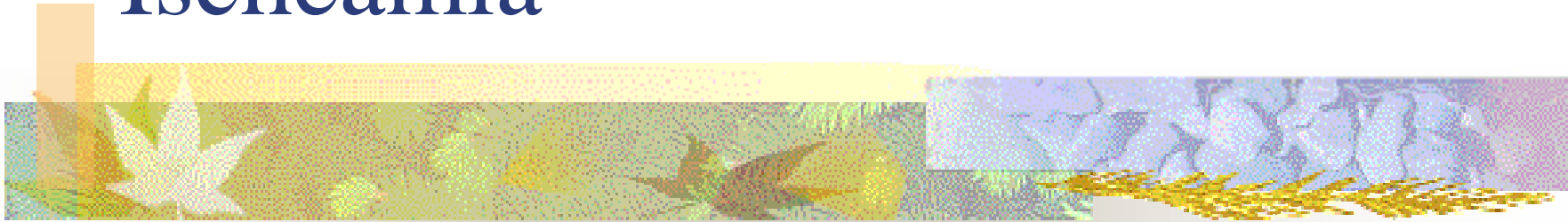


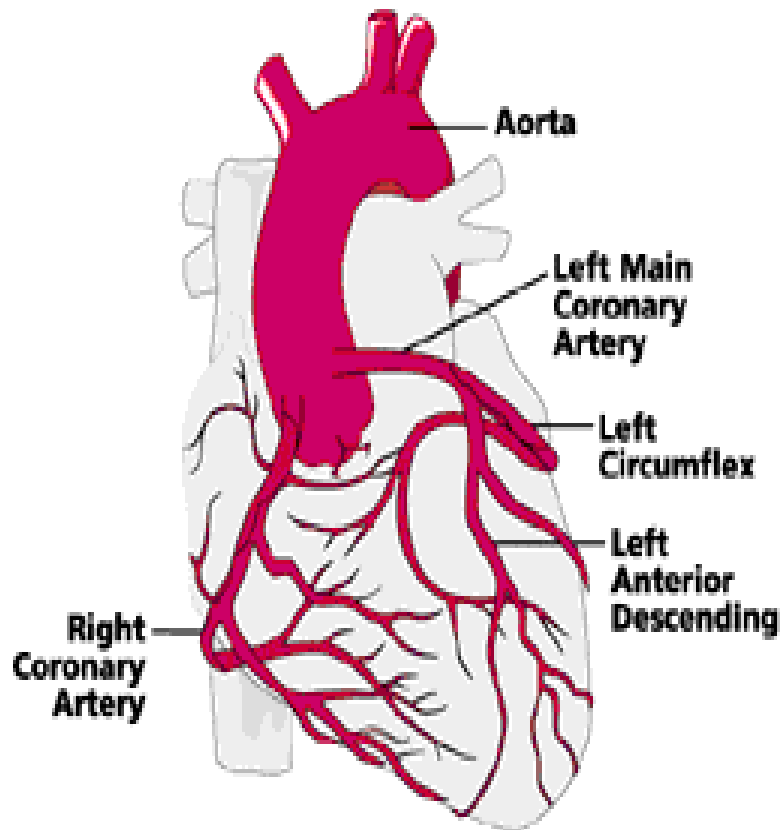
Myocardial Infarction and Ischemia



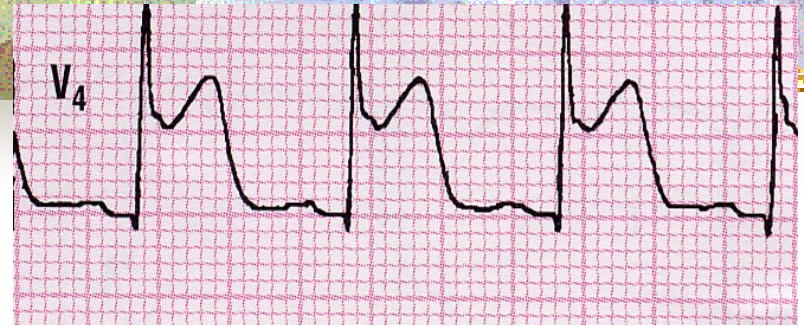
Lancashire & South Cumbria Cardiac Network

Myocardial blood supply

© 1997 HeartPoint



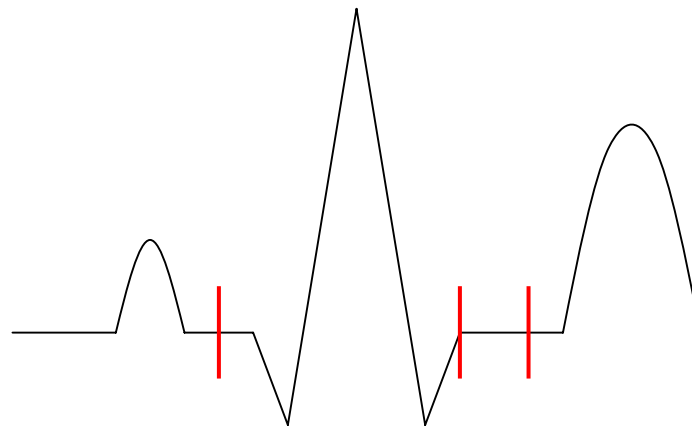
- The left main coronary artery branches into the anterior descending (LAD) and the circumflex (Cx).
- The Cx wraps around the left side and back of the heart-(the lateral side) of the left ventricle (V5, V6, I, aVL)
- The LAD supplies the front of the heart-(anterior portion) of the left ventricle (V1-V4)



