



Clinical Guidelines by Consensus

Recording a Standard 12-Lead Electrocardiogram

**An approved method by the
Society for Cardiological Science & Technology
(SCST)**

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1. Change history

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1	Feb 2010	Consensus	Standardisation of practice	Yes: SCST Council
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2. Introduction

The resting 12-lead electrocardiogram (ECG) is an important first line investigation that records the electrical activity of the heart. This investigation can aid the diagnosis and help define the appropriate patient treatment pathway in a range of cardiac conditions, many of which are life threatening and require immediate action.

Modern ECG machines are portable, low cost and easy to use and these features facilitates recordings in a wide variety of environments including hospitals, GP surgeries, ambulances, sports facilities and patients' homes. The challenge is to ensure high-quality, consistent recording techniques are maintained irrespective of the clinical scenario. ECGs not performed to appropriate standards can result in incorrect diagnoses and inappropriate treatments¹⁻⁷. There are many personnel recording ECGs who have not been properly trained or assessed⁸. Personnel may consider themselves competent^{9, 10}, despite a lack of training, and yet lack essential knowledge in ECG recording technique that results in incorrect ECG recording¹¹⁻¹⁴.

Evidence indicates that appropriate training leads to fewer ECG recording errors¹⁵. While these guidelines generally apply to the hospital/clinical environment, where most ECGs are performed, the training of personnel and technical aspects of the performance of a standard ECG apply to all situations. SCST recommends that all personnel who record ECGs are appropriately trained, assessed and qualified.

These guidelines provide essential information pertinent to the correct ECG recording technique in keeping with good scientific practice¹⁶. They are written by expert practitioners following critical evaluation of published evidence. Where evidence was limited a consensus decision was made.

3. Purpose

In promoting excellence in the recording of 12-lead ECGs, these guidelines address the following areas:

- Patient experience, privacy and dignity
 - Patient identification
 - Communication & Informed consent
 - Chaperone
 - Level of undress
- Patient preparation
 - Patient position
 - Skin preparation
- Electrode placement:
 - Limb electrode positions
 - Chest electrode positions
 - Technique for locating chest electrode positions
- Obtaining a good quality recording
 - Paper speed
 - Use of the filter
 - Variation from standard
 - Amplitude gain
- Qualification requirements for practitioners
- Equipment and clinical room specification
 - Equipment
 - Environment
 - Infection control
- Documentation, processing, storage and confidentiality of 12-lead ECG recordings
- Special situations

4. Patient experience, privacy and dignity

It is vital that patient experience is placed at the centre of the process and to ensure that the patient's perception of the process is positive¹⁶.

4.1 Patient Identification

It is essential that the patient undergoing the procedure is correctly identified.

For patients unable to provide their own identifying details confirmation of identity must be sought from carers or by using hospital wristbands.

The printed recording must always be checked to ensure it bears the correct patient details. Practitioners must be aware of potential sources of error if details are not entered digitally for every patient e.g. some machines retain the

information from the last patient and these may be incorrectly printed on the ECG if they have not been altered. Local policy and practice should be developed to ensure that errors do not occur in busy clinical environments. It is recommended that at least two unique patient identifiers are confirmed e.g. date of birth and address.

4.2 Communication and informed consent

The patient should be given clear, precise information in a format that is consistent with their needs and level of understanding. Information can be in the form of a booklet, information letter or oral explanation or a combination. As a minimum, SCST recommends the person performing the procedure should introduce themselves, explain their role and provide a brief overview of the procedure. If possible, this should include the level of undress involved and the use of adhesive electrodes, with a reassurance that the procedure is brief and painless. Informed consent is required in accordance with local policy before proceeding.

