Great Western Hospitals NHS
NHS Foundation Trust

Recording an Electrocardiogram

Workbook

Our Values
Service Teamwork Ambition Respect

Content

Aim
This workbook is designed to equip you with the knowledge and skills to enable you to attain trust competency in recording Electrocardiograms.

Learning made easy....

Step 1

- Read the workbook and complete the pre-course assessment on training tracker (TT).
- When the TT assessment has been completed print off your certificate and bring to the session.
- Failure to attend with your certificate will mean that you will be unable to complete the study day and will need to re-book.

Step 2 - Support from your manager/mentor

- Ensure that your manager/mentor would like you to learn and practice this/these skill(s)
- It is hoped that during your individual performance review you reflected upon those existing skills and experiences you have acquired within your current role, and have now secured support for your further development from your clinical manager.
- On completion of this workbook, your clinical manager is required to sign the relevant section of the competency. This demonstrates their support for your role development regarding recording Electrocardiograms.
- Please ensure that you send a copy to The Academy to ensure you are entered into ESR

Step 3 - Getting help to learn

- You are expected to contact Mercury Ward or Wiltshire Cardiac Centre, and be supervised by a Senior Technical Officer recording 10 Electrocardiograms and only then will you be signed off as competent.

Step 4 - Ensuring compliance with local guidelines and professional practice

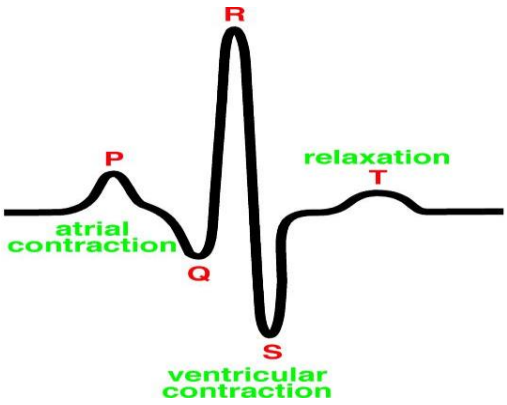
- Ensure you have accessed, read and understood your health care organisation guidelines/policies relating to Electrocardiograms and any national guidelines that have been adapted for your clinical area

Objectives

- To identify what an Electrocardiogram is and indications for use
- Discuss appropriate preparation of patient and machine
- Demonstrate correct application of limb and chest electrodes.
- Discuss what should be reported and documented
- To be able to record Electrocardiograms

What is an Electrocardiogram?

- A heart's electrical activity produces currents that radiate through surrounding tissue to the skin.
- By attaching electrodes to the skin those electrical currents can be sensed and transmitted to a recording device.
- The currents then are transformed into waveforms – the ECG.
- The waveforms can be viewed as continuous images on a cardiac monitor as in ACU, ICU,AAU or Mercury. Shalbourne Suite also on occasions monitor cardiac patients
- The waveforms can be a long strip printout from a cardiac monitor
- They also can be 12 sections printed on an A4 sheet known as a 12 lead ECG
- A waveform is known as the PQRST complex



What does an ECG do?

- An ECG shows the sequence of electrical events occurring in the cardiac cells
- It can give information about the heart's
  - Rate
  - Rhythm
  - Electrical conduction
- An ECG can diagnose cardiac and often rule out non cardiac illness
- An ECG can monitor the effects of medication
- An ECG can provide baseline information

