Clinical Guidelines by Consensus

ECG Reporting Standards and Guidance

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

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Recommendations for

ECG Reporting Standards and Guidance

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1. Background and rationale

An electrocardiogram (ECG) is a graphical representation of the electrical activity of the heart: it is a picture. The information conveyed by an ECG may be invaluable in the diagnosis, prognosis and management of a wide range of conditions. While many clinicians may possess considerable skills in 12-lead ECG interpretation, others do not and information in graphical form may be of little value to them unless it is accompanied by a comprehensible report that describes and summarises the clinically important findings. We therefore recommend that every ECG that is filed in a patient’s record should bear a report.

There are established guidelines, based on evidence and expert consensus, on how to record an ECG\(^1\). There exist authoritative published reference values and diagnostic ECG criteria to guide ECG interpretation\(^{2,3,4,5}\), and there is a consensus document that defines the minimum experience and training necessary to achieve competence in interpreting ECGs\(^6\). However, there is no widely accepted guidance on how a standard 12-lead ECG should be reported.

There may be legitimate variation in conclusions reached from examining an ECG because many combinations of ECG features are open to different interpretations. On the other hand, an interpretation may demonstrably be wrong. An interpretation may also be correct but incomplete and fail to convey some information of importance.

The guidance that follows has been developed to ensure that ECG reports:

- are of maximum clinical value
- minimise risks to patient care
- can be subjected to audit

There is much variation in the reference values, terminology and definitions used in the evaluation and description of ECGs. For consistency, SCST supports the recommendations that have been issued by the American Heart Association in collaboration with partner organisations and published in a series of documents\(^{2,3,4,5}\).
2. Method
There is readily available general guidance relating to standards of documentation, which includes clinical reports, that is intended to be filed in patients’ health records. To research existing agreed guidance and recommendations specifically with regard to the reporting of 12-lead ECGs, a keyword literature search was conducted using five databases: Allied and Complementary Medicine Database (AMED); Health Business Elite (HBE); Health Management Information Consortium (HMIC); Medline; and the Cumulative Index to Nursing and Allied Health Literature (CINAHL), through the NICE-evidence online portal.

The key words used, in various combinations, were: ‘ECG’, ‘EKG’, ‘electrocardiogram’, ‘reporting’, ‘guideline’, ‘interpretation’ and ‘standard’. The search returned no consensus guidelines for the reporting of 12-lead ECGs. The guidance on the recommended structure and style of ECG reports that follows is therefore original and based on expert consensus.

3. Standards
The following standards aim to ensure that ECG reporting complies with the principles of good clinical governance.

3.1 Standard 1: *No report should omit any information that may be of importance*
This standard aims to ensure that ECG reports convey all the important information contained in the ECG recording.

3.2 Standard 2: *Every report should clearly identify the reporting clinician*
It is common practice and consistent with the principles of good clinical governance that reports contained in patients’ health records should clearly identify the author and there are recommendations on how this should be done\(^7\). It is important for both quality assurance and medico legal reasons that the individual who has reported an ECG can clearly be identified. The name and job title of the author are minimal identifying details; the professional registration number, if applicable, should also be included. Printed or handwritten reports should also be signed by the reporting clinician to authenticate their identity.
4. Guidance
The following guidance on the approach to evaluating an ECG and on the structure, format and content of ECG reports aims to maximise compliance with standard 1 and ensure that no report is unclear, ambiguous or omits any important information.

4.1 Systematic analysis
To minimise the possibility that a report fails to convey clinically important information it is recommended that the ECG be systematically analysed before it is reported.

There is no single scheme that needs to be followed for the full and accurate analysis of an ECG but any systematic evaluation should include assessment of:

- Ventricular rate
- Cardiac rhythm
- QRS axis
- QRS morphology
- P wave morphology
- PR interval
- QT interval
- ST segments
- T waves
- Any other deflections or waveforms in the ECG

4.2 Implicit and explicit reporting
The elements of an ECG may be described explicitly and in detail or implicitly by, for example, stating that the ECG is normal, thereby implying that there is sinus rhythm with a heart rate of between 60 and 100 beats per minute, a QRS axis between -30 and +90 degrees and normal intervals and waveform morphologies. A report may be partly explicit in describing an abnormality, e.g. right bundle branch block, and partly implicit, e.g. by stating also that the ECG is otherwise normal.