4.3 Chaperone

In accordance with good clinical practice, patients undergoing examinations that have the potential to be embarrassing or distressing should have the option of having a chaperone present¹⁷. The chaperone should usually be a health professional and must have knowledge of the standard practice of recording a 12-lead ECG. Patients may also request a relative or carer to be present. If the practitioner or the patient declines an examination without a chaperone present, or if either is uncomfortable with the choice of chaperone, an offer may be made to defer the examination to a later date when a suitable chaperone would be available, if the delay would not adversely affect the patient's health¹⁷.

4.4 Level of undress

Practitioners should respect the cultural sensitivities of the patient and minimise embarrassment¹⁸. Patients may feel uncomfortable being touched on their upper torso; practitioners must act in a sympathetic, caring and compassionate manner.

Patients should be asked to remove all clothing impeding access to the correct chest electrode positions. Normally this will involve undressing above the waist. Patients should be allowed to undress in a private environment with minimal risk of interruption. Once the cables have been attached to the electrodes the patient should be covered to preserve his/her modesty. The practitioner should make every effort to ensure the patient is comfortable and relaxed to minimise artefact on the ECG recording. Clinical discussions with the patient should only take place after re-dressing.

5. Patient preparation

Whilst it is recognised that 12-lead ECGs are performed in a variety of contexts, environments and states of urgency, attempts to achieve best practice and standard electrode positioning should always be made.

5.1 Patient position

Many patients are uncomfortable lying flat, so for consistency and practicality, a semi-recumbent position of approximately 45 degrees is recommended. Any significant variation from this position should be documented on the ECG recording. The limbs should be supported by the bed/couch to minimise artefact due to muscle tension.

The ECG appearance can be affected by the angle of incline of the torso at the time of recording. An ECG recorded from a patient in a supine position may vary significantly from one recorded with the patient in an upright position^{19, 20} or inclined at 60 degrees or greater to the horizontal²¹. There is no evidence that variation of the inclination of the patient between horizontal and 45 degrees to the horizontal has any significant effect on the ECG.

Time should be taken to ensure that the patient is relaxed and comfortable. If these conditions are not satisfied the ECG may record somatic muscle potentials as well as cardiac activity and will make the ECG more difficult to interpret and potentially limit clinical value. Some patients cannot relax fully because of painful conditions such as arthritis, or they may have a condition such as Parkinson's disease which causes a tremor. These patients should be made as comfortable as possible and the ECG trace annotated with an appropriate explanation if it is suboptimal quality. Before recording the ECG, checks should be made to ensure the patient's limbs are still and appear relaxed. If the patient has clenched fists or stiff arms or is moving his/her fingers, it will not be possible to obtain a high-quality ECG.

5.2 Skin preparation

Skin preparation is often required to help produce an artefact-free ECG. Care must be taken with patients who have sensitive or broken skin. There are various ways to minimise the skin-to-electrode impedance, for example:

- The skin may require cleansing. There are a variety of methods, including washing with mild soap and cleaning
- Exfoliation may be required and should be undertaken with very light abrasion using a paper towel, gauze swab or proprietary abrasive tape designed for this purpose
- Chest hair may need to be removed to ensure adequate contact with the skin. Oral consent should be obtained from the patient and a battery-

operated razor with a single use blade or a single use razor should be employed and disposed of in a sharps bin immediately afterwards

6. Electrode placement

Electrodes must be positioned in accordance with AHA recommendations²²⁻²⁴.

If any of the electrodes are to be sited in non-standard positions the recording must be labelled with this information to avoid misinterpretation of altered ECG waveforms²⁴⁻²⁸.

ECG cable connections are usually colour coded to aid identification. However, colour may vary depending on manufacturer. The colours detailed in this document comply with European (IEC) recommendations.

Note on electrode care: disposable electrodes should be checked to ensure they are not outside the 'use by' date specified by the manufacturer and that they are in good condition. It should be verified that the core of 'wet-gel' electrodes has not dried out. Electrodes should be kept inside the foil packaging to prevent dehydration of the gel.