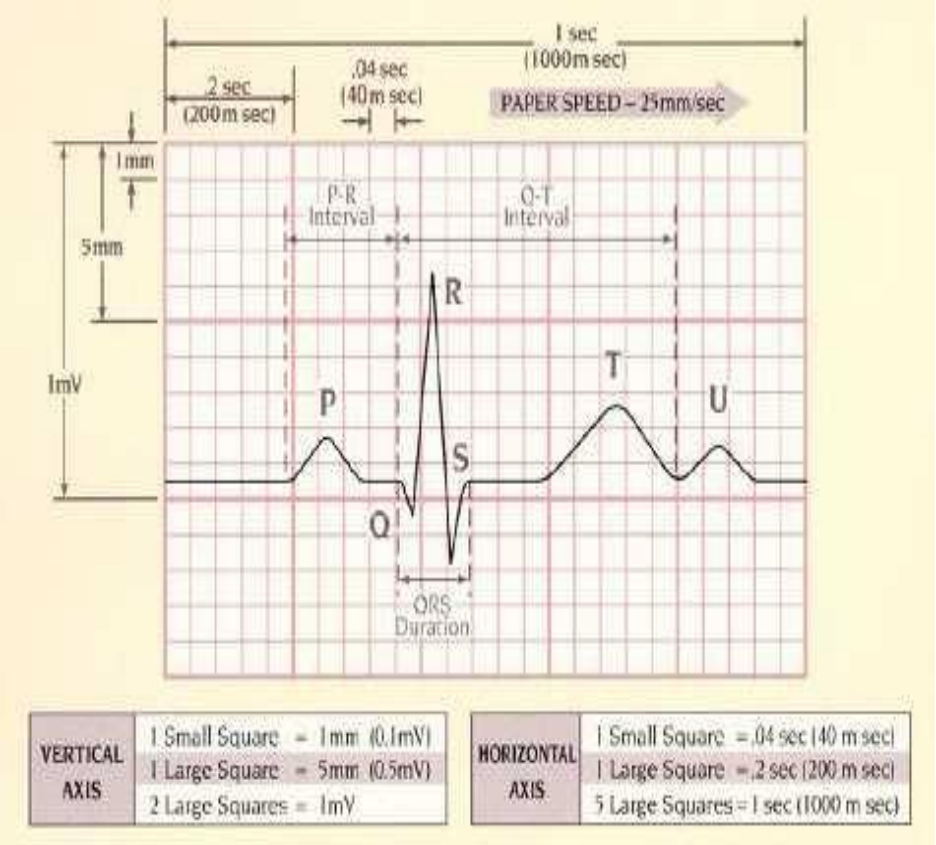
Indications for an ECG

- Chest, arm, or jaw pain (may be symptoms of a heart attack or angina)
- Breathlessness
- Sudden collapse
- Post electric shock
- Post cardiac arrest
- Abnormal blood test (electrolytes)
- Observation of known cardiac disease
- Abnormal observations such as;
  - Slow pulse rate
  - Fast pulse rate
  - Irregular pulse rate
- High blood pressure

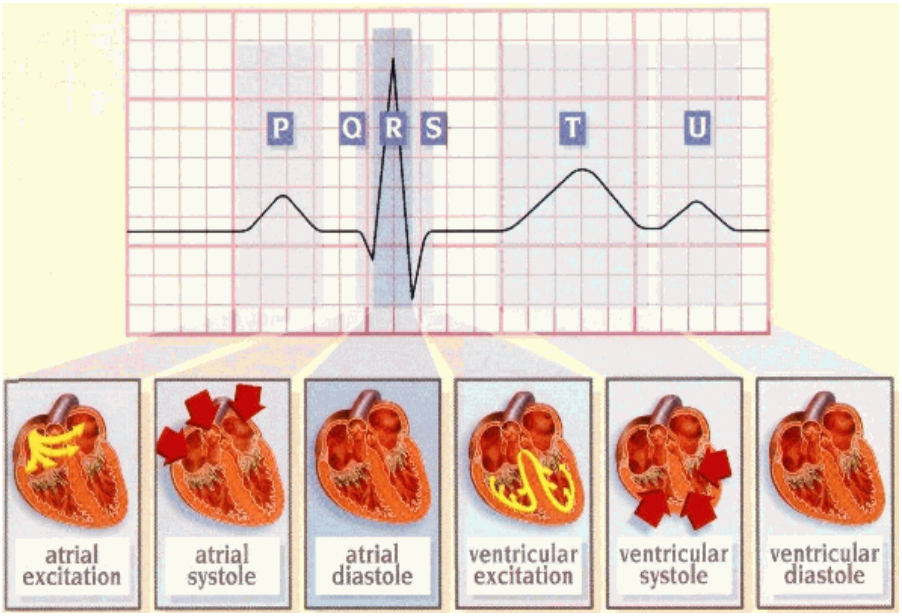
- Low blood pressure

- It is also routine to do a baseline ECG before surgery especially if the patient has a history of cardiac disease

