



Improving diagnostic quality – advanced analysis tools in a standard ECG cart

Spacelabs Healthcare Clinical Support Team

- **A new standard ECG cart** can offer 15- and 18-lead recording and analysis tools which lead to improved diagnosis for certain conditions.
- **Routine 12-lead ECGs** can miss significant diagnostic information.
- **Availability and ease of use** are the keys to efficient workflows and effective tests.



18-Lead ECG and vectorcardiogram (VCG) can help you to determine the origins of an arrhythmia or localise areas of myocardial damage with increased accuracy^{*1,2,3,4,5}. The procedure is non-invasive and easily performed.

Instant accessibility and ease of use is the key to fast, accurate results. Spacelabs Healthcare now provides advanced functions and multi-lead capability in the standard SL18A ECG cart. This supports the clinician with valuable additional information and leads to optimal diagnosis and treatment for the patient.

15- and 18-lead ECG and advanced analysis – clinical diagnostic benefits

- A standard 12-lead ECG can miss up to 31% of infarctions^{*1}.
- In pediatrics, changes in the axis during development can lead to abnormalities being missed.
- VCG is superior to ECG in specific aspects of conditions including Wolff-Parkinson-White, pre-excitation, axis deviation, Brugada syndrome, enlargement, localised electrical inactivity and associated conduction disorders.
- Additional features provide benefits, but will not be used effectively unless they are automatic, quick, and simple to read.
- It can be difficult to ensure that a cart with this level of capability is ready to hand when it may be needed.



- 15-lead ECG can localise to RV or posterior LV
- 18-lead ECG allows both RV and posterior LV to be analysed instantaneously
- 18-lead ECG provides increased accuracy and ability to observe abnormalities
- Vectorcardiogram is provided automatically through a simple user-interface and report format
- SL18A's automatic analysis presents the information so as to help clinicians quickly identify whether the result is normal or needs further attention
- Fully featured carts can be provided within a commonly acceptable 'standard' cost envelope





Coronary Artery Disease – up to 31% of infarcts may be missed by 12-lead ECG^{*1,2,3,4}

Coronary artery disease is one of the largest threats to health. The rapid and early identification of a patient with acute coronary syndrome is paramount. The standard 12-lead ECG does not provide comprehensive diagnosis of MI.

History – 12-lead, STEMI and the significance of the problem

- The most common ECG exam is the standard 12-lead ECG. It is simple to measure, and observing the heart from these 12 directions provides key information for a wide range of clinical applications.
- However, some areas, especially pathological change in the right ventricle and the posterior wall, cannot be observed from the 12-lead ECG. In order to actually measure the right chest (V3R, V4R, V5R) and back (V7, V8, V9) areas, it is necessary to use additional electrode positions compared to the standard 12-lead ECG.
- ^{*2,3,4} Posterior infarction accompanies 15-20% of STEMI, usually occurring in the context of an inferior or lateral infarction.
- ^{*3,4} Isolated posterior MI is less common (3-11% of infarcts). So up to 31% of infarcts could be missed on a 12-lead ECG.

Why this happens

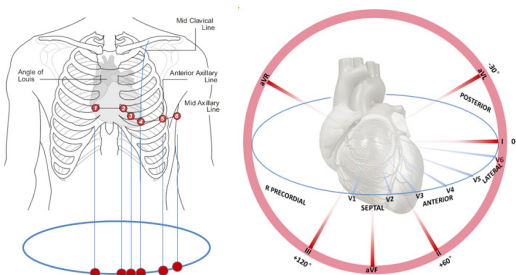
- Posterior extension of an inferior or lateral infarct implies a much larger area of myocardial damage, with an increased risk of left ventricular dysfunction and death.
- Isolated posterior infarction is an indication for emergent coronary reperfusion. However, the lack of obvious ST elevation in this condition means that the diagnosis is often missed.
- Right ventricular (RV) myocardial infarction most often occurs in the setting of inferior wall myocardial infarction. Right ventricular infarction complicates approximately 25% (range 20% - 60%) of inferior acute myocardial infarction.
- ST-segment elevation of greatest magnitude in lead III, ST-segment elevation in lead V1, and/or ST-segment elevation in right chest leads (RV1 through RV6).