6.1 Limb electrode positions

Limb electrodes should be placed proximal the wrists and ankles whenever possible. Moving the electrodes up the limbs may alter the appearance of the ECG and should be avoided unless there is a significant tremor or a limb has been amputated.

Note: Limb electrodes must not be placed on the torso since this causes significant alteration to wave amplitudes. This can invalidate the use of the recording for many diagnostic purposes^{25, 29}.

Limb electrode positions:

Right arm limb lead (RA, red) – right forearm, proximal to wrist

Left arm limb lead (LA, yellow) – left forearm, proximal to wrist

Left leg limb lead (LL, green) – left lower leg, proximal to ankle

Right leg limb lead (RL, black) – right lower leg, proximal to ankle

6.2 Precordial (chest) electrode positions

The correct anatomical positions for the chest electrodes have been defined²² (see figure below) and must always be used unless access is not possible. The centre of the active area of the electrode should be aligned with the relevant anatomical landmark.

Precordial (chest) electrode positions:

V1, red (C1) – Fourth intercostal space at the right sternal edge

V2, yellow (C2) – Fourth intercostal space at the left sternal edge

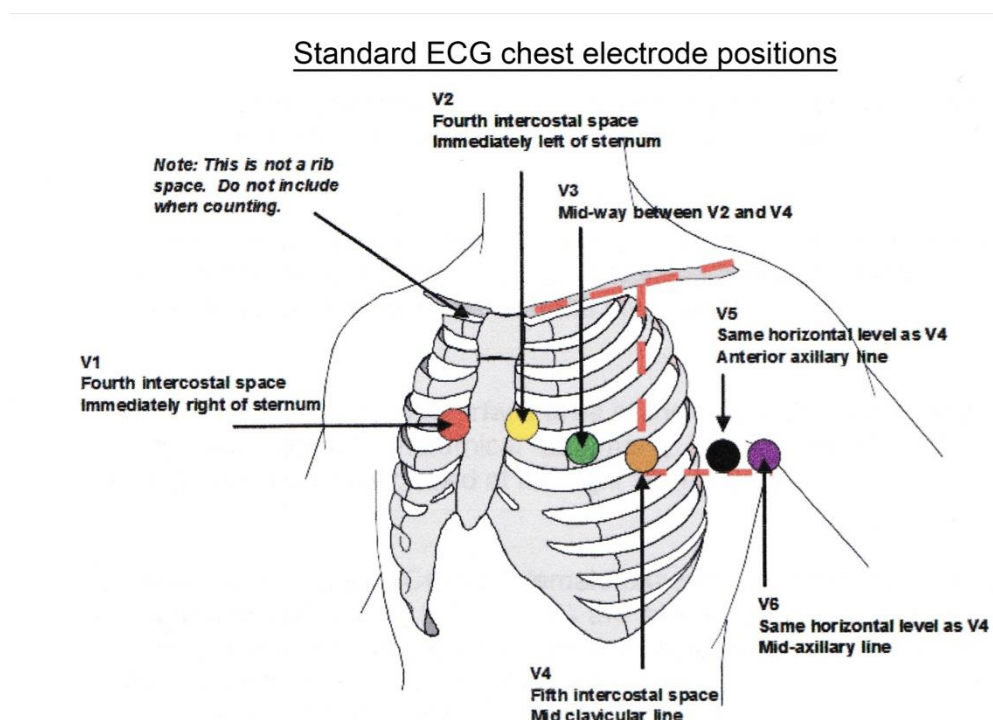
V3, green (C3) – Midway between V2 and V4

V4, brown (C4) – Fifth intercostal space in the mid-clavicular line

V5, black (C5) – Left anterior axillary line at the same horizontal level as V4

V6, purple (C6) – Left mid-axillary line at the same horizontal level as V4 & V5

Studies have demonstrated that the V1 and V2 electrodes are frequently placed too high and the V4, V5 and V6 electrodes too low^{13, 30, 31, 32}. These errors can result in diagnostically misleading alterations to the ECG waveform³³.



