

An ECG is a recording of waveforms that reflects the electrical activity of the heart.

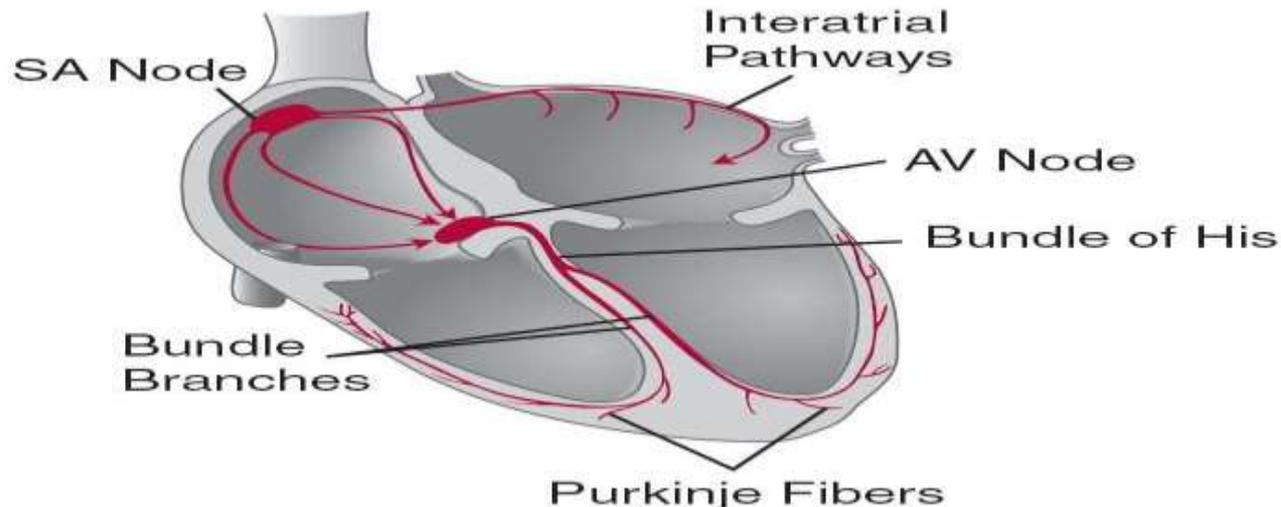
An Electrocardiogram is a graphic record of the electrical impulses that are generated by depolarization & repolarization of the myocardium.

THE ELECTRICITY OF THE HEART

The contraction of any muscle is associated with electrical changes called “depolarization” & these changes can be detected by electrodes attached to the surface of the body.

The wiring diagram of the heart

The normal pacemaker site of the heart is the SA node. The conductivity of the heart normally follows an electrical pathway from the SA node through the interatrial pathway to the AV node to the Bundle of His down the bundle branches to the Purkinje fibres.



Indications

**Myocardial Infarction & other types of CAD such as angina
Cardiac dysrhythmias Cardiac enlargement Electrolyte
disturbances**

Inflammatory diseases of the heart

Effects on the heart by drugs, such as antiarrhythmics.

Shortcomings of ECG

Fifty percent of all patients with AMI have no ECG changes.

A patient may have a normal ECG, present pain free & still have significant risk for myocardial ischemia.

Several disease processes can mimic that of an AMI, including Left bundle-branch blocks, Ventricular paced rhythms, and Left Ventricular Hypertrophy.

ECG – A galvanometer & electrodes with six limb leads and six chest leads. Recorded on graph paper with divisions.

Electrocardiographic paper

A graph paper with each small square measuring 1mm X 1mm.

ECG recorders & monitors are standardized at a speed of 25mm/sec. Time is measured on horizontal axis & voltage on Y axis.

Each small square represents 0.04seconds. Five small squares make up one large square representing 0.20 seconds.

ECG Pattern

The baseline is the iso-electric line. It occurs when there is no current flow.

If the current flows toward the lead, a positive deflection, ie above the baseline.

If the current flows away from the lead , a negative deflection, ie, below the baseline.

Left ventricle has more influence on the ECG, because of its increased muscle mass.

Lead system

A 12- lead ECG provides multiple electrical views of the heart along a vertical & horizontal plane.