ST Segment Depression

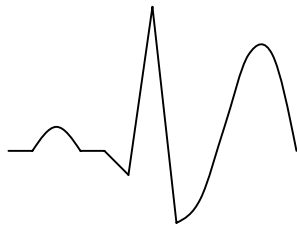
ST Segment Elevation

- ST segments which are below an imaginary baseline is called ST depression. Indicates ischaemia, typically seen in angina
- ST segments above the baseline are evident during the acute stage of an MI and indicates muscle injury. Can also be seen in pericarditis and Prinzmetal angina

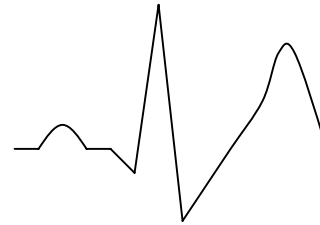


E

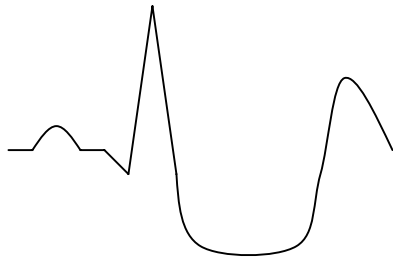
J + 60



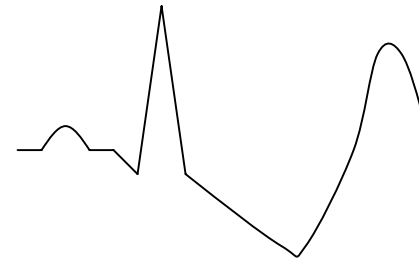
Normal



Borderline

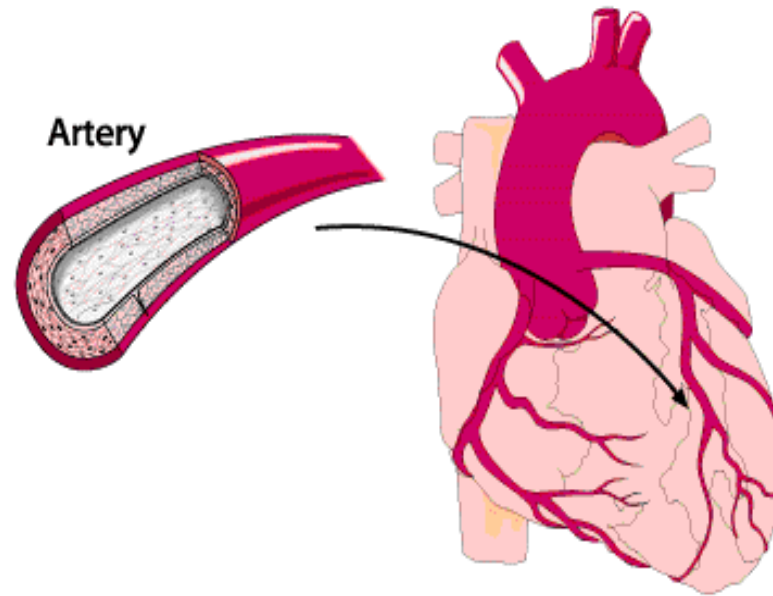


Horizontal

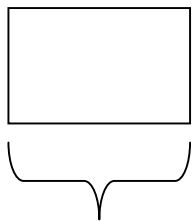
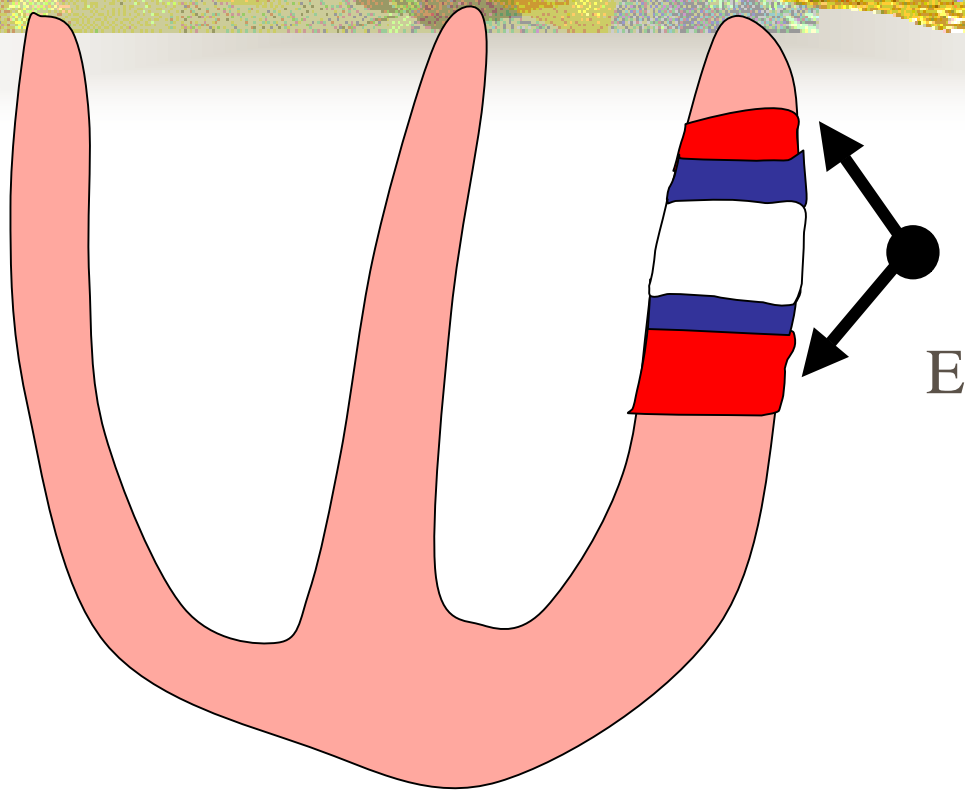