Pediatrics

- Pediatric ECGs are regularly performed for a variety of conditions, including chest pain, syncope and suspected arrhythmia. Correct interpretation can be challenging. Pediatric ECGs have to be interpreted — especially during the first year of life with due regard to the age-specific changes associated with the anatomic/physiologic development of the heart.
- 15/18-lead ECGs provide increased accuracy to help ensure that no electrical abnormalities will be missed in the test.

15-lead is better than 12-lead, but 18-lead is even better.

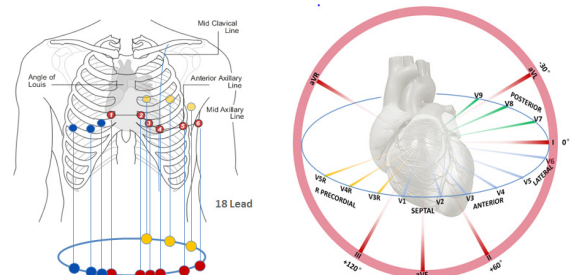
- 15-lead isolated to localisation of either RV or posterior LV electrical mapping.
- 18-lead allows both RV and posterior LV electrical signal to be analysed instantaneously.
- Real-time capture guarantees accuracy — no “derived” channels. A 360-degree electrical map of the heart!
- Leads are fitted in one ECG recording, so a single 10s recording captures all channels.



Lead placement and resulting views for 12- and 18-leads.

12-lead

18-lead

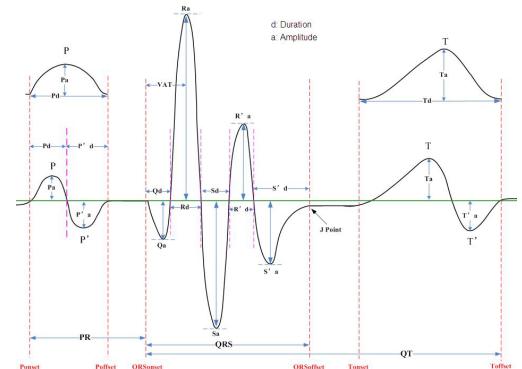


Graphics from the University of Nottingham



SEMIP Algorithm and presentation – automated and quick to review

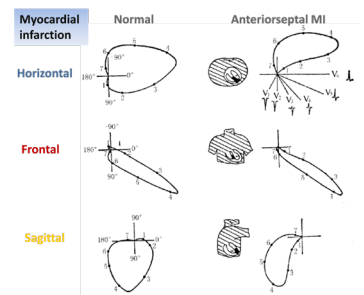
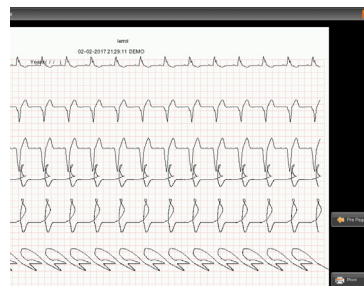
- SEMIP is designed to assist the physician in reading and evaluating an ECG printout with up to 18-leads. This method of measurement and interpretation was developed in cooperation with leading cardiologists.
- Interpretation of ECGs uses **Minnesota Code Classification and Diagnosis Information for Electrocardiology**.
- The interpretation and graphical presentation support rapid recognition of normal and abnormal recordings for further review.



Vectorcardiogram (VCG) is superior to ECG in specific aspects of conditions including –

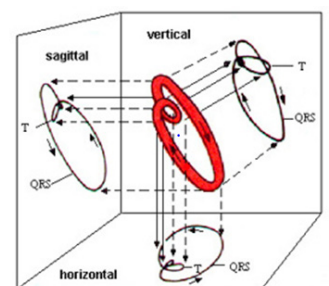
- Wolff-Parkinson-White, pre-excitation, axis deviation, Brugada syndrome, enlargement, localised electrical inactivity and associated conduction disorders.

