



## How to Acquire a 12-Lead ECG & 15-Lead ECG

Zoll X Series

Self Learning Package



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September 2019

### **Import Points to Consider:**

- 12 lead ECG monitoring is intended for the recording of 12-lead ECG signals from adult and pediatric patients in the supine, resting position- always ensure that the patient is kept motionless during 12-lead ECG acquisition and analysis. Use of the device to acquire ECG signals from moving or shaking patients may produce noisy signals that are difficult to interpret.
- The 12-Lead Interpretive algorithm's interpretive statements are designed to enhance the diagnostic process. They are no substitute for the qualified judgment of a properly trained clinician. As with any diagnostic test, always give consideration to patient symptoms, history, and other relevant factors.
- It is important to enter each patient's age and gender prior to performing ECG analysis using the Inovise 12 Lead Interpretive Algorithm. Providing patient age and gender will ensure the highest accuracy of ECG analysis is attained. If age is not provided, a default of 45 years is used. If gender is not provided, the default is male.
- 12-lead interpretive Algorithm on the Zoll X series is for use with only adult patients
- Excessive body hair or wet, sweaty skin may interfere with electrode adhesion. Remove the hair and/or moisture from the area where the electrode is to be attached.

### **Cables & Wires**

The 4 lead ECG cable will already be attached to the monitor on the left side of the unit (see below).



Connect the precordial lead cable to the 4 lead ECG cable. Attach arrow to arrow on the connection (look for arrows). Follow diagram below. You require all 10 wires for your 12-Lead ECG.



## Placement of Electrodes:

The proper application and placement of electrodes is essential for high quality 12-Lead ECG monitoring. Good contact between the electrodes and skin minimizes motion artifact and signal interference. A 12-lead ECG consists of placing 10 electrodes on the patient's chest for a 12 lead view of the heart (I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6).

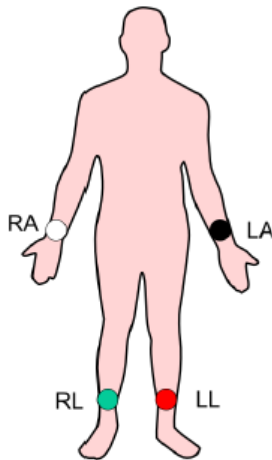
### ➤ Skin Prep

Skin preparation is essential for high quality ECG monitoring. Skin should be clean and dry. You may need to shave or clip excess hair to ensure proper adhesion of electrodes. Clean oily skin with an alcohol pad.

### ➤ Limb Leads

Place the 4 limb lead electrodes and corresponding wires on the chest (RA, LA, RL, LL). The limb leads provide a frontal plane view of the heart and display 6 different views of the heart (I, II, III, aVR, aVL, aVF). These electrodes do not require extensive landmarking but try to place them over fleshy areas of the wrist/ankles, avoid placing over bone, tendons and major muscle masses. If these limb lead placements are not acceptable (e.g. Amputee, or limb tremors causing artifact) alternate placement may be used (e.g. Shoulders and lower torso). Be sure the electrodes are mirrored placement to each other on both halves of the body.

## Limb Lead Placement



RA = Right Arm  
LA = Left Arm  
RL = Right Leg  
LL = Left Leg

RA– inner aspect of right wrist  
avoiding placement over bone.

RL– very bottom of right leg avoiding  
placement directly over bone.

LA - inner aspect of left wrist avoiding  
placement over bone.

LL- very bottom of left leg avoiding  
placement directly over bone.