Downsloping

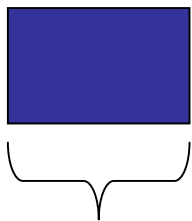
ECG Changes during Myocardial Infarction



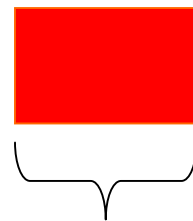
- 
- Cross sectional analysis of an area of infarcted myocardium reveals the three electrically differentiated zones.



INFARCTION



INJURY



ISCHAEMIA



INFARCTED MYOCARDIUM

- myocardium electrically dead
- The electrode lying over the area of infarction has the effect of looking through the infarcted area as a window. This therefore will detect and record potentials from the myocardium directly opposite.



INJURED MYOCARDIUM

- myocardium is never completely polarized
- The electrode lying over the area of injury will record ST Segment elevation on the ECG because of the myocardium retaining its polarity.



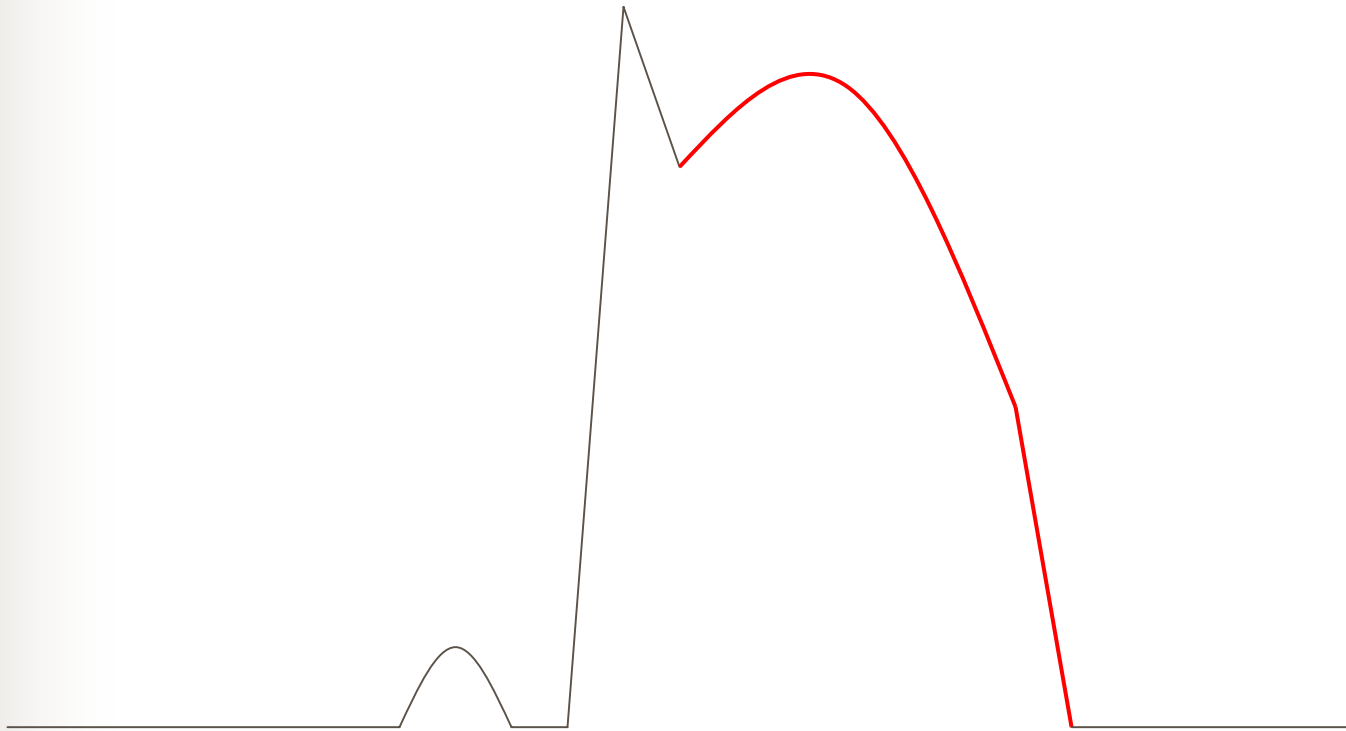
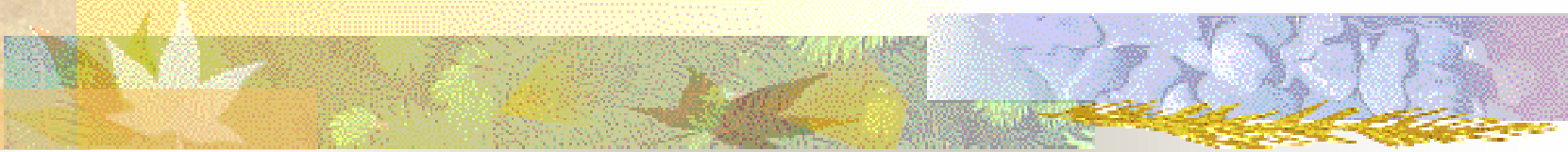
ISCHAEMIC MYOCARDIUM