4.3 Primary and secondary ECG abnormalities
Abnormal ECG features when they are inevitable secondary characteristics need not be described. For example, ST depression and T wave inversion invariably accompany the primary abnormality of left bundle branch block and therefore do
not need to be described: their presence is implicit in the diagnosis of left bundle branch block. Similarly, T wave inversion in lead V1 when there is right bundle branch block need not be described, but T wave inversion elsewhere on the ECG that is unrelated to the right bundle branch block should be. The absence of expected secondary abnormalities may indicate additional pathology and should be described.

4.4 Describing ECG patterns
Where abnormal ECG abnormalities clearly indicate the presence of a particular underlying pathological condition, it may be more helpful and appropriate to describe the pathological condition, e.g. right bundle branch block, rather than the ECG features that define it. When abnormal ECG patterns may have more than one possible cause, e.g. deep symmetrical T wave inversion from V1 to V3, the ECG abnormalities themselves should be described.

4.5 Abbreviations
Abbreviations, because they may be ambiguous or not understood, should be used only sparingly if at all. Only very commonly understood abbreviations, e.g. VT, should be used.

4.6 Elements of a report
An ECG report should address all the following elements either explicitly or implicitly.

4.6.1 Ventricular rate
The ventricular should be expressed in beats per minute. If the ventricular rate is irregular, the rate should be expressed as a mean value from a period of at least 6 seconds. If the atrial rate is different from the ventricular rate, and the rhythm is not atrial fibrillation or atrial flutter, the atrial rate should be described explicitly or implied, e.g. as in atrial tachycardia with 2:1 block and a ventricular rate of 70 beats per minute.
4.6.2 Rhythm
The cardiac rhythm should be described. If the atrial rhythm and ventricular rhythm are independent of each other, each should be described, for example *sinus bradycardia* (*atrial rate 50 beats per minute*) with *an AV nodal escape rhythm* (*ventricular rate 52 beats per minute*).

4.6.3 QRS axis
If the mean frontal plane QRS axis is between -30 and +90 degrees, the angle need not be described it should be stated that the axis is normal. If the mean frontal plane QRS axis is abnormal it should be stated to a precision of $\pm$ 15 degrees; additionally, it should be stated whether there is a left, right or extreme axis deviation.

4.6.4 QRS morphology
Abnormalities of the shape, amplitude or duration of the QRS complex should be described, either by detailing the abnormality itself, e.g. *deep Q waves in leads II, III and aVF*, or by describing the cause of the abnormal QRS, e.g. *left bundle branch block*.

4.6.5 P wave morphology
This should be described if it is abnormal, e.g. *broad, notched P waves in most leads*.

Additionally or alternatively, the cause of the abnormal P waves should be described, e.g. *left atrial abnormality*.

4.6.6 PR interval
The PR interval should be stated if constant and outside the normal range, in which case it should also be described as abnormally short or long. If the PR interval varies, the cause of the variation must be described (and will normally be done in the process of describing the cardiac rhythm).
4.6.7 QT interval
The corrected QT interval (QTc) should be stated if it is outside the normal range, in which case it should also be described as abnormally short or long.

4.6.8 ST segments
Any abnormal displacement or shape of the ST segments should be described. It is conventional to express deviation of the ST segment in millimetres rather than millivolts, assuming normal standardisation of 10 millimetres to a millivolt.

4.6.9 T waves
Any abnormality of T wave shape, amplitude or polarity should be described.

4.6.10 Pacing
In an ECG that shows pacemaker activity, there should be a description of the chamber(s) paced and any intrinsic cardiac activity, e.g. atrial fibrillation with conducted and paced ventricular beats. Any evidence of failure to sense or capture should be described.