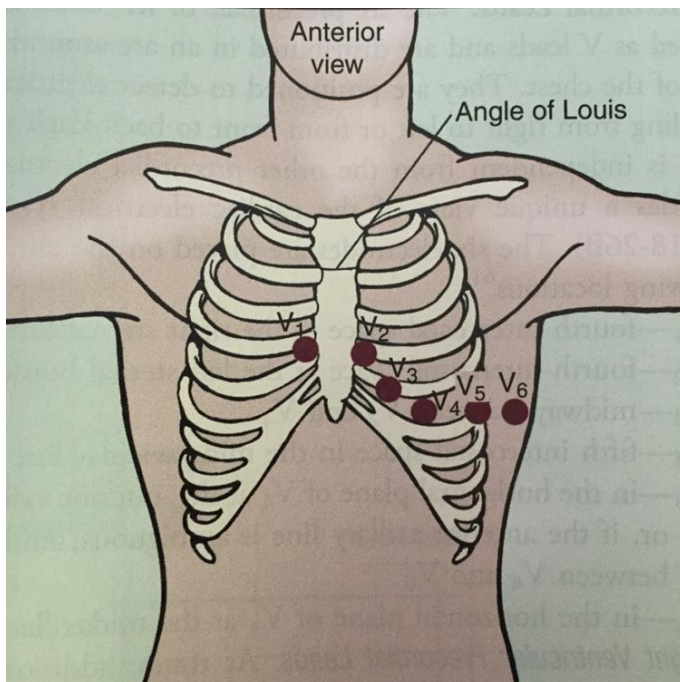
“White to Right, Snow over Grass, Smoke over Fire”

(phrase used to memorize where the coloured limb leads are placed)

➤ **Precordial Leads**

The precordial leads include the 6 V leads (V1, V2, V3, V4, V5, V6) which provide a horizontal view of the heart. These must all be accurately landmarked. Failure to landmark can lead to incorrect diagnoses. To assist in finding the 4<sup>th</sup> and 5<sup>th</sup> intercostal spaces, place your finger on the patient's jugular notch and then slide downward about 1.5 inches until you feel a raised ridge. This is the "Angle of Louis", where the manubrium joins the sternum. If you slide off the sternum you will land on rib #2. You can proceed to count down until you find the appropriate intercostal spaces to place the precordial electrodes.

*Female consideration: always place V3-V6 under the breast rather than on the breast itself.*



**V1**- 4<sup>th</sup> intercostal space at the Right sternal border

**V2**- 4<sup>th</sup> intercostal space at the Left sternal border

**V3**- midway between V2 and V4

**V4**- 5<sup>th</sup> intercostal space in the midclavicular line


**V5**- 5<sup>th</sup> intercostal space at the anterior axillary line

**V6**- 5<sup>th</sup> intercostal space at the midaxillary line

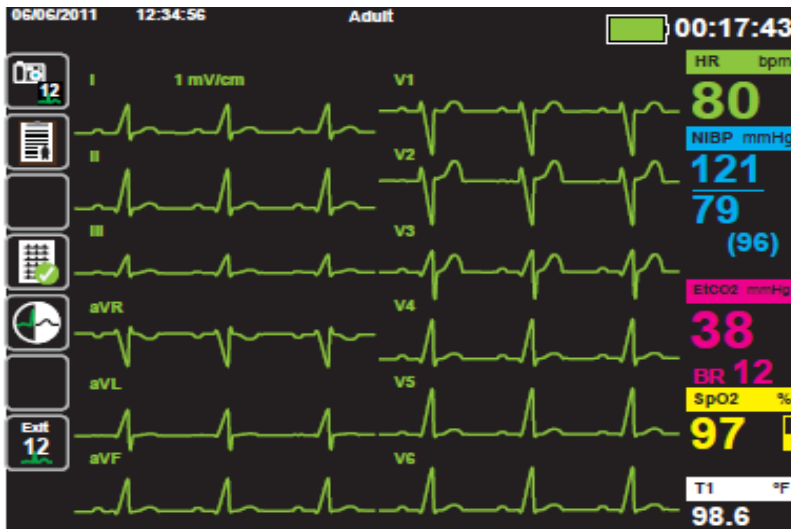
**Acquiring the 12 Lead ECG**


Once all of your 10 electrodes are placed on the chest and the corresponding lead wires are attached, you are ready to acquire the 12 lead ECG. It does not take long to acquire, but you may want to ask your patient to sit still for approximately 10 seconds while the monitor acquires the best 12 lead quality possible with as little artefact as possible.

