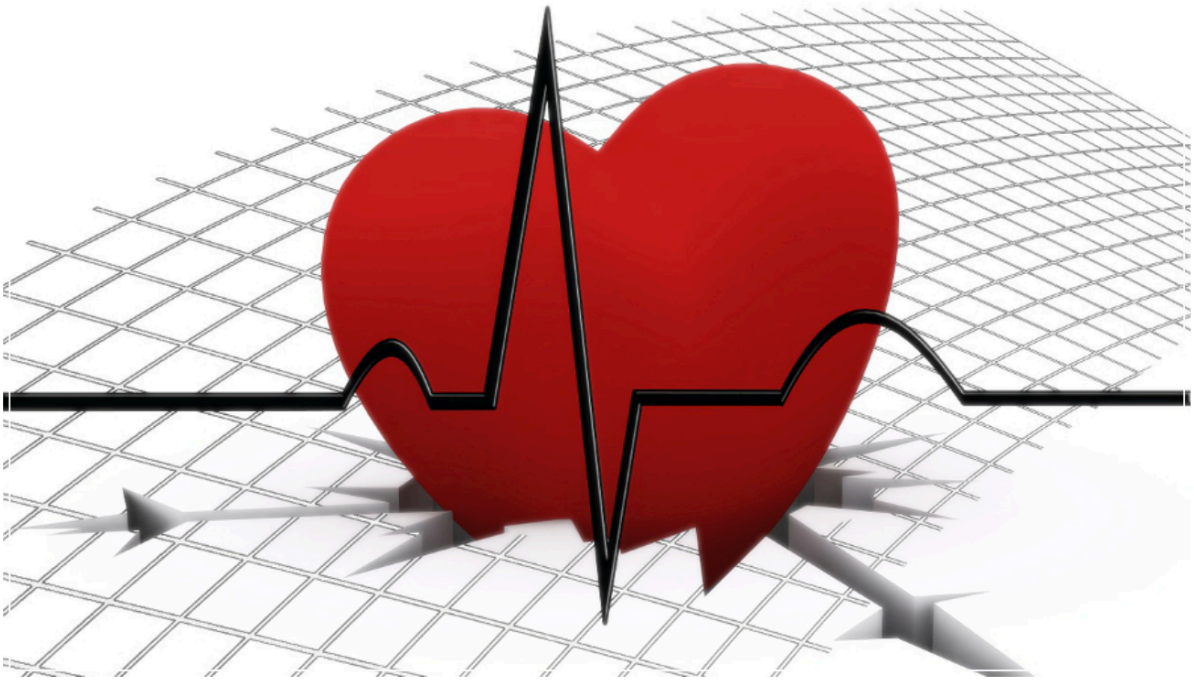


Acquiring the PERFECT 12-lead ECG.

PUBLISHED ON *December 21, 2016*

Here are some tips and practice guidelines to help you run off the perfect 12-lead ECG.

Operator-related Factors

Become familiar with the working of your particular type of 12-lead ECG machine. Before taking any ECG be sure to verify the paper speed (standard 25mm/s), calibration (standard is 1 mV=10mm), and frequency response (filtering on/off). All of which can result in non-standard distortions to the final waveforms.

Cables.

Worn cables may lead to signal loss or excessive artefacts.
Leads should be regularly checked and replaced if necessary.

Key Points:

Incorrect electrode placement may lead to misleading information on the ECG.
The *Mason-Likar* limb lead positions should be avoided.
Lead placement (and pt positioning) should be identical for subsequent ECGs on any individual patient.
12-lead ECG should be acquired with pt in supine position when possible.

Patient data.

Modern ECGs will require entering patients correct age and sex in order to deliver any accurate analysis on the printout.
Every ECG must be identified with the patient's name, DOB and medical record number.

Skin preparation

If there is excessive hair, removal is a necessity for good electrode contact. Use clippers not shaving razor to minimise risk of infection.

Each electrode target area should be cleaned with an alcohol swab to remove any oils from the skin.
To improve contact it can then be rubbed *vigorously* with a piece of 4× 4 inch gauze to remove residual alcohol and debride dead skin particles.

Patient positioning.

Different positions of the patient will result in the movement of the hearts position relative to the chest leads.
12-Lead ECGs should be performed in the supine position whenever possible.

The recumbent (semi-Fowler) position is also acceptable.

Subsequent ECG's on the same patient should be performed in the same position (write it on the ECG).

Artefact:

Tips to help avoid artefact from pt tremor or electrical interference include:

- Placing pt in supine position.
- Make sure pt is relaxed and comfortable as possible. This includes making sure pt is warm enough and that they are not lifting their head to see what is going on.
- If there is a tremor in the arms ask pt to place palms face down on the bed and wiggle their hands under their buttocks and then relax.
- Make sure there is no mobile phones (including your own) or other electrical equipment nearby.
- Ensure pt is not touching metal bedrails etc.

Limb leads.

The practice of placing limb leads on the upper anterior chest wall (or on the shoulders) and lower abdomen is known as the *Mason-Likar lead position.*
This lead position should be avoided as it may result in distorted ECG morphology (it may alter ST segment falsely indicating infarction or ischaemia).