6.3 Technique for locating chest electrode positions

Accurate identification of the appropriate intercostal spaces should begin with location of the manubriosternal joint, also known as the angle of Louis.

- To locate the angle of Louis a finger should be run down the sternum from the top until a bony horizontal ridge is met. Sliding the finger down and to the right side will locate the second intercostal space. From here it is possible to count down to the third and fourth intercostal spaces. In the fourth space, the finger should be slid towards the sternum until the edge is felt. This is where the centre of the V1 electrode should be placed.
- This procedure should be repeated on the left side to correctly position the V2 electrode. (Note that the left and right sided rib spaces may be offset, so practitioners should avoid placing V2 adjacent to V1 without counting the rib spaces).
- Next, the V4 electrode should be placed in the 5th intercostal space in line with the mid-point of the clavicle.
- The V3 electrode should then be placed mid-way between the V2 and V4 electrodes.
- The V5 and V6 electrodes should then be positioned in horizontal alignment with the V4 electrode. The V5 electrode should be placed on the anterior axillary line; the V6 electrode should be placed on the mid-axillary line.

When recording an ECG from female patients it is convention to place the V4, V5 and V6 electrodes beneath the left breast when breast tissue overlies the correct anatomical positions. There is some evidence to suggest that the positioning of these electrodes over the breast may not significantly attenuate the signal^{33, 34} but further supporting evidence is needed to warrant a change in this recommendation.

When lifting the breast to place electrodes, care and sensitivity is required. Using the back of the hand to lift the breast can be helpful in minimising contact.

To achieve accurate ECG electrode positioning, it is usually necessary for all upper torso clothing to be absent.

Note: If positioning varies from the recommended positions it is essential that this is documented on the ECG recording, including electronically stored ECGs.

7. Obtaining a good quality recording

A 12-lead ECG and simultaneous rhythm strip is most commonly recorded at 25mm/s with a gain setting of 10mm/mV. The appropriate button should be pressed to initiate a recording; this is usually labelled as 'start' or 'auto'.

Standard ECG recording settings:

Paper speed – 25mm/sec

Voltage gain – 10mm/mV

All filters should be 'off' for the initial attempt to record an ECG. The low-pass filter will reduce interference but it also distorts the ECG³⁵, so should only be used when necessary and only after all attempts to eliminate the interference have failed.

If, despite efforts to relax the patient and make them comfortable, there is somatic muscle interference on the ECG, the filter may be switched on and the recording repeated. Use of the filter should be clearly identified on the final ECG.

Use of the filter (in auto mode):

Initial recording – filter off – recording made at 0.67 - 150Hz

Evidence of somatic muscle interference:

Repeat recording – filter on – recording made at 0.67 - 40Hz

The filter reduces interference but also distorts the ECG

Any features on the ECG that might indicate the need for urgent medical attention should be brought to the attention of appropriate staff. If the patient has any symptoms of possible cardiac origin, such as chest pain, palpitations or dizziness, at the time of recording, then this should be noted on the ECG.

Confirmation that an ECG of good quality has been recorded should be made by the practitioner. The recording should be assessed to ensure that all waveforms (such as P waves, QRS complexes and T waves) are clearly visible. The isoelectric line (the baseline between ECG deflections) should be stable, not wandering, and free of interference

At the end of the procedure, all the electrodes should be removed from the patient and disposed of as clinical waste.

Note: Incorrectly pressing 'copy' or 'reprint' may on some models of ECG machine initiate a printout of an ECG from a previous patient³⁶. If patient details are not entered into the machine it may not be clear that this ECG relates to a previous patient. Practitioners must fully understand the equipment they are using and the potential consequences of mistakes. Local practice guidance must minimise the chance of an identity or recording error occurring in this way.