➤ **Steps:**

- 1) Press the  button on the left hand side of the screen to enter into 12 Lead mode

- 2) Check for a good quality signal and ensure all leads are displayed across the screen (see picture below)



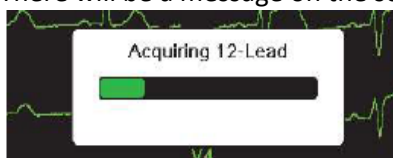
- 3) Press the  button.
- 4) You will be prompted to enter the patient's info. To ensure accurate diagnostics, you must enter the patient's age and sex as minimum patient demographic data. Note: As long as the monitor remains on, you will only need to enter this data once, as any subsequent 12 lead completed on this patient, the data will be stored. If you do not change the demographics, they will remain as a 45 year old male. Once you have made the changes, click the arrow back or the "home key".

The image shows a 'Patient Info' form on a monitor screen. The form has the following fields and values:

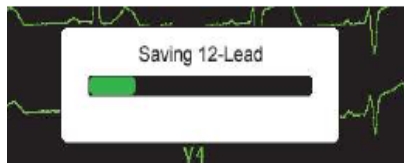
Field	Value
Patient Age	21
Patient Sex	M
Patient First Name	
Patient Middle Name	
Patient Last Name	
Patient ID	

A back arrow icon is located at the bottom left of the form.


- 5) There will be a message on the screen that says "acquiring 12 lead".




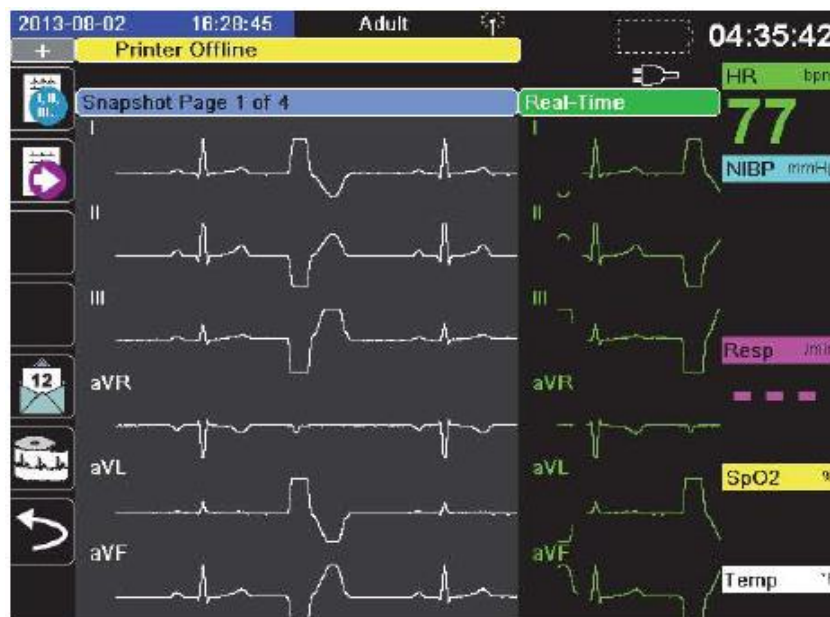
If you are not pleased with the signal quality at this time, you can press the stop sign, troubleshoot, make adjustments and retry. If the signal quality is adequate, let it finish acquiring and you will see “saving 12-lead”.



6) Once the monitor has completed the acquisition it will automatically print out the 12 lead. You may want to add a patient addressograph sticker on it or you may want to post it in the chart. The 12 leads printed off the Zoll monitor are diagnostic quality, meaning a physician can review and diagnose off of them. The 12-Lead consists of interpretive statements, patient demographics (if you've set any) along with the waves and interval measurements followed by a 2.5 seconds strip of all 12 lead views as well as a full strip of Lead II.