The ECG recorder compares the electrical activity detected in different electrodes, and the electrical picture so obtained is called a “lead.” For eg. when the recorder is set to’ lead I’, it is comparing the electrical events detected by the electrodes attached to the right & left arms. The ECG is made up of 12 characteristic views of the heart, six obtained from the limb leads and six from the chest leads.

Limb leads-6

3 Bipolar limb leads

(Standard limb leads)-I, II,& III.

3 Unipolar Augmented leads

(aVR, aVL&aVF). Obtained through 4 electrodes placed on the right arm, right leg, left arm & left leg.

Chest leads-6 V1,V2,V3,V4,V5&V6

V1-Electrode positioned in the 4th intercostal space in the right sternal border.

V2-4th ICS in the left sternal border. V3- Midway between V2&V4.

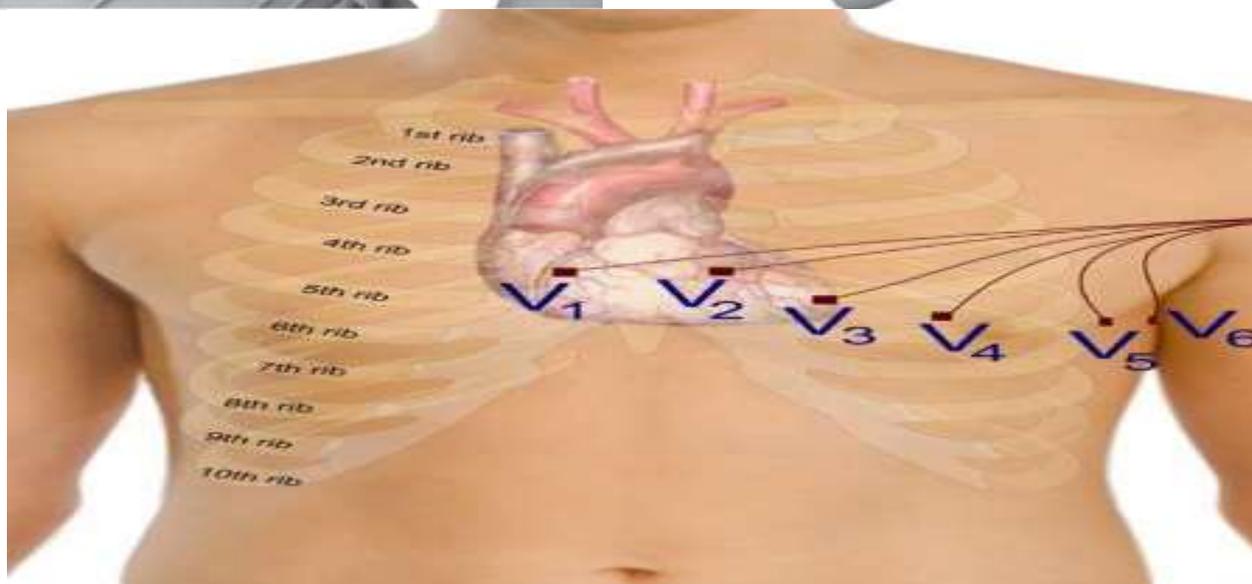
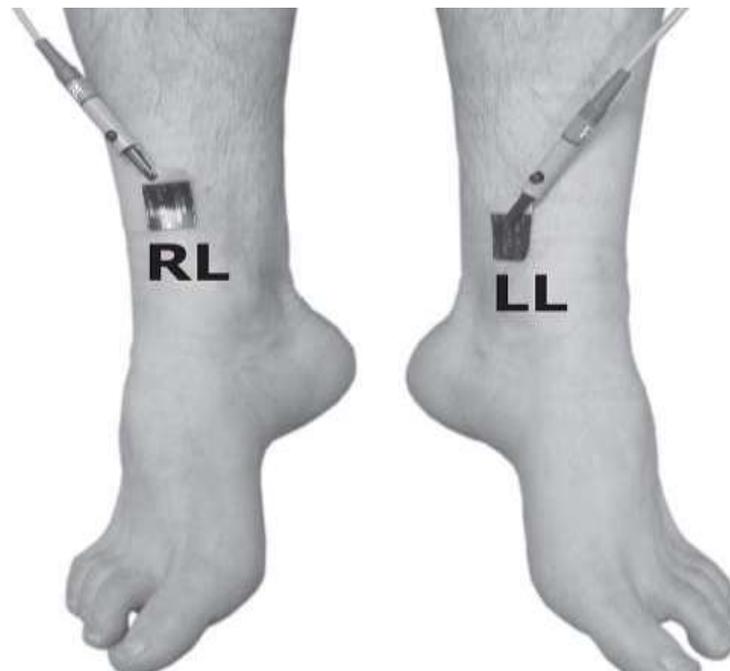
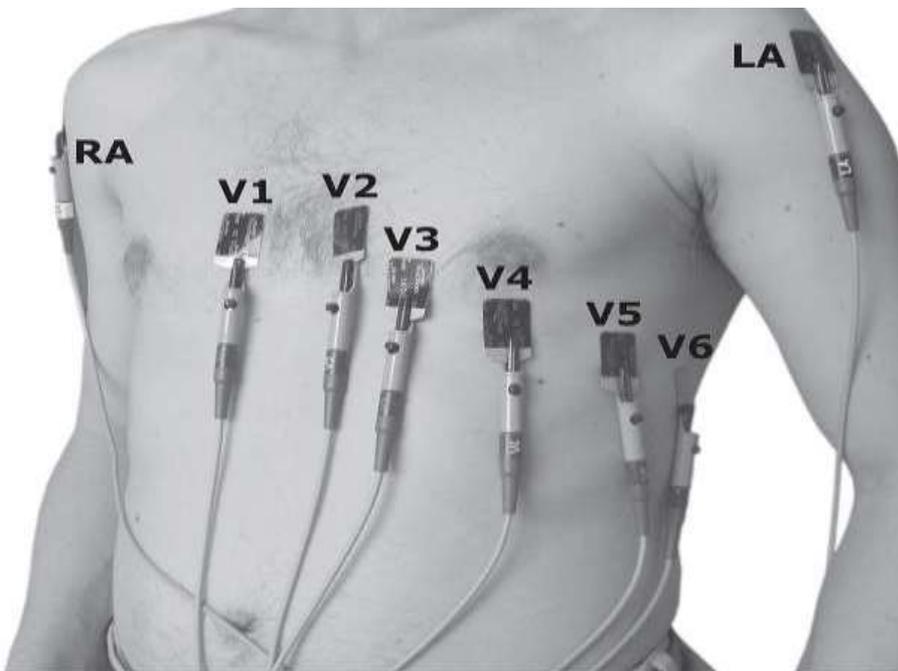
V4-5th ICS in the left midclavicularline.