7.1 Variation from standard

If ECG complexes are of such high amplitude that they overlap, then the gain may be adjusted to 5mm/mV to enable clearer visualisation of the complexes and more accurate measurements to be made. Any alteration to the gain settings should be clearly marked on the ECG.

On occasions, it may be necessary to adapt the recommended ECG recording techniques. For example, patients in wheelchairs may need to remain in their wheelchair during the recording process. Any variations to standard recording techniques should be described clearly on the recording for hard copy and electronically stored ECGs.

8. Qualification and training of staff recording 12-lead ECGs

The practitioner must be competent in the use of the electrocardiograph and in the recording of an ECG¹⁰. This should be demonstrated by the possession of a recognised qualification, such as one of those awarded by the Society for Cardiological Science and Technology, including:

- Award in Practical Electrocardiography
- Certificate in Electrocardiography

It is essential that competence in the recording of an electrocardiogram be maintained and this should be demonstrated by periodic review.

9. Equipment and clinical room specification

The room and equipment should be clean and orderly with all waste from previous investigations disposed of in line with local policy and guidance.

Equipment should be safe and ready to use with correct date and time settings. A visual inspection should be performed prior to use to ensure that mains leads, cables and connectors are intact with no evidence of fractures, faults or insulation damage.

For battery-operated machines, the battery will need to have sufficient charge. It may be useful for a mains-powered ECG machine to have an easily

distinguishable plug if it is to be used in environments where several items of vital equipment are plugged into wall sockets e.g. intensive care units.

9.1 Equipment specification

The electrocardiograph must meet or exceed the requirements of International Electrotechnical Commission standards IEC 60601-2-25:2015 which establishes requirements for safety, including essential performance of recording and analysing single channel and multichannel electrocardiographs.

The device should be pre-programmed in accordance with the American Heart Association (AHA) specifications²² as follows:

- To avoid distortion of the ST segment the low-frequency cut-off should be no higher than 0.67Hz in 'auto' mode or 0.05Hz in 'manual' mode.

Note: Digital filter design allows for a low-frequency filter level of 0.67Hz when recording in 'auto' mode. However, this may cause ST segment distortion when this setting is used in 'manual' mode. Fixing the low frequency setting at 0.05Hz in the pre-set should prevent this error occurring.

- To prevent the loss of high frequency information the high frequency cut-off should be no lower than 150Hz in adults and adolescents and no lower than 250Hz in children
- Disposable tab electrodes must meet or exceed the requirements of the American National Standards Institute/Association for the Advancement of Medical Instrumentation (ANSI/AAMI) EC12:2000(R)2015, which establishes minimum labelling, safety and performance requirements for disposable electrodes used for diagnostic electrocardiography

Recommended recording bandwidths pre-stored in ECG device setup:

'Auto' mode	0.67 – 150Hz
'Manual' mode	0.05 – 150Hz
Mains filter	off

9.2 Environmental considerations

The environment in which a 12-lead ECG is recorded may contribute considerably to the quality of the patient experience and output. As far as possible the environment should be:

- Safe
- Private: walled, curtained or screened
- Quiet
- Comfortable
- Accessible for disabled and able-bodied patients and staff
- Furnished with a height adjustable couch accessible from both sides
- Stocked appropriately, with battery operated razor with a single use blade (or a single use razor), electrodes, ECG paper, etc.
- Clean, with appropriate hand-cleaning and clinical waste facilities

9.3 Infection control

Appropriate measures to minimise the risk of infection transmission must be undertaken in accordance with local policy.

Hands should be washed³⁷ with soap and water or cleansed with alcohol gel, as per local policy, before and after any contact with a patient. It may be reassuring to patients if this is done in their presence.

For patients requiring high levels of infection control precautions, personal protective equipment such as gowns and gloves must be worn in accordance with local policies.

Appropriate clinical waste disposal facilities should be available including sharps bins for the disposal of the single-use blade for a battery-operated razor or a single use razor.