7) Should you need to reprint that 12 lead, you can go into the “Review 12 Leads area”  where you can review and print the appropriate 12 lead. Caution: there may be several 12 leads saved in this section from past patients. You will want to be sure you have chosen the correct 12 lead based off of date, time and patient demographics that you entered. Reprint as many as you require.

8) Don't forget the feature where you can compare the 12 lead against the patient's real time 12 lead. This feature is handy if you are administering tenecteplase (TNK) and wish to watch your patient's ST segment and/or rhythm while you administer the anticoagulant. You can access this in the “12 lead review” area  once you click into it. You will see the 12 lead Snapshot on the left side of the screen and the “Real-time” ECG on the right side of the screen.



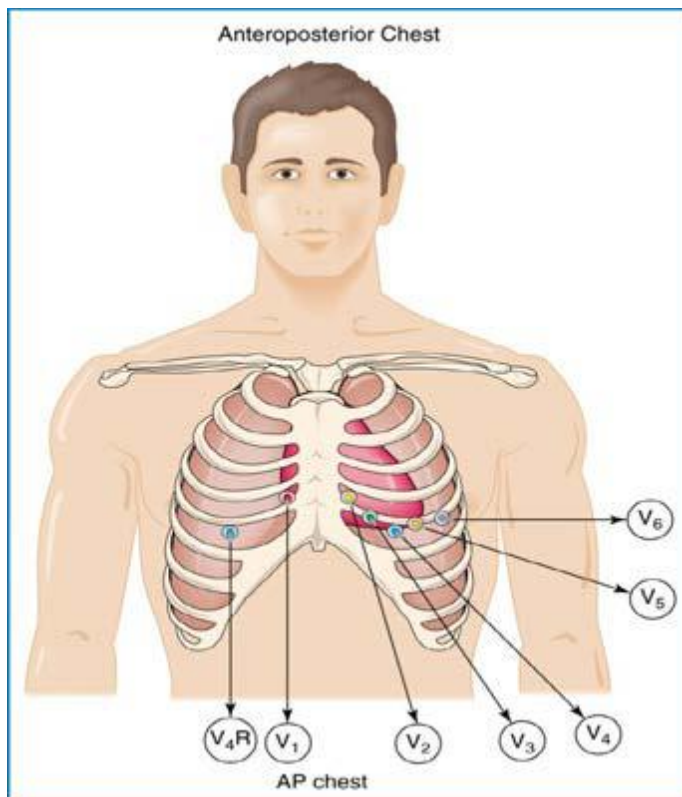
## 15 Lead ECG

### ➤ When to acquire a 15-Lead ECG

Additional lead placement including V<sub>4R</sub>, V<sub>8</sub> and V<sub>9</sub> should be routinely recorded in patients with suspected myocardial infarction (MI) in the inferior (II, III, aVF) area of the heart and any non-diagnostic 12-Lead ECG to look for posterior or right ventricular MI. This enables practitioners to view additional areas of the heart and diagnose any MI's accurately, thereby establishing the appropriate reperfusion treatment (Primary Percutaneous Coronary Intervention or thrombolysis) if required.