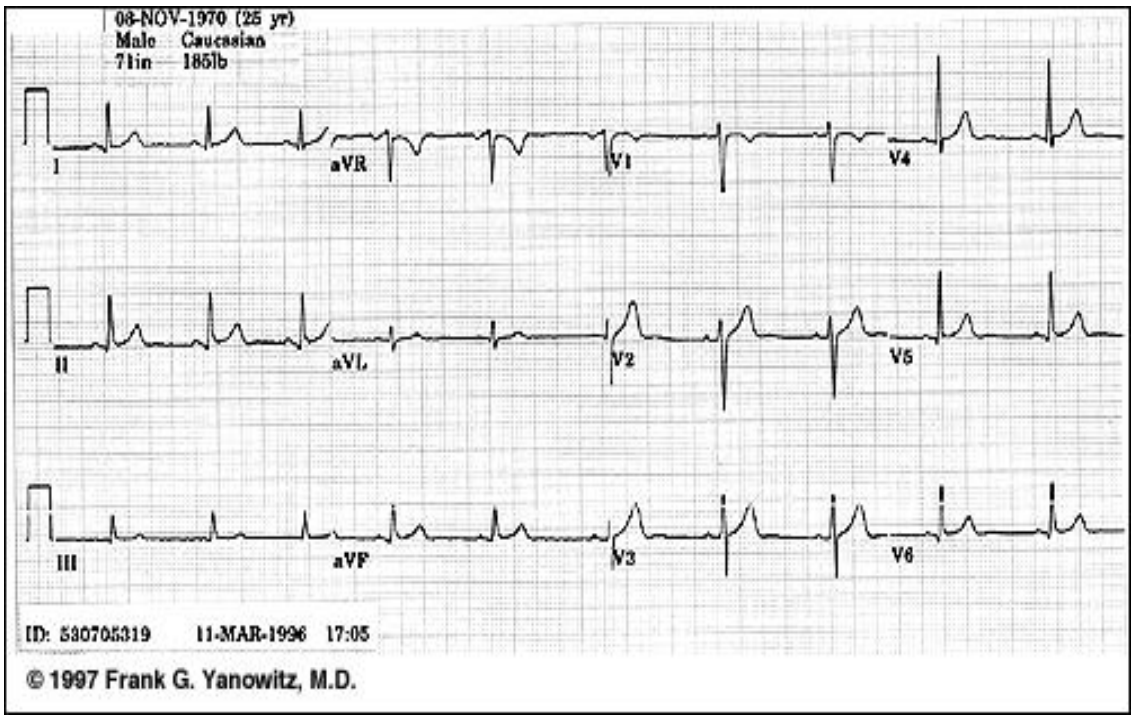
The PQRST Complex related to ECG paper



The ECG related to Heart Contraction and Relaxation



An Example of a Normal ECG



Preparation for taking the ECG

- Ensure machine available and that it is safe and ready to use. Check date and time are correct especially in March and October when the clocks are altered
- Is it plugged in (if necessary) and switched on? (Some machines can run on internal batteries-If the machine has been charged!)
- Have you checked it has paper?
- Do you have enough electrodes?
- Do you have skin preparation materials?
- Do you know how to use the machine-they differ throughout the hospital so familiarize yourself with the ECG machine in your area

Checking the Machine

- Is it set for 12 leads? Auto setting is 12 lead default
- Is the paper speed correct?
- Have you entered patient details?
    - Do not use filter routinely-only as a last resort if you cannot get an accurate trace any other way. Putting on the filter in the first instance is bad practice and should be discouraged. If filter is used always indicate so on the ECG

Paper Speed

Standard paper speed is 25 mm/sec.
Paper speed may be increased to better analyze tachycardias. A faster paper speed makes the rhythm appear slower and the QRS wider. If used by mistake it can lead to incorrect interpretation of the ECG and incorrect treatment.

Skin Preparation

- In order to obtain a good quality diagnostic ECG it is imperative to have good skin preparation prior to applying the ECG electrodes.

- Remove any hair from the areas in which the ECG electrodes are going to be attached.

When measured from the patient's skin, the heart's electrical signal is extremely small, about 0.0001 to 0.003 volts.
That's as small as one-ten thousandth of a volt. Compare this with energy from a nine volt battery.
Good skin prep will make the ECG signal as strong as possible, and make the artefact signals as small as possible.

Various skin prep aids are commercially available. Some stress test labs use 400 grit sandpaper.
Obviously, only minimal force is required when using these aids.

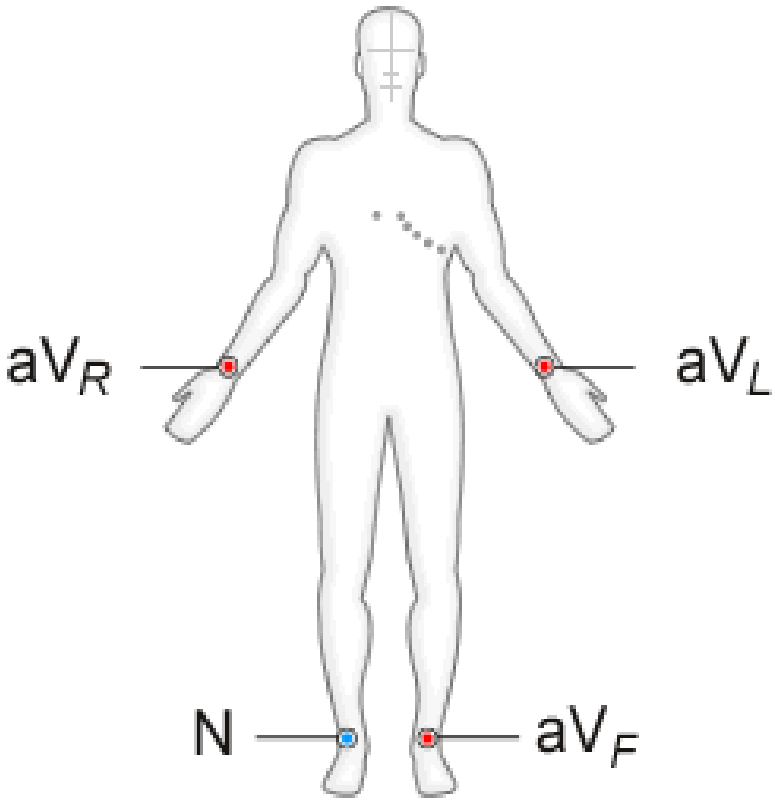
Simply rubbing the skin with a gauze pad can have a noticeable effect on ECG clarity by:

- Reducing skin oil
- Removing part of the stratum corneum(top layer of skin)

Preparing the Patient

- Explain the procedure and obtain consent
- Reassure the patient
- Check environment for sources of interference
- Screen the patient
- Raise bed to a safe comfortable working height
- Clean your hands
- Explain the need for skin preparation
- Prepare the skin – shave or clip hairs if needed
- Use gauze or skin tape to abrade skin-it should redden but not graze
- Assist the patient into a comfortable position – semi recumbent if possible
- Keep patient warm and protect privacy
- Make the patient as comfortable as possible. Keep them warm, consider their modesty and try to get them to relax.
- Apply electrodes and leads
- In female patients electrodes should be placed under the breast
- Explain the need for the patient to remain still and quiet if possible

Applying the Electrodes

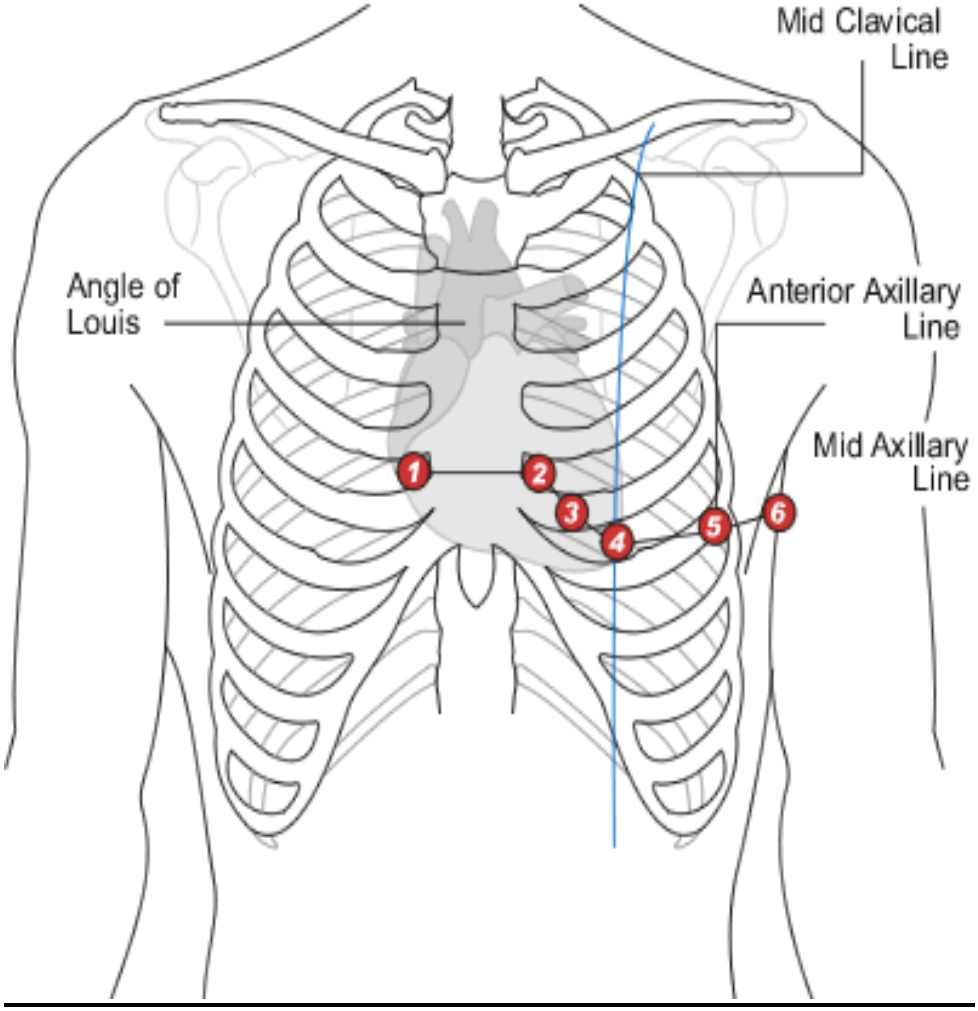


Limb Leads

Lead labelled	Colour of clip	Position on body
R or RA	Red	Right arm
L or LA	Yellow or white	Left arm
F or LL	Green	Left leg
RL or N	Black	Right leg

While there are 4 limb electrodes / cables, it is important to remember that the electrode attached to the right leg plays no part in the formation of any lead – it is only there to stabilise the ECG. Although the fronts of the wrists and ankles are common positions for the attachment of cables to electrodes, all parts of the limb will give an identical electrical signal. However, it is **NOT** good practice to place limb electrodes on either the abdomen or shoulders.