10. Documentation, processing, storage and confidentiality of ECG recordings

The ECG should be correctly labelled with the patient's identification, relevant clinical details and any variations to the normal recording conditions. ECG recordings that are digitally stored should be accompanied by the following identifiers to ensure accurate retrieval of clinical data and allow audit:

- Patient's first name and surname (formatted and spelled correctly)
- Patient's date of birth
- A unique identifying number if available
- The name and position of the referrer
- Identity of the person making the recording of the ECG
- Date and time of the recording
- The name of the institution
- Alterations from standard lead positions must be noted (section 8.1)

Typically, the electronic storage of ECG recordings is made by compressing data. This can speed up the transmission and retrieval of records that are stored in central databases and minimise the memory required for storage.

Data compression affects high frequency (short duration) signals more than the smoother low frequency (longer duration) signals. Therefore, compression has greater potential to alter measurements within the QRS complex, such as pacemaker 'spikes', Q-wave duration and R-wave amplitude, than to alter other signals such as the ST segment and the T-wave. A non-compressed ECG may differ from its compressed version. This has the potential to affect the comparison of serial ECGs when retrieving ECGs from storage media.

For the electronic storage of ECGs, it is recommended that compression algorithms should perform in a manner that allows retrieved data to adhere to the fidelity standards established in the 1990 AHA statement with reference to the original signal³⁸.

All information pertaining to the patient should be treated in a confidential manner in accordance with local policies and national guidelines on data protection³⁹.

11. Audit

Audit is a recognised way of assessing and improving practice. The appendix contains a useful checklist intended for use and an audit tool. This checklist can be used to assess how well the guideline is being followed. It may also be used to ensure that any local guidelines developed from this consensus document meet the requirements for competent service delivery.

12. Special situations

12.1 Dextrocardia

Dextrocardia is the most common form of cardiac malposition and refers to any situation where the heart is located within the right side of the chest rather than the left. It may be associated with the condition situs inversus where other organs are in a mirror image relation to the usual position.

Dextrocardia may be suspected if a resting 12-lead ECG reveals negative P waves and QRS complexes in lead I in the absence of any technical error such as reversal of the right and left arm connections. Poor R-wave progression observed in leads V1 through V6 supports this interpretation.

A second ECG should be recorded with the chest electrodes (V3 to V6) positioned on the right side of the chest using the same intercostal spacing and anatomic landmarks as previously described but on the right side. V1 and V2 should remain in the usual position.

This approach should provide a 'true' ECG representation. The limb lead complexes will continue to appear inverted, demonstrating the abnormal location of the heart. However, the repositioned chest leads (V3R to V6R) will now show appropriate R-wave progression.

There should be clear annotation on the recording to describe the repositioned electrodes, for example "V3R", "V4R" etc.

An alternative approach is to swap the right and left arm connections. This will 'normalise' the appearance of the limb leads. If this approach is preferred it is imperative that the ECG be very clearly annotated to prevent the possibility of dextrocardia being overlooked.

In dextrocardia:

Initial recording	–	standard positioning
Repeat recording	–	right-sided chest leads V3R to V6R
Annotate ECG clearly		

12.2 Posterior electrode positions

For some clinical situations recordings should be made from posteriorly positioned electrodes.

Posterior electrodes are placed in the same transverse plane as V4

Posterior electrode positions:

V7 (C7) – Left posterior axillary line at the same horizontal level as V4

V8 (C8) – Left mid-scapular line at the same horizontal level as V4

V9 (C9) – Left spinal border at the same horizontal level as V4

Annotate ECG clearly

In the absence of an ECG machine/device with the ability to record a 15-lead ECG, it is recommended that a standard 12-lead ECG be recorded first. Subsequently V4, V5, and V6 should be repositioned as V7, V8 and V9 and a second recording made showing these posterior leads. The second recording must be clearly annotated with the new lead positions.

Right-sided posterior electrode positions are in the same anatomical positions but on the right side and are annotated V7R, V8R and V9R.