V5- Same level as V4, anterior axillary line. V6-Same level as V4 & V5, midaxillary line.



The electrical activity of the cardiac cycle is characterized by five primary wave deflections, designated by letters

P, Q, R, S, T.



P WAVE

Represents atrial contraction. Shape of the 'P' wave remains the same unless it is generated from a different focus.

QRS complex

Represents ventricular depolarization and is composed of 3 waves, the Q, R & S.

Q wave is the first negative deflection.

R wave is the first positive deflection after the P wave. S wave is the negative deflection following R wave. It is about 0.08 to 0.12 sec, represented by 3 small squares.

PR Interval

Measured from the beginning of P Wave to the beginning of QRS complex.

The normal PR interval is 0.12 - 0.2 sec, represented by 3-5 small squares.

The time it takes for the impulse to spread from atria to ventricles.

ST segment

An isoelectric line representing early ventricular repolarisation. Normally not elevated >1mm or depressed > 0.5mm.

T wave

Represents ventricular repolarisation. Usually positive, rounded, & slightly Asymmetric.

U wave

Results from slow repolarisation of ventricular Purkinje fibers. More common in lead V3. Hypokalemia.

QT interval

Represents total time required for ventricular depolarization & repolarisation. From the beginning of QRS complex to the end of T wave. Normal QT interval is 0.36 to 0.45 sec. A prolonged QT interval may lead to ventricular tachycardia.

Reporting an ECG

- Description
- Interpretation

Description includes

Where depolarization started - presence / absence of 'p' wave, number, shape.

Whether conduction occurred normally-'p' wave- number, shape, PR interval.