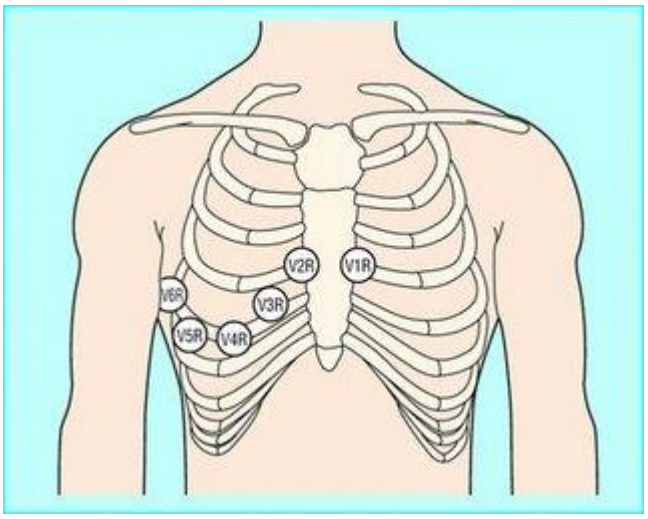
Chest Leads



Lead Labelled	Colour of Clip	Position on Body
C1 or V1	Red	4th intercostal space- Rt sternal border
C2 or V2	Yellow	4th intercostal space- Lt sternal border
C3 or V3	Green	Diagonally between V2 and V4
C4 or V4	Brown	5th intercostal space- mid clavicular line (mid collar bone)

C5 or V5	Black	Anterior axillary line level with V4 (start of armpit)
C6 or V6	Purple	Mid axillary line level with V4 (mid armpit)

Position for Right sided ECG



It is impossible to get a good quality ECG if the patient is moving

Check for Patient Movement

- Check for subtle movement
  - Toe tapping
  - Shivering

- Look for muscle tension
  - Hand grasping rail
  - Head raised to “watch”
  - Fist clenched

Even small movements can produce artefact. Take a moment to look for even minor patient movements.
The patient may have a firm grasp on the bed rail or strain to look at the 12-lead monitor. Both of these activities can result in increased artefact.

Keep the patient's arms resting on a steady surface.
In colder temperatures ensure the patient is warm and free from shivering.

Check the Cable

- Some "slack" between monitor and patient is needed
- Not too much "slack"- The cables should have enough "slack" to avoid tugging on the electrodes

The clip should be attached to the patient's clothing or the sheet to keep the cables in place.

Avoiding Artefact

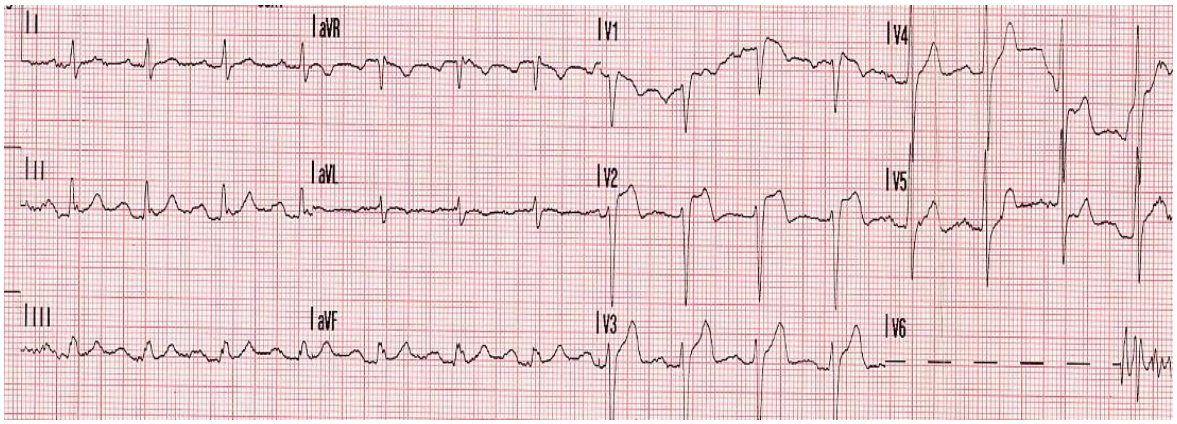
- It is important that an ECG is free from any artefact when making a diagnosis from it.

With a 12 lead ECG the diagnosis can be made from just a single complex in any of the 12 positions viewed. Due to the sensitivity of 12 lead ECG machines in diagnostic mode, it is more likely to pick up artifact, therefore it is imperative to take all steps to eliminate the causes of artifact to produce a high quality, diagnostic ECG.