12.3 Electrocardiography on children

A patient and gentle approach is recommended to obtain an artefact-free ECG from children. The standard recording method is identical to that described for adults.

If possible, the recording should be made with the child semi-recumbent, but the sitting position may be used if this will prevent restlessness or distress.

The four limb electrodes are attached as previously described in section 6.1.

The chest electrodes are normally positioned as previously described (section 6.2) but additional leads, such as V4R, V5R and V7, may be recorded at the request of a clinician or according to local policy. V4R and V3R are right-sided leads recorded from electrodes placed in a mirror image position to the V3 and V4 positions. V7 is a posterior lead with the electrode placed in the posterior axillary line in the same horizontal plane as the V4 electrode.

The routine use of right-sided chest leads when recording ECGs from children is variable but it is common for V4R to be used and V3 to be omitted in infants (up to 1-year old). Practice is determined largely by the indications for the ECG and clinician preference.

13. Conclusion

Consideration of the patient undergoing any diagnostic investigation must be at the centre of all clinical pathways and meticulous patient preparation, precise electrode placement, and the other factors described in this document are essential in the provision of accurate diagnostic information. It has been estimated that 300 million ECGs are performed each year in Europe⁴⁰ in a wide range of environments. Hence, it is of paramount importance that the recording of an ECG is undertaken by appropriately trained and qualified practitioners to ensure that high-quality consistent care and patient safety are upheld irrespective of where and by whom the procedure is performed.

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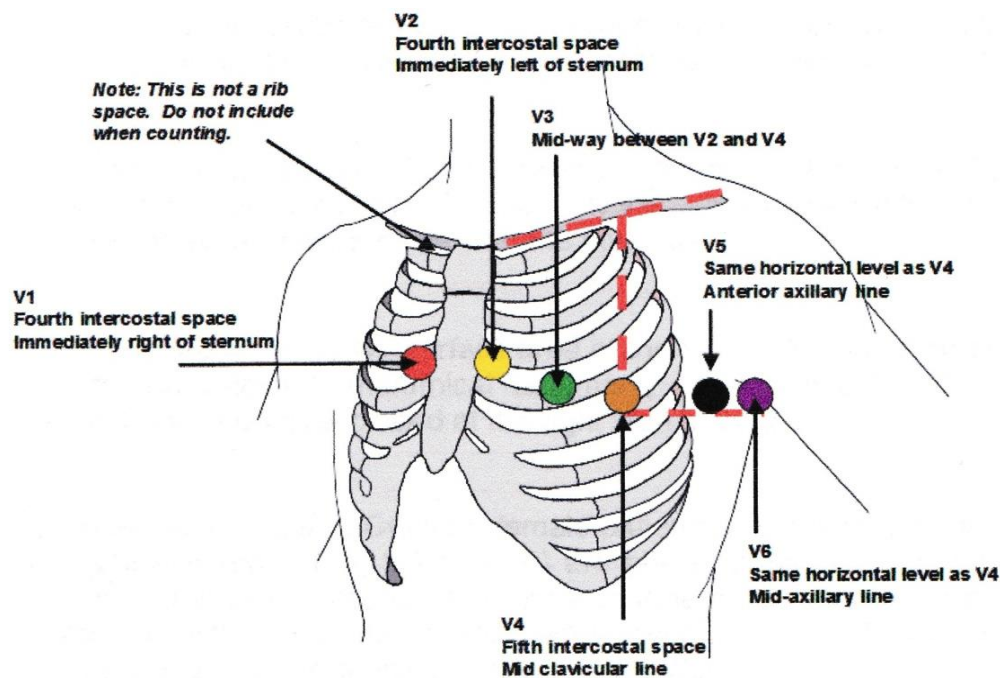
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15. Appendix 1: 12-lead ECG Service Audit Tool