An account of QRS complex, shape and duration. Description of T waves in different leads.

1. Heart Rate

As per speed of the paper, one minute is equal to 1500 small squares or 300 big squares.

$$\text{So Heart rate} = \frac{1500}{\text{No: of small squares in one RR interval}}$$

OR

$$\frac{300}{\text{No: of big squares}}$$

2. Rhythm

Whether the waves are repeated at regular interval in consecutive beats. Usually Normal Sinus Rhythm.

3. P wave

One 'p' in front of every QRS, regular, all look alike. 3mm in height & a duration of 0.04 to 0.11 sec. It is tall in RAH and broad & bifid in LAH. It is replaced by fibrillary wave in Atrial fibrillation & saw toothed wave in Atrial flutter.

Normal 'p' wave indicates

the impulse is originating in SA node impulse is travelling normally along atria the atria are normal

4. PR interval

Measured by counting the no. of small squares and multiplying by 0.04. Must be normal & constant. It gradually lengthens in Wenchebach phenomenon.

(2nd degree heart block).

5. QRS complex

- Examined for
 - a) Duration- 0.08 to 0.12 sec. Prolonged in ventricular hypertrophy and bundle branch block.
 - b) Q wave - Normal in V5,V6 & it is due to septal depolarization. Q is always absent in lead II, V1,V2. Presence of a large Q wave >5mm is abnormal, usually signifies myocardial infarction.
 - c) R waves & S waves- R waves are tall in V5 & V6, but in V1 & V2, the S waves are deep.

6. ST segment

ST depression in ischemia & ST elevation in acute myocardial infarction.

7. T wave

Positive except in aVR. Inverted T wave is found in ischemia, RVH, LVH, severe hypokalemia.

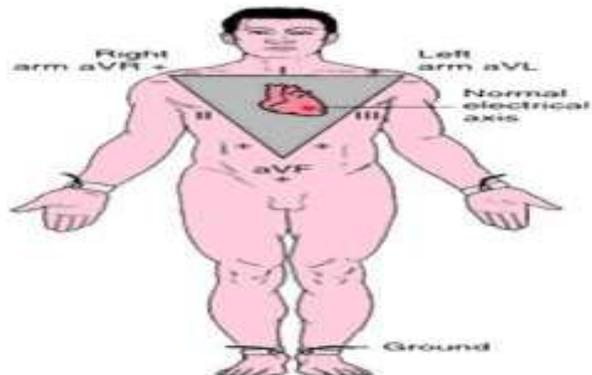
Tall 'T' wave in moderate hyperkalemia.

8. QT interval

Changes with variation of plasma potassium & calcium concentration, drugs like quinidine prolongs QT interval. Normal QT interval is 0.42 seconds.

Einthoven's triangle

It is an imaginary equilateral triangle formed by connecting the points of junctions of the right & left superior extremities & the left inferior extremity.



We can identify the side or wall of the heart affected by identifying the changes in particular leads.

Anterior wall- V2, V3, V4

Inferior wall - aVF, II, III

Lateral wall - I, aVL, V5, V6

Nursing implications

No preparation of the client is necessary for taking ECG. Explain the procedure & reassure him that the procedure is absolutely safe & he will not be electrocuted.

In coronary care units, the nurses must be familiar with ECG monitoring & must be able to detect the development of abnormalities. Abnormal changes should be recorded & reported immediately.

Ensure good contact between the client's skin & the electrodes by applying electrode jelly to the skin where the electrode is attached.

The client should lie flat & as relaxed as possible, because any movements or muscular twitchings recorded by the machine may alter the tracings.

The bystanders should be kept away from the client to prevent them touching during ECG procedure.

The client should not wear ornaments during ECG.

If it is unavoidable, care should be taken that the leads should not come in contact with the ornaments.

The nurses should ensure the correct placement of leads while taking ECG. The improper placement of chest leads can greatly distort the tracing and alter the diagnosis.

No other electric equipment should work in the monitoring area.

Transport the client on trolley, to the ECG department.

The machine should be checked for proper standardization. When the standardization button is pressed, there should be a deflection of 10mm on the graph. A spike made will be of two large squares.

The machine should be properly grounded to prevent interference with the recording.