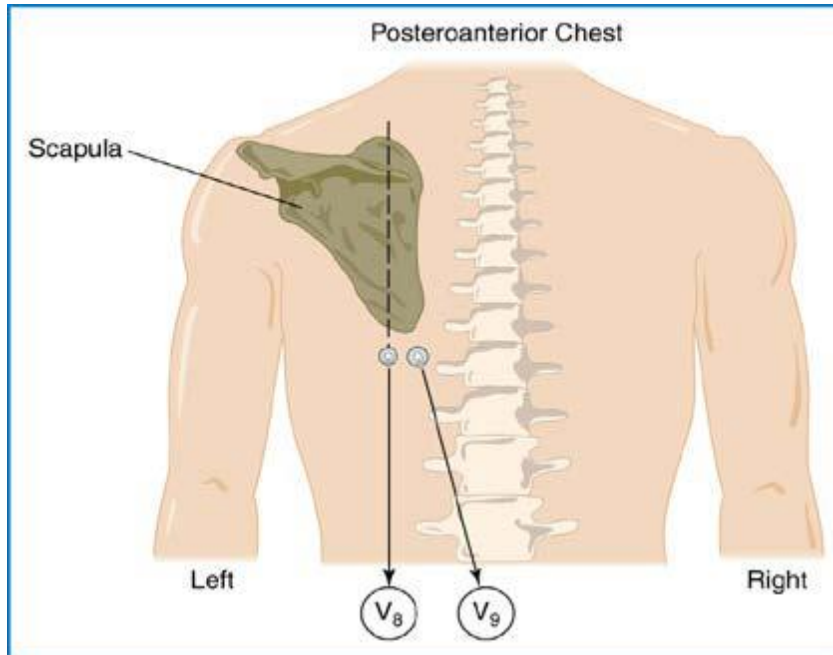
### ➤ How to acquire a 15-Lead ECG

- 1) After completing the standard 12-Lead, 3 of the lead cables must be moved to alternative locations and the ECG is repeated. This will give you 3 other views of the heart which equals a total of 15 leads. Remove the V<sub>4</sub> precordial lead cable from the left side of the chest and add another electrode to V<sub>4R</sub> which is in the exact same location as V<sub>4</sub> but on the right side of the chest. It is now referred to as V<sub>4R</sub>. (See diagram below.)