4.6.11 Other deflections or waveforms
Other deflections or waveforms, including J waves, U waves and epsilon waves, should be described.

4.7 Report’s conclusion
Most ECG reports, and all those describing multiple abnormalities, should contain a conclusion, and this should attempt to integrate the various findings. If there is more than one possible explanation for a particular ECG pattern the various possibilities should be outlined in the conclusion. If the ECG appearances are suggestive but not diagnostic of a particular diagnosis, this should be made clear. If the conclusion, e.g. acute anterior myocardial infarction, is critically important it should be placed at the head of the report.

4.8 Computer-generated reports
Many ECG machines are able to produce a computer-generated report. Research
has shown that these reports may not be accurate and authoritative bodies have recommended that although computer generated reports may have an adjunctive value in making the interpreter aware of possibilities they had not considered, they should not be relied on when making clinical decisions\(^{(6,8)}\). ECGs bearing a computer-generated report should be subjected to the same scrutiny as those without a report and the report should be checked by a clinician. If the report is considered to be accurate and complete it should be signed by the clinician, who is then the *de facto* author of the report. If the report is considered inaccurate or incomplete it should be amended or deleted, in which latter case it should be replaced by the clinician's own report. The identity of the clinician who signs the report should be clear.

5. Conclusion
An ECG, to be of maximum diagnostic value, should be accompanied by a structured, accurate and informative report and the report's author should be clearly identifiable. This document provides guidance to help reporting clinicians to achieve these aims.
Appendix: sample reports

Two alternative sample reports for ECG 1 are provided below, each of them consistent with the guidance provided in this document. Report 1(a) is a detailed report ending with a conclusion that the ECG is normal. Report 1(b) merely states that the ECG is normal.

ECG 1

<table>
<thead>
<tr>
<th>Report 1(a)</th>
<th>Report 1(b)</th>
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<tbody>
<tr>
<td>Sinus rhythm at 63 beats per minute. QRS axis = +75°. PR interval = 160 ms. QRS duration = 80 ms. QTc = 360 ms. No ST/T abnormalities. Normal QRS amplitudes. No pathological Q waves.</td>
<td>Normal ECG.</td>
</tr>
</tbody>
</table>

Conclusion: Normal ECG.

Reported by:
John Smith MSc
Registered clinical scientist
Registration number A12345
Signed
18 September 2018
Sample report 2 below for ECG 2 details all the abnormalities present, providing possible explanations for them where appropriate and summarising them in a conclusion.

**ECG 2**

**Report 2**

<table>
<thead>
<tr>
<th>Sinus bradycardia (42 beats per minute).</th>
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<tbody>
<tr>
<td>Left axis deviation, consistent with left anterior fascicular block.</td>
</tr>
<tr>
<td>Right bundle branch block.</td>
</tr>
<tr>
<td>Abnormal Q waves V1 – V4, suggestive of old anterior myocardial infarction</td>
</tr>
<tr>
<td>Inverted T waves I, aVL and V1 – V5.</td>
</tr>
</tbody>
</table>

**Conclusion:** Probable old anterior myocardial infarction with right bundle branch block and left anterior fascicular block.

*Reported by:*
John Smith MSc
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Registration number A12345

Signed

18 September 2018
Sample report 3 for ECG 3 describes the rhythm and heart rate, then details the abnormalities, providing possible explanations where appropriate and ending with a conclusion which includes a probable clinical explanation for the ECG pattern.

**ECG 3**

![ECG Image]

**Report 3**

| Sinus rhythm at 70 beats per minute. |
| Right axis deviation. |
| Dominant R wave in V1. |
| Q wave in V1 and V2. |
| Poor R wave progression with R=S in V6. |
| Tall P waves consistent with right atrial abnormality. |
| Inverted T wave in leads III and aVR. |

**Conclusion:** Right ventricular hypertrophy and right atrial abnormality, consistent with cor pulmonale.

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Signed

18 September 2018
References


Acknowledgements

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