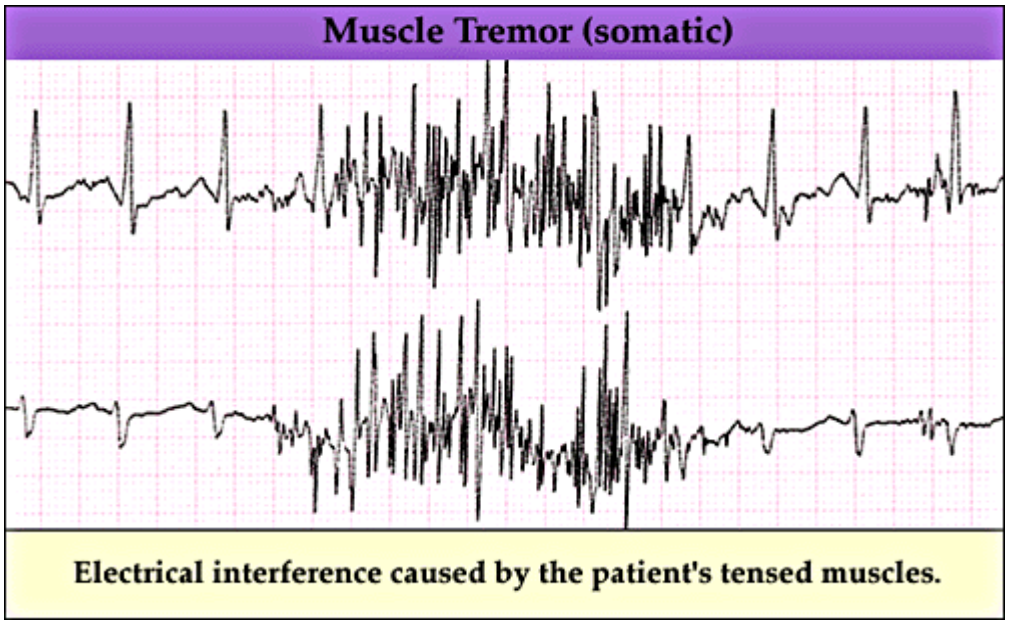
Causes of artifact can be:

- Poor application of ECG electrodes (dried out gel, air trapped under electrode & patient hair preventing good skin contact.
- Patient movement.
- Electrical interference.
- Cable movement

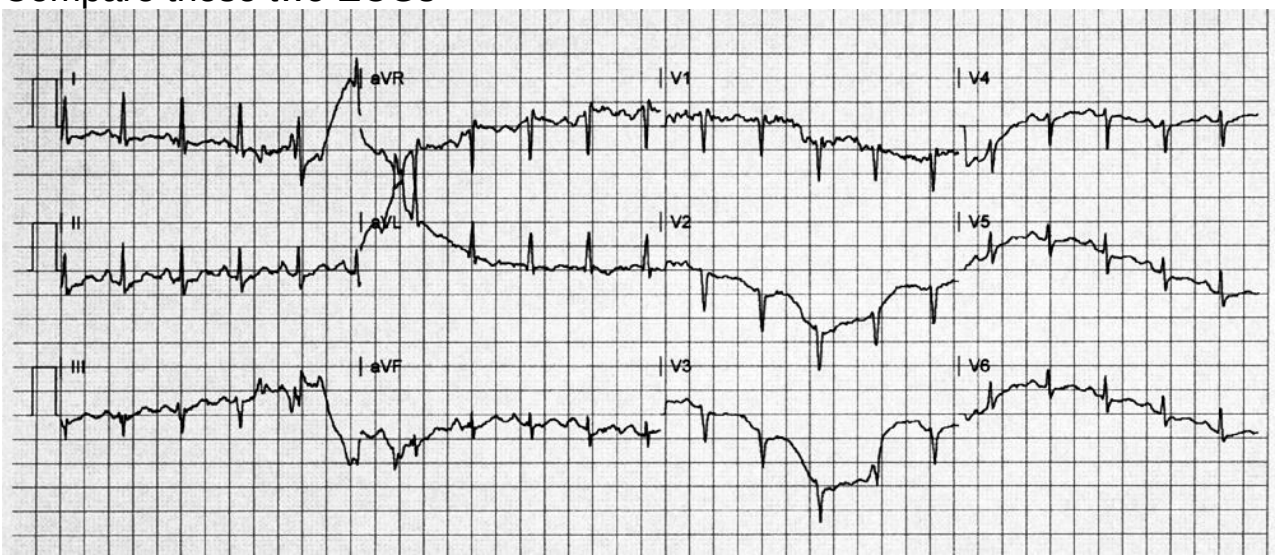
The following ECG demonstrates what can happen with poor preparation