- myocardium exhibits impaired repolarisation
- The electrode lying over the area of ischaemia will record T wave changes on the ECG

STAGE 1

ACUTE STAGE - HOURS OLD

- Acute stage of injury – The myocardium is not yet dead and unless rapid intervention is possible then death of the affected area of muscle will certainly follow. In the case of rapid intervention then the area of death may be reduced although even with treatment some necrosis will take place

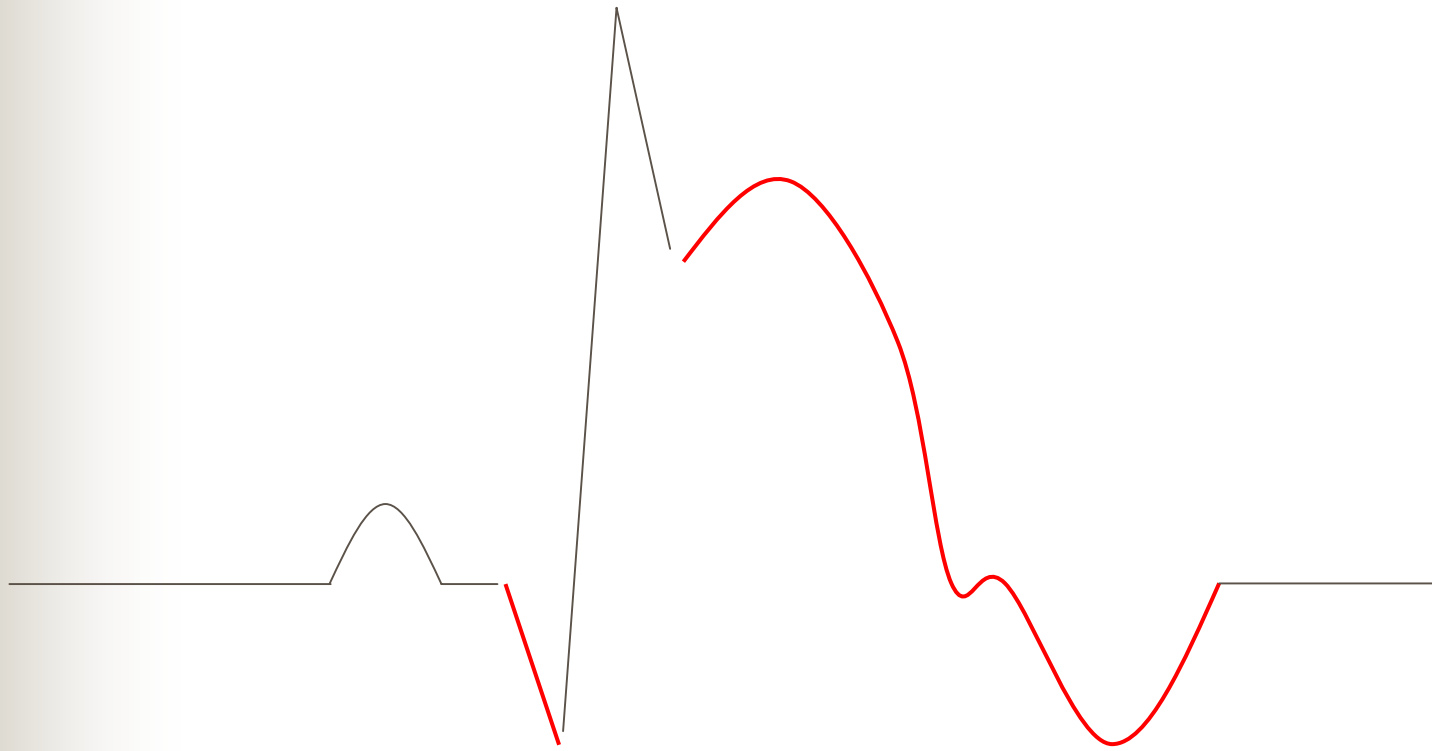
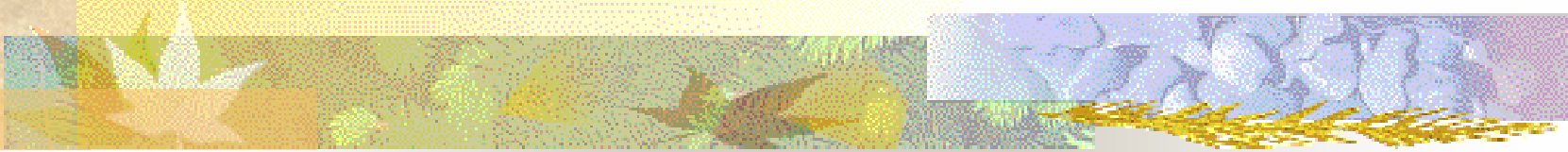


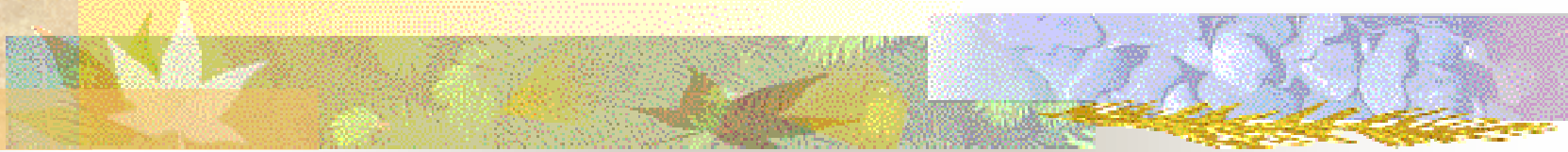
- 
- The typical shape of the ECG leads which are positioned directly over the injured area of myocardium will show significant ST segment elevation of greater than 2 mm, there may also be a reduction in the size of the R wave.
 - There will be ST segment depression in the areas of myocardium opposite the injured area these are known as **RECIPROCAL CHANGES**