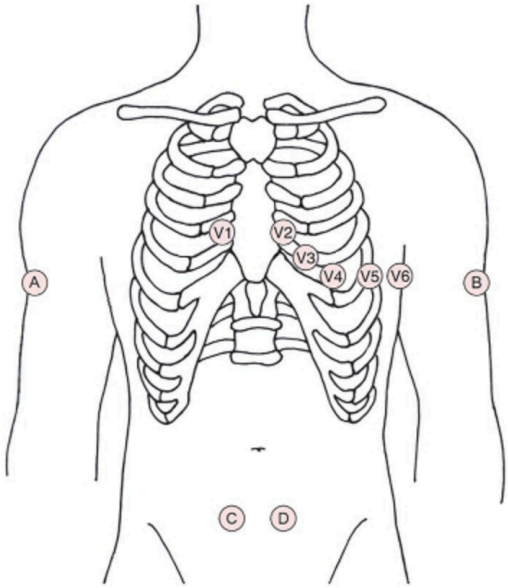
While the AHA acknowledges that rhythm diagnosis is not adversely affected by lead placement on the torso, tracings that use this position differ significantly from the standard 12-lead ECG. Specifically, "electrodes placed on the trunk do not provide standard limb leads, and distortion of the central terminal alters the augmented limb leads and the precordial leads." Differences in QRS morphology and repolarization may then lead to false-negative and/or false-positive infarction criteria. – (prehospitalfoam.wordpress.com 2016)

Correct positioning of limb leads should be: on the arms distal to the shoulders and on the legs distal to the hips. Avoiding wrists and ankles when possible.

OR

The arm electrodes can be placed on the mid-arm, on the lateral aspect of the biceps, immediately below the V4 horizontal line [A & B on diagram below].
The leg electrodes can be placed on the abdomen 7.6 cm below the umbilical horizontal line, and 5 cm on either side of the umbilical vertical line. The distance between these two electrodes to be 10 cm [C & D on diagram below].

Reference for this method – https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4463488/



If patient has limb amputations, the best achievable limb lead patient should be mirrored on the non-affected side.

Chest leads.

Correct placement of the precordial leads is critical to ensure correct ECG morphology.

Identification of the forth intercostal space (ICS) is especially important and studies have shown that nurses commonly end up with superior (that's as in inappropriate, not as in excellent) lead placement. This can result in false myocardial injury patterns.

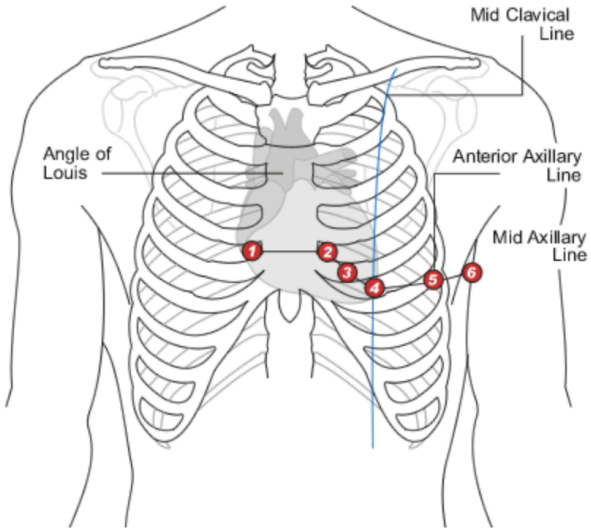


Image via: https://goo.gl/JN8O2s

The angle of Louis, which is adjacent to the second rib, and the second ICS, which is just below the second rib, are located.

2. Once the second ICS has been located, the operator can palpate down the chest wall adjacent to the sternum until he or she arrives at the fourth ICS.

3. When the operator is facing the patient, the electrode for V1 is placed in the fourth ICS to the left of the sternum (patient's right) and the electrode for V2 is placed in the fourth ICS to the right of the sternum (patient's left).

4. The next electrode placement is V4, which is located in the fifth ICS in the midclavicular line on the patient's left precordium.

5. The electrode for V3 is then located midway between the electrodes for V2 and V4.

6. The remaining 2 electrodes for V5 and V6 are located in a straight line from V4. The electrode for V5 is located in the anterior axillary line, even with V4, and the electrode for V6 is located in the mid-axillary line, even with V5.

Breasts:

ECG electrodes should be placed UNDER the breast as close to the chest wall as possible.

Because the emergency department is the gateway into the hospital during an ACS episode, it is essential for emergency nurses to be the "experts" in the acquisition of the 12-lead ECG. Emergency nurses should also serve as the quality-control monitors to identify ECGs obtained in a nonstandard fashion. In doing so, nurses perform their highest function as advocates for high-quality patient care and safety. (–Garcia 2016)

References

1. Khan, Gabriel M. 2016. "A New Electrode Placement Method for Obtaining 12-Lead ECGs".
   Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4463488/
2. Kligfield, P., L. S. Gettes, J. J. Bailey, R. Childers, B. J. Deal, E. W. Hancock, and G. van Herpen et al. 2016. "Recommendations for The Standardization and Interpretation Of The Electrocardiogram. Part I: The Electrocardiogram and Its Technology. A Scientific Statement from The American Heart Association Electrocardiography And Arrhythmias Committee, Council On Clinical Cardiology; The American College Of Cardiology Foundation; And The Heart Rhythm Society. Endorsed By The International Society For Computerized Electrocardiology".
3. "Settling an Argument: Prehospital Limb Lead Placement". 2016. *Prehospitalfoam*. https://prehospitalfoam.wordpress.com/2015/01/02/settling-an-argument-prehospital-limb-lead-placement/.

4. T, Garcia. 2016. “Acquiring The 12-Lead Electrocardiogram: Doing It Right Every Time. – PubMed – NCBI”. *Ncbi.Nlm.Nih.Gov*. https://www.ncbi.nlm.nih.gov/pubmed/25959896.

Ian Miller