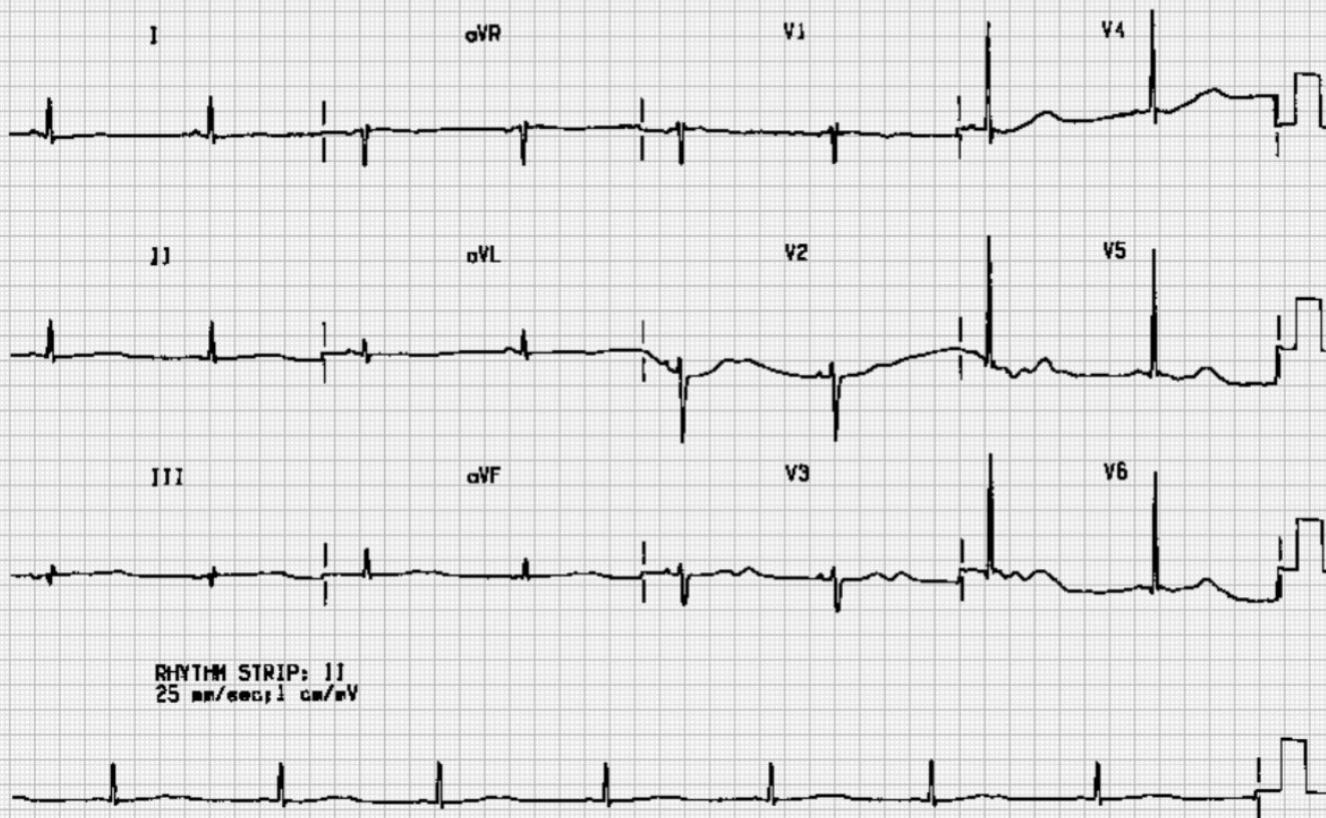
This man's serum potassium was 9.6 mmol/L.

Hyperkalaemia

The following changes may be seen in hyperkalaemia

- small or absent P waves
- atrial fibrillation
- wide QRS
- shortened or absent ST segment
- wide, tall and tented T waves
- ventricular fibrillation

A 22 year old lady with prolonged vomiting.



This lady's serum potassium was 1.8 mmol/L.

Hypokalaemia

The following changes may be seen in hypokalaemia.

- small or absent T waves
- prominent U waves (see diagram)
- first or second degree AV block
- slight depression of the ST segment