STAGE 2

LATER PATTERN - DAYS OLD

- In stage 2 the injured myocardium is now starting to necrose and this results in Q waves beginning to appear on the ECG which are representations of depolarization on the opposite wall of the heart, this is due to the window effect over the area of dead myocardium





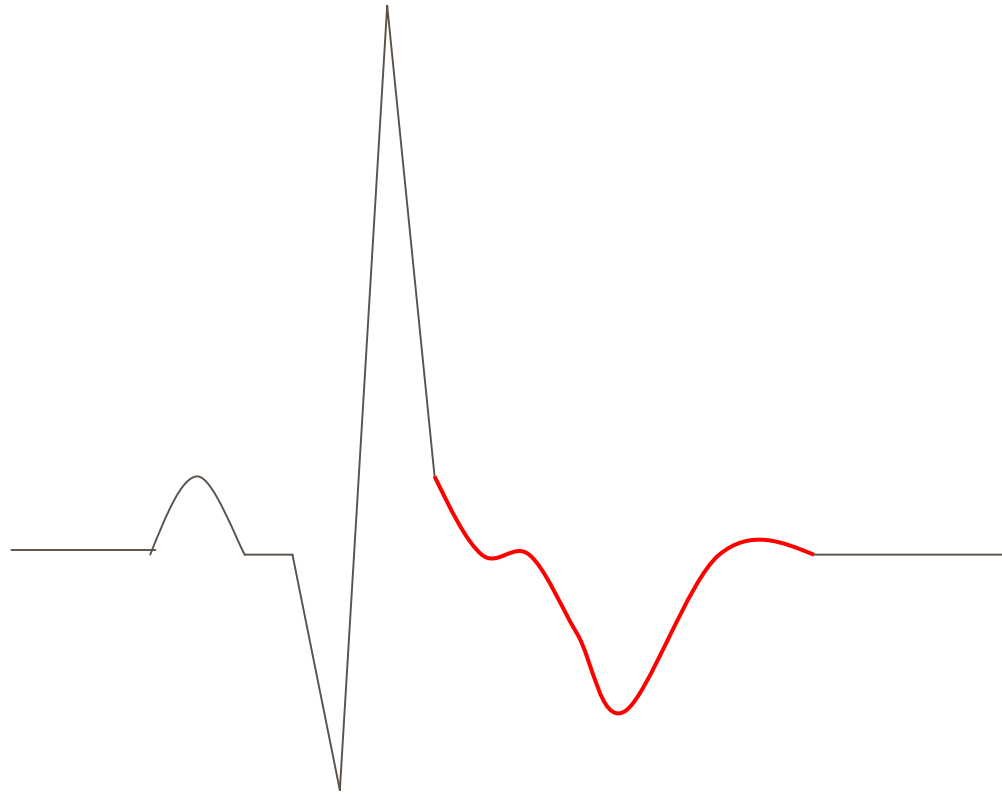
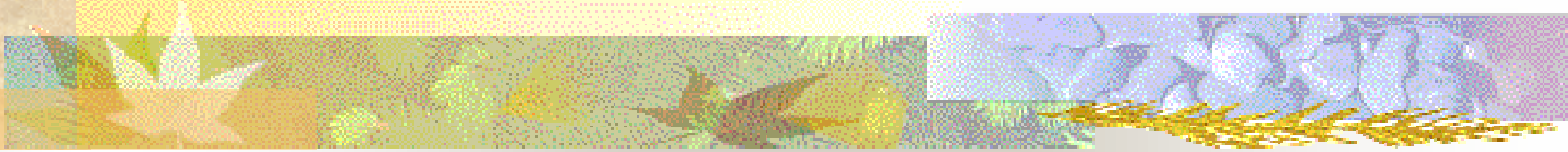
- The electrode is looking through the electrical window where no electrical activity occurs
- The ST segment elevation will lessen as the area of injury either becomes Ischaemic or dies
- T waves now begin to appear representing the area of ischaemia which is surrounding the infarcted muscle