Quality indicator	Yes	No
(1) Qualification & Training		
Did the operator have a recognised ECG qualification?		
Was the operator trained on the specific ECG equipment being used?		
(2) Identification of patient		
Were 3 identifiers used?		
Was wristband checked (unconscious / inpatients)?		
(3) Consent		
Was the procedure explained before proceeding?		
Was consent (verbal or written) properly obtained?		
(4) Patient experience, privacy and dignity		
Did the operator communicate with clarity and accuracy?		
Was information appropriate to patient's needs?		
Was level of undress appropriate?		
Was the patient treated with dignity and respect?		
Were cultural sensitivities observed?		
Was the patient aware / asked if they wanted a chaperone?		
(5) Environmental considerations		
Was the environment private (curtained, walled, screened)?		
Was the procedure conducted with no interruptions?		
Was the environment comfortable and warm?		
Was the area accessible for all users including disabled?		
Did the area have hand-cleaning facilities?		
Did the area have clinical waste disposal facilities?		
Was a height-adjustable couch available, wide enough for arms to rest on?		
Was the room stocked appropriately?		
(6) Equipment specification		
Was there an electrocardiograph meeting IEC 6061-2-25:2011 available?		
Were the default settings as specified below?		
Auto record 0.67-150Hz		
Manual record 0.05-150Hz		
ECG filter off		
(7) Infection control		
Did the operator wash or use alcohol gel to clean hands?		
Was clinical waste disposed of appropriately?		
(8) Patient preparation		
Was the patient in the semi-recumbent position?		
Was appropriate skin preparation performed if required?		
(9) Electrode Placement		
Were limb leads placed on wrists and ankles?		
Were the precordial (chest) leads in the correct anatomical positions in accordance with SCST guidelines?		
Was an appropriate technique used to locate the correct anatomical positions for the precordial (chest) leads?		
Were the leads connected correctly to the electrocardiograph?		
(10) Recording Quality		
Was an artefact-free recording obtained?		
Was the initial recording at appropriate settings for paper speed (25mm/sec) and gain (10mm/mV)?		
Was the initial recording made with the filter off?		
Were appropriate modifications made and a second ECG recording produced if required (including changes to paper speed, gain, rhythm strip, right sided chest leads etc.)?		
(11) Documentation, processing and storage		
Did 3 identifiers appear on the printout / stored recording?		
Was the ECG annotated correctly with any modifications made (such as 'in wheelchair' or right-sided leads)?		
Was the ECG recording forwarded appropriately according to local policy (e.g. for medical review, electronic storage, copy in notes etc.)?		
Has the patient's information been treated in a confidential and secure way?		

16. ECG Standard Electrode Positions Reminder Chart



Precordial (chest) electrode positions:

- V1 (C1) - Fourth intercostal space at the right sternal edge
- V2 (C2) - Fourth intercostal space at the left sternal edge
- V3 (C3) - Midway between V2 and V4
- V4 (C4) - Fifth intercostal space in the mid-clavicular line
- V5 (C5) - Left anterior axillary line at the same horizontal level as V4
- V6 (C6) - Left mid-axillary line at the same horizontal level as V4 & V5

Limb electrode positions:

- Right arm limb lead (RA, red) - right forearm, proximal to wrist
- Left arm limb lead (LA, yellow) - left forearm, proximal to wrist
- Left leg limb lead (LL, green) - left lower leg, proximal to ankle
- Right leg limb lead (RL, black) - right lower leg, proximal to ankle

17. ECG Settings Reminder Chart

Standard ECG recording:

Paper speed - 25mm/sec

Voltage gain - 10mm/mV

Use of the filter:

Initial recording - filter off - recording made at 0.67-150Hz

Evidence of somatic muscle interference:

Repeat recording - filter on - recording made at 0.67- 40Hz

The filter reduces interference but also distorts the ECG

In dextrocardia:

Initial recording - standard positioning

Repeat recording - right-sided chest leads V3R to V6R

Annotate ECG clearly