V<sub>4R</sub>- 4<sup>th</sup> intercostal space  
midclavicular line on the right side of  
the chest

- 2) Remove the V<sub>5</sub> precordial lead cable from the anterior chest and reposition it posteriorly at the 5<sup>th</sup> intercostal space mid-scapular line. This is called V<sub>8</sub>. Remove the V<sub>6</sub> precordial lead cable from the anterior chest and reposition it posteriorly between V<sub>8</sub> and the left spinal border. This is called V<sub>9</sub>.



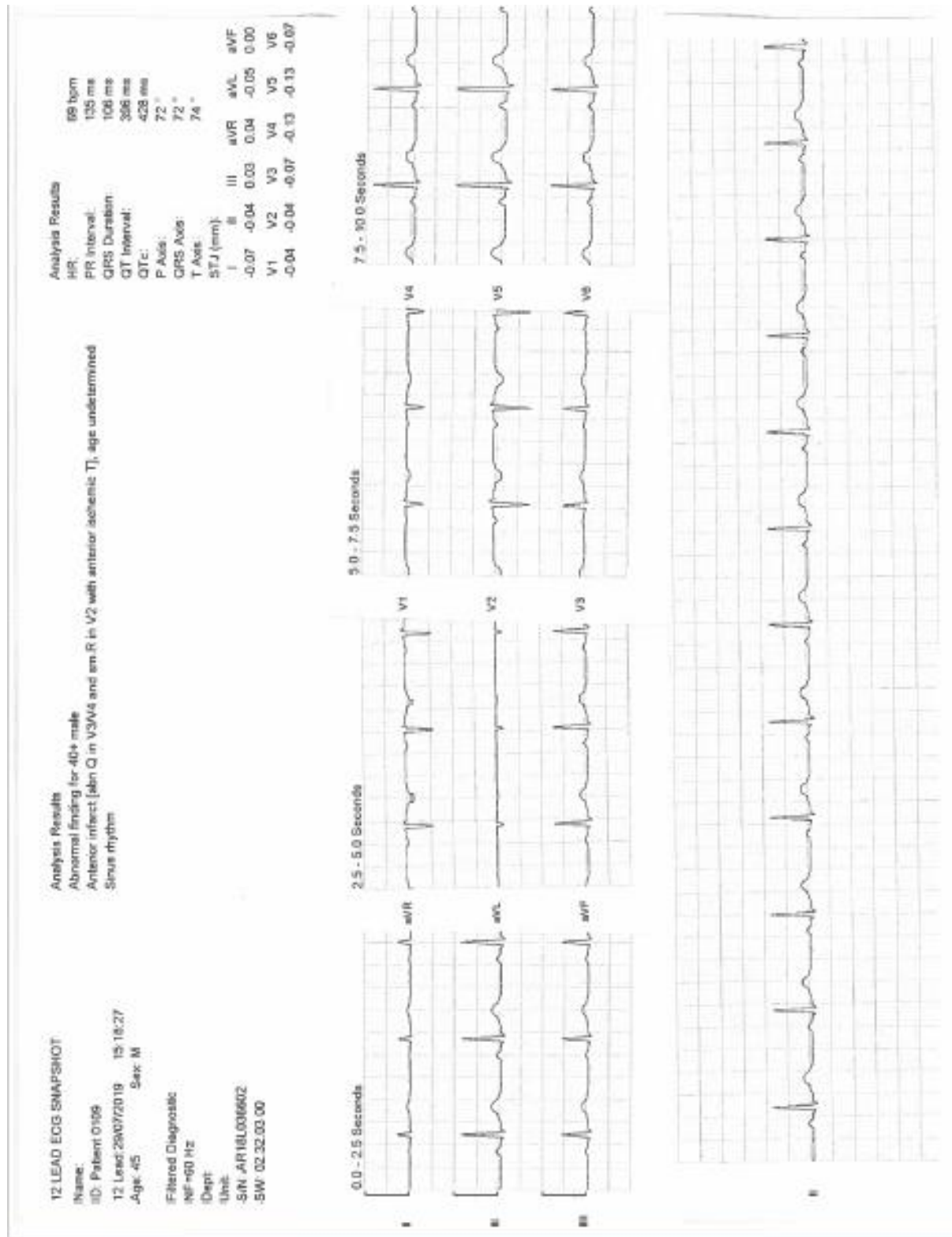
V<sub>8</sub>- 5<sup>th</sup> intercostal space mid scapular line on the left posterior