STAGE 3



LATE PATTERN - WEEKS OLD

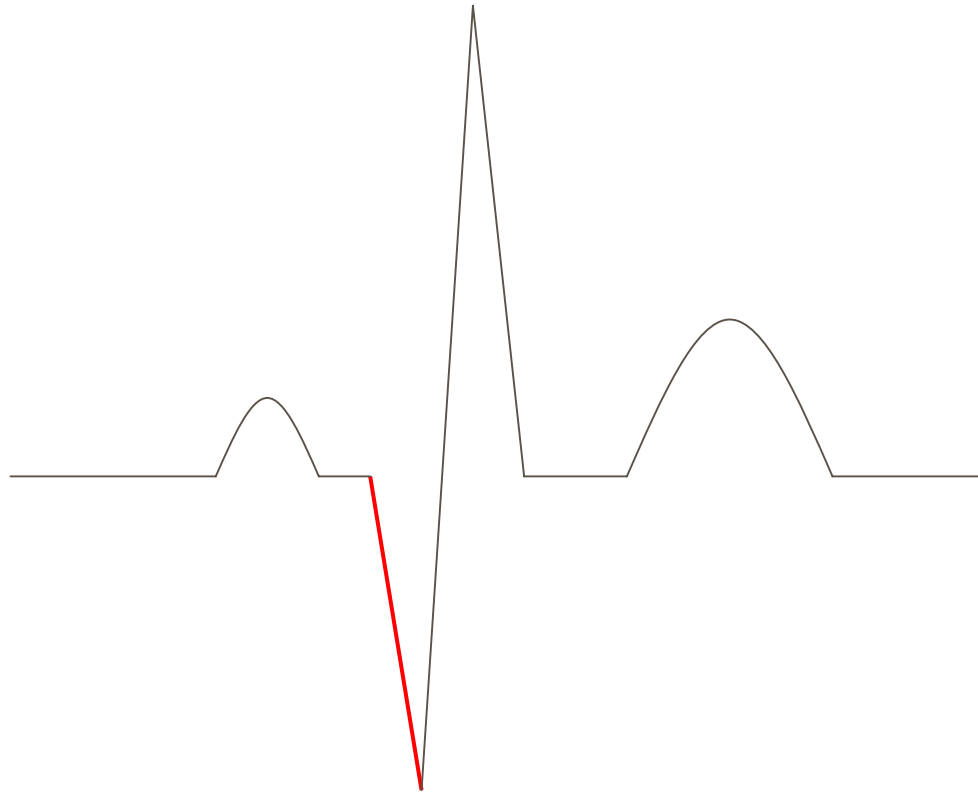
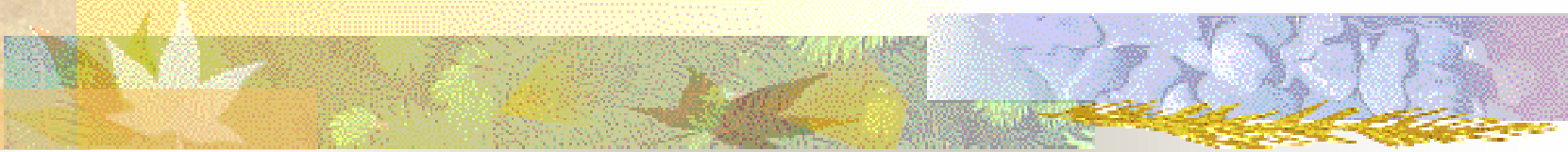
- In stage three, the zone of injury has now evolved into infarcted myocardium
- There is a pathological Q wave seen on the ECG due to the electrical window being present
- The ST segment has now returned to normal/Iso-electric line because the injured area has now necrosed or become ischaemic
- There is now a symmetrically inverted T wave present on the ECG which represents persistent ischaemia surrounding the area of infarct