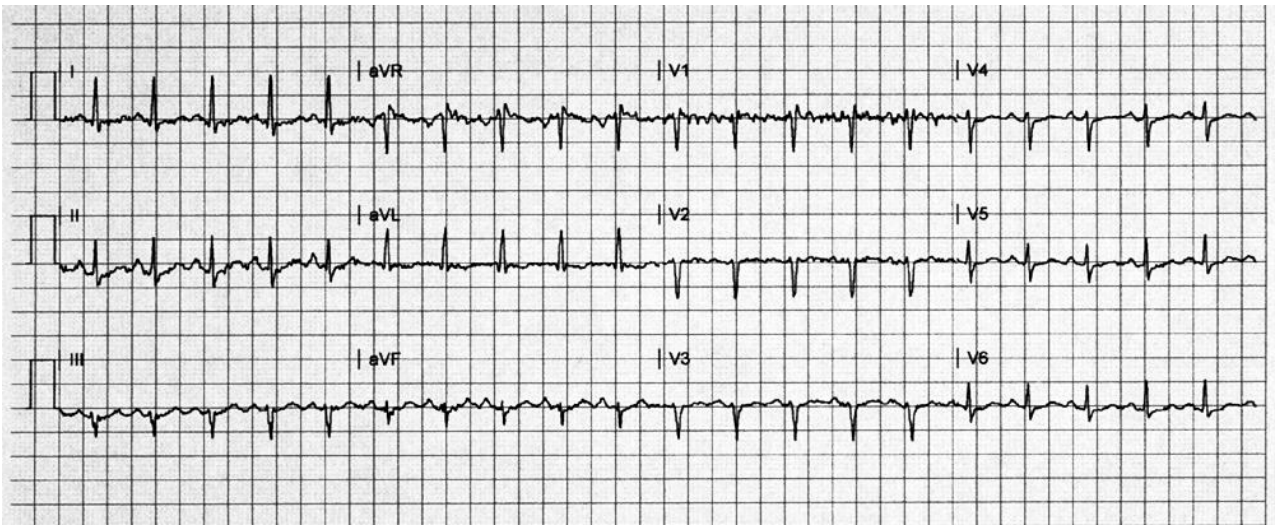


This ECG has a wandering baseline in V1, V4 & V5 and no data from V6
The wandering baseline can be caused by many factors such as poor skin prep or cable/patient movement.



Compare these two ECGs





Note how the baseline straightened out by simply repositioning the patient cables and clipping them onto the sheet.

Other Causes of Artefact

Once the skin has been prepped and the electrodes applied, there are still other sources of artefact to consider.

- Patient movement

- Cable movement
- Electro magnetic interference (EMI)

Electro Magnetic Interference (EMI)

Strategies

- Move away from AC equipment-fans, pumps, monitors, televisions
- Ensure cables do not touch
- Do NOT switch off infusion pumps without checking with patient's nurse
- Move away from areas with electrical "noise"

In addition to the above mentioned suggestions it is advisable to examine the patient cables for cracks or damage.
When using the monitor powered by AC, it can be helpful to switch to battery power.

Goals for taking an ECG

Clear

- Little or no artefact

Accurate

- Once a clear ECG has been obtained (free of excess artefact and has a steady baseline), it may then quickly be examined to confirm accuracy.

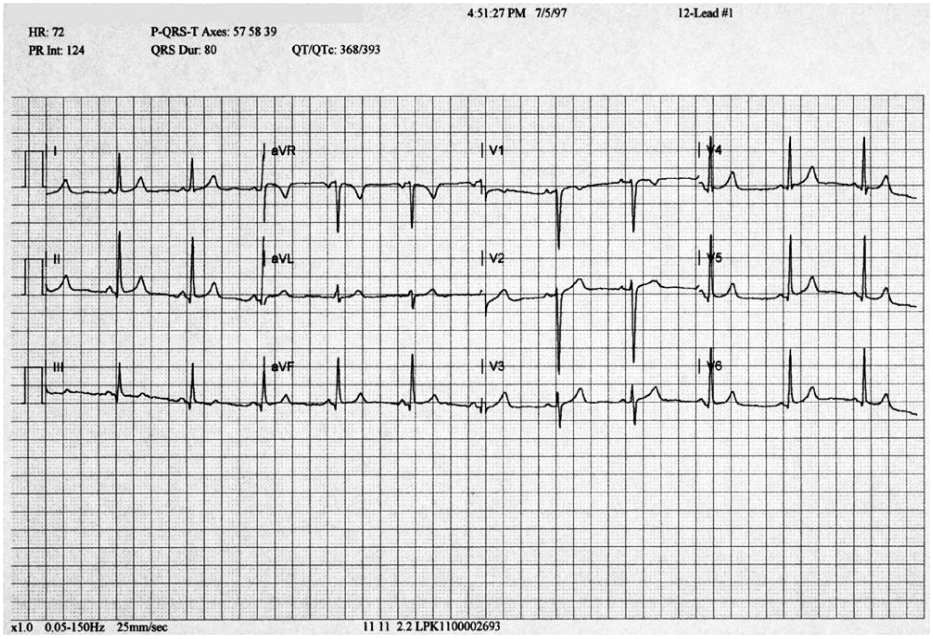
Look for:

- Negative aVR (complex points downwards)
- One complete cardiac cycle in each lead

- Correct calibration (10 mv)
- Appropriate speed-25mmsec/mv

Fast
The sooner a diagnosis can be made the sooner the patient receives appropriate treatment

A Good Quality ECG



Following the Procedure

- Remove the electrodes and wipe away traces of gel
- Ensure the patient is warm, comfortable and nightwear back in place
- Leave ECG machine plugged in to recharge internal battery
- Replace stocks of electrodes if required
- Lower the bed if necessary

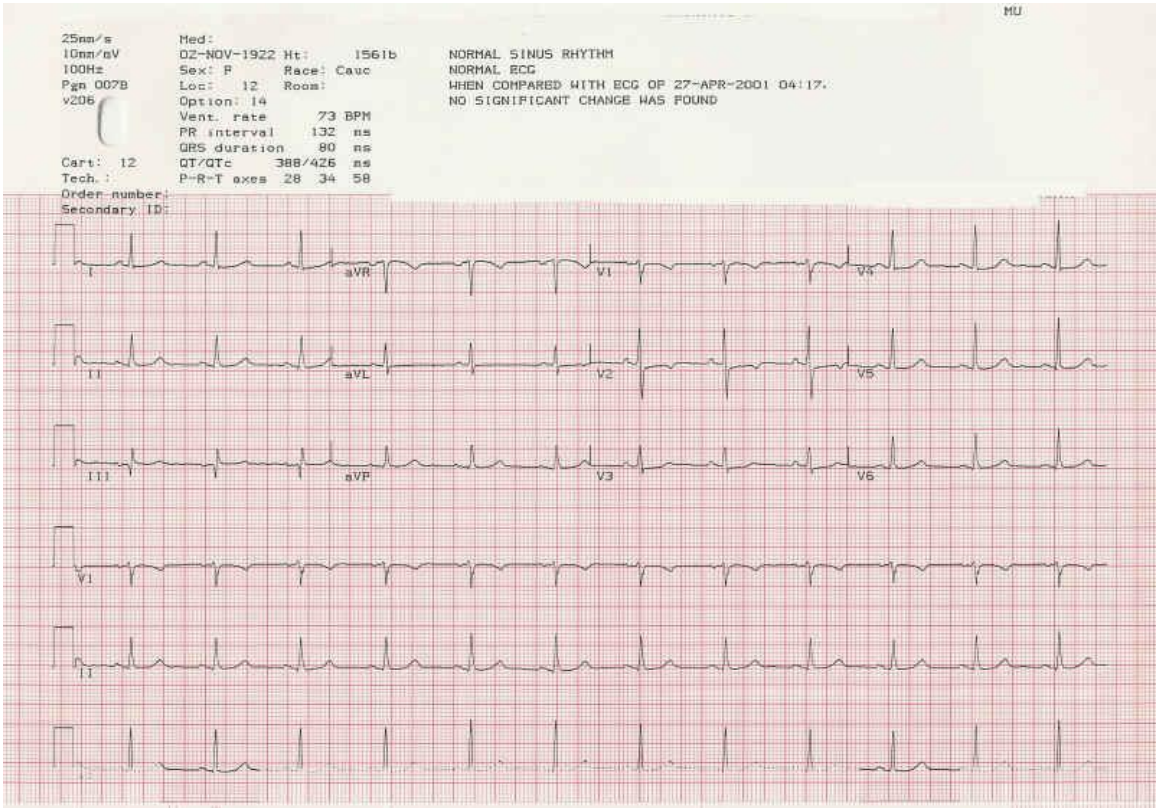
- Store cables neatly. Do not tie together as this can crack the insulation

- Remember to label ECG if details not added on ECG machine
  - **NAME**
  - Hospital number
  - Date,
  - Ward
  - Number the ECG if it is in a sequence

- Reason for ECG (chest pain, irregular pulse, low B/P)

- Show the ECG to a doctor or qualified nurse

- If ECG is a routine ECG file appropriately in the patient's file



An ECG without a name and date is useless

Remember!
Show the ECG to a registered nurse or a doctor for interpretation

References

Clinical Guidelines by Consensus-Recording a standard 12 lead Electrocardiogram:An Approved Methodology-The Society for Cardiological Science & Technology. British Cardiovascular Society October 2006

Special Thanks to:
Margaret Richens, Senior Staff Nurse, Coronary Care Unit