V<sub>9</sub>- 5<sup>th</sup> intercostal space left spinal border on the left posterior

- 3) Acquire 12-Lead in the same manner as described earlier. Once the 12-Lead has printed out, **be sure to re-label V<sub>4</sub> as V<sub>4R</sub>, V<sub>5</sub> as V<sub>8</sub> and V<sub>6</sub> as V<sub>9</sub>.**



**12 Lead Example- Printed, Cut and Glued on a 8 by 11.5 inch sheet of paper**



**15 Lead Example- Printed, Cut and Glued on a 8 by 11.5 inch sheet of paper (re-label V4, V5, V6)**

**12 LEAD ECG SNAPSHOT**

Name:  
 ID: Patient 0109  
 12 Lead 2807/2019 15 18 27  
 Age: 45 Sex: M

Filtered Diagnosis  
 HR=60 Hz  
 Dept:  
 Unit:  
 S/N: AR18L03602  
 S/W 02.32.03.00

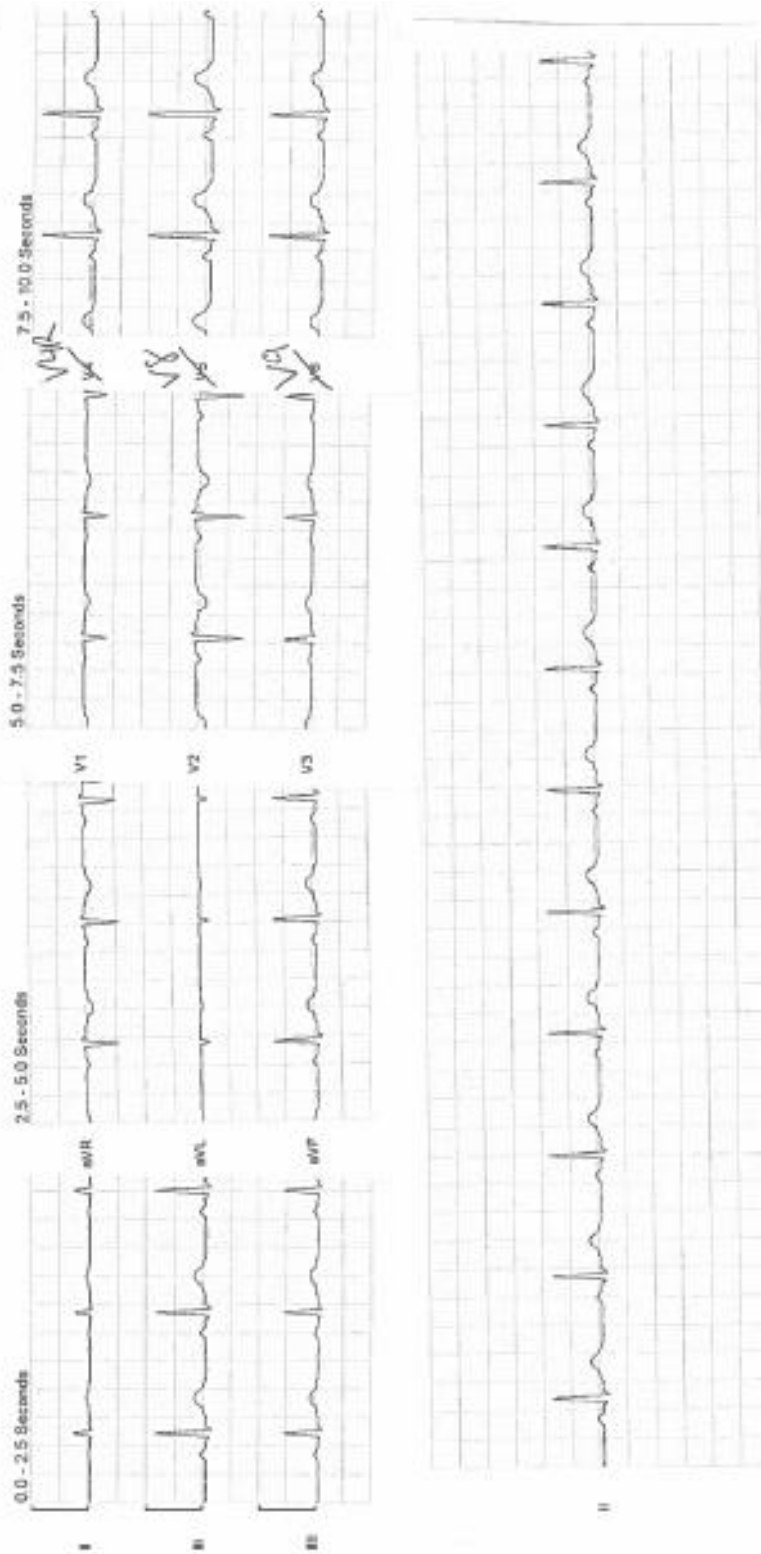
**Analysis Results**

Abnormal finding for 40+ male  
 Anterior infarct (abn Q in V3/4 and sm R in V2 with anterior ischemic T), age undetermined  
 Sinus rhythm

**Analysis Results**

HR: 68 bpm  
 PR Interval: 135 ms  
 QRS Duration: 106 ms  
 QT Interval: 386 ms  
 QTc: 428 ms  
 P Axis: 72°  
 QRS Axis: 72°  
 T Axis: 74°

STJ (mm):	I	II	III	aVR	aVL	aVF
	-0.07	-0.04	0.03	0.04	-0.05	0.00
	V1	V2	V3	V4	V5	V6
	-0.04	-0.04	0.07	-0.13	-0.13	-0.07



## **Resources & References**

Adapted from Camille Meub (2013) Southern Health-Santé Sud How to Obtain a 12-Lead ECG HeartStart MRx Self Learning Package.

Urden, L.D., Stacy, K.M., & Lough, M.E. (2010) Critical Care Nursing Diagnosis and Management 6<sup>th</sup> Ed. St. Louis, Mosby.

Zoll X Series Operator's Guide. Chapter 14: 12 Lead ECG Interpretive Analysis.