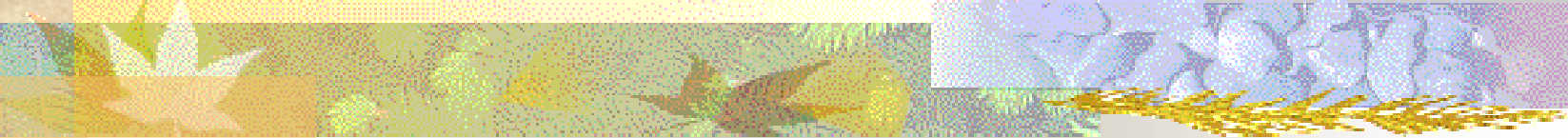
STAGE 4

OLD INFARCT -MONTHS TO YEARS

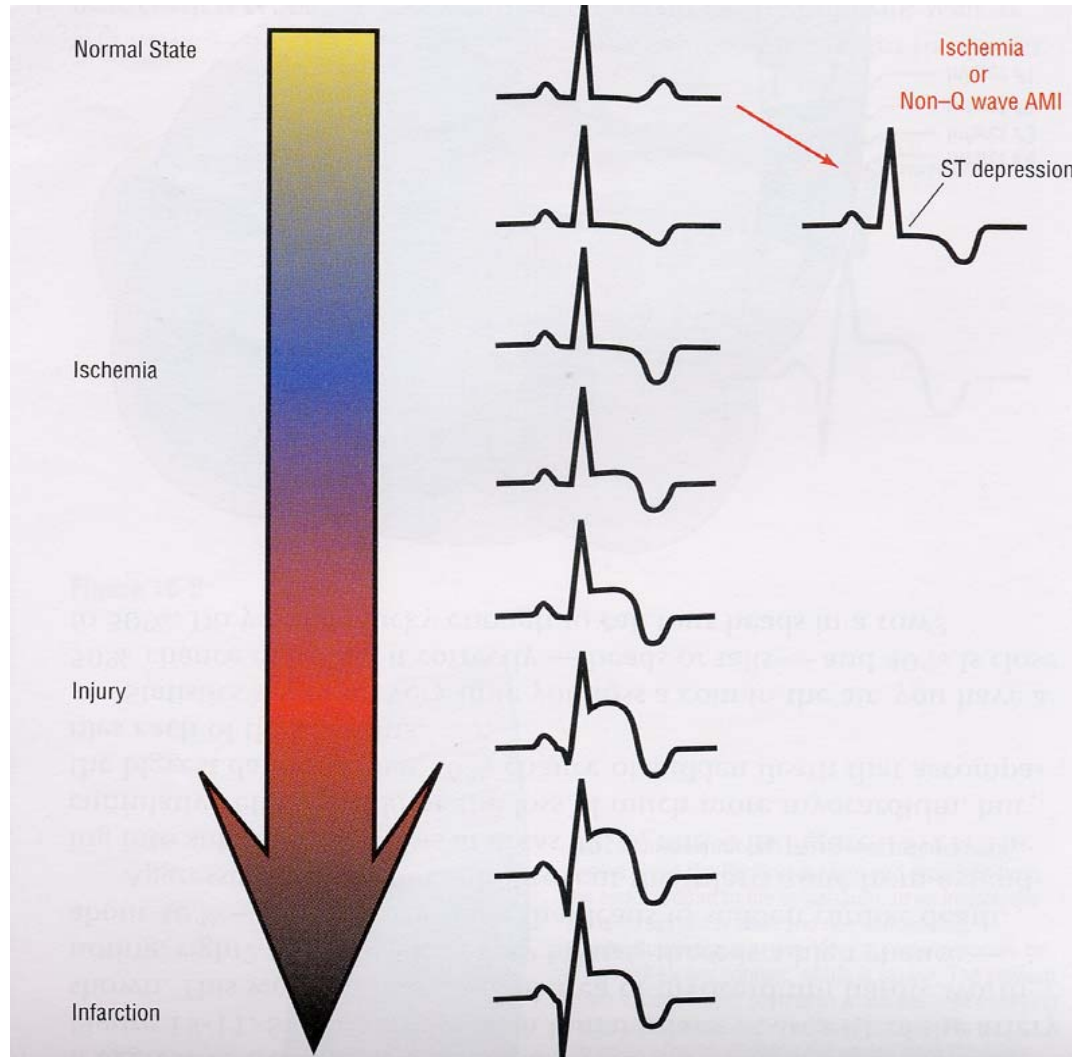
- In stage 4 the zone of ischaemia has recovered and the ECG returns to almost normal
- However there are changes which allow us to identify a previous infarct on the ECG
- The pathological Q wave is considered the fingerprint for life of a previous myocardial infarction
- The R wave height is reduced in the leads positioned directly over the area of infarct





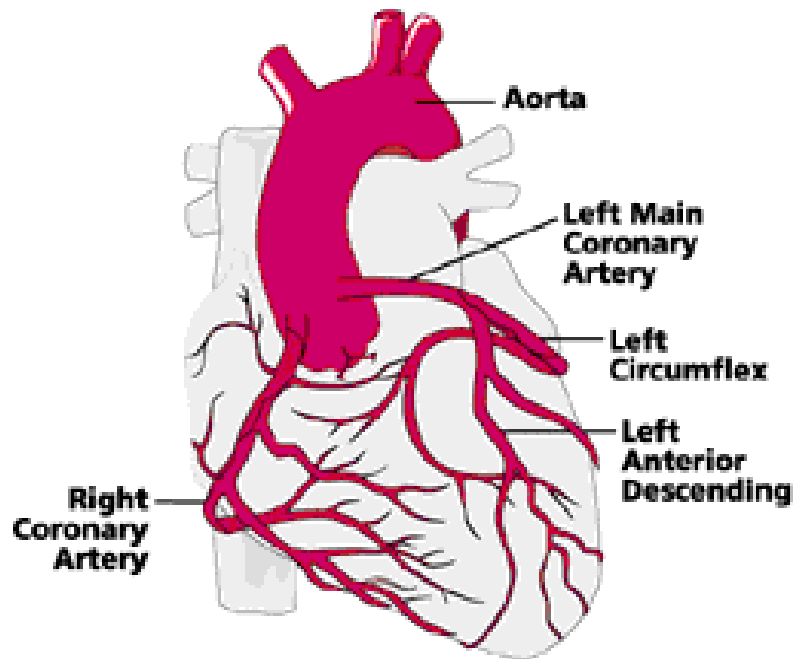
- 
- fingerprint for life of MI - Q wave
 - For the Q wave to be significant
 - Q wave must be 25 % in depth of the following R wave height

Overview Of ECG Changes During An MI



Left coronary artery

© 1997 HeartPoint



■ Blood supply to the myocardium

The left coronary arteries

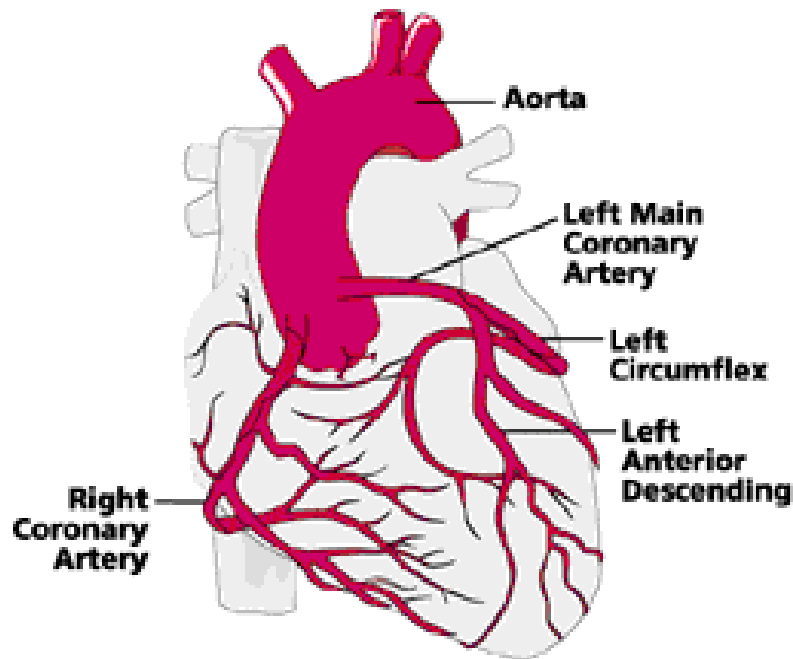
Left coronary supplies the Anterior wall of LV, Posterior wall of LV, SA Node (45%), AV Node (10%) And aspects of the left and right bundle branches (2/3rds RBB, Antero-superior branch LBB and portion postero-inferior branch LBB)