- Vectorcardiography (VCG) is a method of recording the magnitude and direction of the electrical impulses generated by the heart. It works by means of a continuous series of vectors that form curving lines around a central point using the Frank Lead system to create VCG loops.



Graphic from Clinical Electrocardiographic informatics, KD Zhang

- Each cell in the heart can be represented as a dipole with differing direction throughout the heartbeat. A collection of all these small dipoles close to each other can be represented as a single dipole. The electrical field of the heart can then be studied as a field of a single dipole — the cardiac vector. The line drawn by the tip of the cardiac vector is the VCG.



Graphic from <http://www.monte.amu.edu.pl>

Signal-averaged ECG – may represent a predisposition to VT

- Signal-averaged electrocardiography (SAECG) is a special electrocardiographic technique in which multiple ECG complexes are averaged to remove interference and reveal small variations in the QRS complex.
- These are the so-called "late potentials." They may represent a predisposition towards potentially dangerous ventricular tachyarrhythmia.



CardioExpress SL18A – key features

12/15/18-lead Electrocardiogram with automatic and manual Interpretation, HRV, VCG and SAECCG

Interpretation

- SEMIP automatic measurement and interpretation tested with authoritative CSE database
- Vectorcardiography, Signal-averaged ECG, HRV

15" color touchscreen and light sensor

- High-resolution, clear view of the ECG traces
- Automatically adjusts the brightness according to the working environment

Silicone touchscreen keyboard

- Waterproof alphanumeric keyboard to minimize the likelihood of cross-infection

Function icons

- Frequently used functions at the touch of a button

Signal quality indicator

- Enables the user to check signal quality at a glance

Battery backup

- For prolonged mobile use

Signal acquisition

- Sample rate 16,000Hz
- Digital filters for baseline drift, AC, EMG
- Pacemaker detection ANSI/AAMI/ECB

Printing

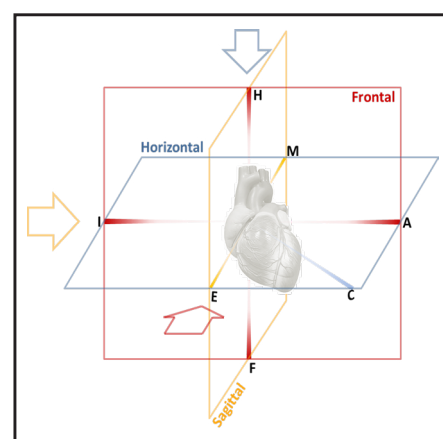
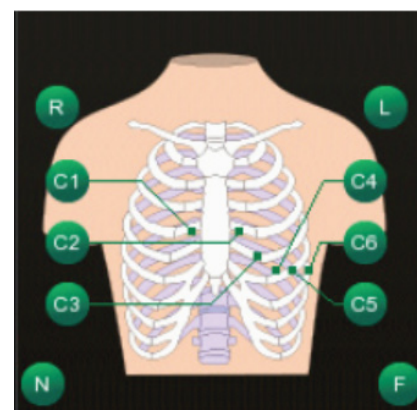
- Flexible formats for 9,12,15- and 18-lead reports
- Internal high-resolution thermal or external USB printer
- Speeds 5/6.25/10/12.5/25/50 mm/s, user selectable

Memory, storage and connectivity

- Internal storage of up to 1000 10-second resting ECGs
- External archiving to Spacelabs Sentinel
- Export to network or USB: PDF,SCP,DICOM,FDA-XML

Networking

- Port or built-in Wi-Fi for 802.11 b/g/e/l single-stream /n
- 2.4GHz, 802.11n RF transceiver, high performance amplifier
- WPA and WPA2 supported but not Vendor EAP Type(s)



References –

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- *4 Van Gerselen EO, Verheugt FW, Meursing BT, Oude Ophuis AJ. Posterior myocardial infarction: the dark side of the moon. *Neth Heart J*. 2007; 15: 16-21.[PMC PMC1847720]
- *5 Andres Ricardo Perez Riera MD et al, "Significance of VCG in Cardiological Diagnosis of the 21st Century" , *Clin.Cardiology* 30, 218-323 (2007)

Additional Reading –

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