Right coronary artery

Blood supply to the myocardium

The right coronary arteries

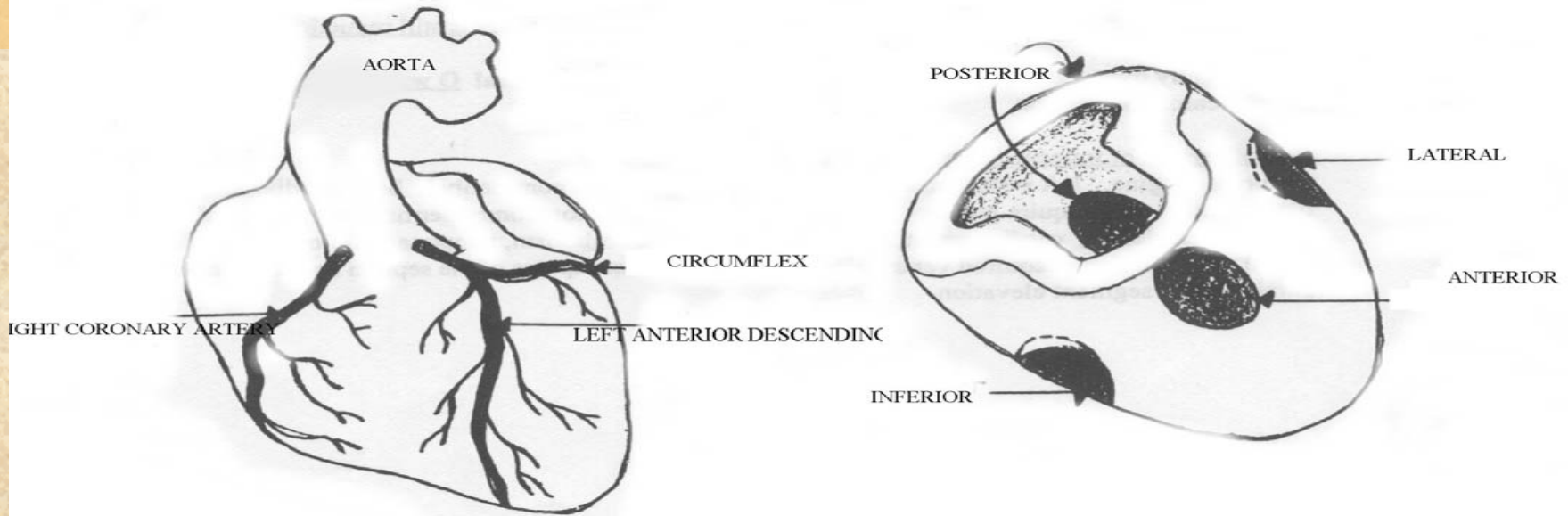
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Right coronary supplies the SA node, AV node and the His Bundle!!.
And the back (posterior) part of the heart

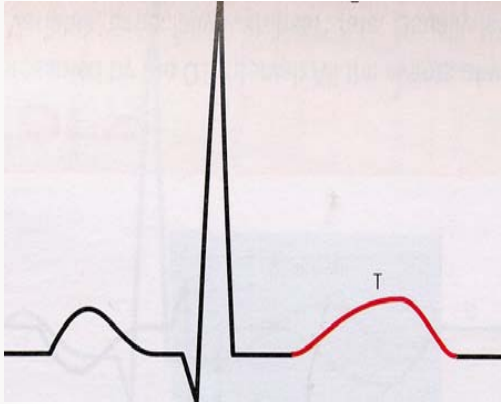
acute posterior infarcts can therefore lead to dangerous arrhythmias and may need a temporary or permanent pacemaker

Location Of Infarction



- Surface electrodes can identify which part of the heart has been involved.
- Once you know which part of the heart has been involved this can give you an idea about the extent of disease and which coronary arteries maybe involved
 - **Anterior: I, aVL, V2, V3, V4**
 - **Anteroseptal: I, Avl, V1, V2, V3**
 - **Anterolateral: I, Avl, V4, V5, V6**
 - **Apical: 1, aVL, V3,V4**
 - **Extensive anterior: I, aVL, V1-V6**
 - **Inferior: II, III, Avf**
 - **Infero lateral: II, III, aVF,V5-V6**
 - **Posterior: V1, V2**

Abnormal T waves



Normal



Deep symmetrical T wave
-Subendocardial



T wave inversion

Eg. Ischemia/ Old MI



Tall peaked T wave

Hyperkalemia



Summary

- Atheroma - build up of plaque
- ST Elevation Myocardial Infarction - occlusion
- 4 stages - Acute (days), Weeks, Months, Years
 - Stage 1 ST elevation
 - Stage 2 Q wave starts, ST Reduces
 - Stage 3 T inverts
 - Stage 4 Q wave - fingerprint for life
- NSTEMI ACS – more common
 - ischaemia
 - ACS protocol