

12 and 15 lead ECG Interpretation

Lead Placement: even if you are not performing the test itself, knowledge of the correct lead placement is useful in troubleshooting an ECG test.

V2 : feel for the space between the left clavicle and the rib beneath, place your baby finger there and feel down with subsequent fingers until your index is resting on the 4th rib space (4th intercostal space, left sternal border)

V1 : place this lead directly across from V2 on the right side of the sternum (4th intercostal space, right sternal border)

V4 : feel for the midway point of the left clavicle and then come straight down to the rib space beneath V1's level (midclavicular 5th intercostal space)

V3 : midway between V2 and V4 on a curve

V6 : feel straight down below the armpit to the same rib space that V4 sits on; "where a woman's bra would sit" (mid-axillary 5th intercostal space)

V5 : midway between V4 and V6 on the same plane/rib space (anterior axillary 5th intercostal space)

Breast/Adipose Tissue: move soft tissue aside, if possible, to place leads close to chest wall. Otherwise, if the correct placement will be compromised – place the lead on the tissue directly above the correct landmark.

Ground/limb/reference leads: place at your discretion, leg leads can occupy the same limb (ie: amputee, cellulitis), or lowest part of the trunk.

The QRS Complex: brief explanation of what is normal and what is not. (Note: on the 12 lead paper; 1 tiny square=.04 sec and 1 big square=.20sec)

P wave: initiated by the sinus node, if it is not present then the beat is being paced from another area (accessory/abhorrent pathway)

PR interval: time it takes the sinus beat to be transmitted to the AV node (normally .12-.20 sec or 3-5 tiny squares), measured from the beginning of the P wave to the beginning of the R wave

-long or changing PR = AV block

-short PR = ?accessory pathway

Q wave: negative deflection just prior to R spike, may be subtle or absent. Appears 4-6 hours after an infarct, may represent old damage but treat as new tissue insult if patient has symptoms and has ST changes

Pathological Q wave: the negative wave depth is more than 1/3 the height of the positive R wave, denotes tissue death – old or current

R wave: any positive spike in the main body of the QRS, tall R denotes ventricular hypertrophy

QRS: normally .12 sec or less, otherwise considered a wide QRS which indicates a Bundle Branch Block (hides acute changes, may permanently change the T)

S wave: negative deflection just after the R spike, may be subtle or absent

ST interval: measured from where the S wave is ending (returning to baseline/neutral) to the end of the T wave

T wave: positive wave after the QRS

QT interval: measured from the start of the Q wave to the end of the T wave, should be 1/2 of the R-R interval (*MANY COMMON DRUGS CAN PROLONG*)

R wave progression: normal phenomenon where in leads V1-V4 the S wave prominence gradually gives rise to R wave being prominent, if not – denotes infarct

-no progression = Q wave MI (ie: if the R is difficult to see, the deflection is not an S wave but a Q wave = infarct)

-poor progression = smaller MI (ie: R is small/subtle and increases slightly as you move through to V4)

R-R interval: the measurement of the distance from one R spike to the next

R on T phenomenon: if the QT interval is prolonged ie: > 1/2 R-R interval (*MANY COMMON DRUGS CAN PROLONG) then a T wave and R wave may occur simultaneously causing Torsades de Pointes

T elevation: means complete occlusion, Q wave will appear, needs thrombolytics

T depression: means partial or impending occlusion, ACS is termed, T may elevate, treat also.

Basic Lead groups: T changes(inversion) or elevation/depression in ST segment

LEFT &/or RIGHT VENTRICLE:

Inferior Wall - leads II, III, aVF (* 45-55% of Inferior Infarcts affect the Right Ventricle, VERIFY WITH 15 LEAD)

Septal Wall - leads V1, V2

LEFT VENTRICLE:

Anterior Wall - leads V2, V3, V4

Lateral Wall - leads I, aVL, V5, V6

RIGHT VENTRICLE:

Posterior Wall - RV4, V8, V9 (15 lead)

NOT AS CLINICALLY SIGNIFICANT: aVR (Q inverted, T inverted)

Blood work: most useful ~ 4 hours post infarct, pericarditis or myocarditis will not cause increase in these levels

Myoglobin: earliest to spike, false positives more likely (MVA, trauma, ARF)

Troponin: small changes even with angina, stays elevated > week after damage/infarct

CK-MB: most significant, normalizes in 3-5 days, heart muscle specific

SYSTEM FOR ECG INTERPRETATION ("RIRI"):

RATE: count the # of beats on the bottom rhythm strip from far left to mid way through the column containing V3, multiply by 10

INTERVALS:

~PR: AV block, sinus rhythm, or alternate beat pathway

~QRS: widened? may mean drugs, pacemaker, PVC, LBBB (negative deflection on V1) or RBBB (rSR/positive deflection on V1)

RHYTHM:

~Sinus (brady/tachy), AV blocks, BBB (LBBB hides acute changes more than RBBB; treat as acute MI if pt has symptoms)

~Atrial Flutter/Fibrillation, PVCs, Paced beats

~ If Unstable Use Electricity: slow = pace, fast = shock

ISCHEMIA: check for ST changes and which leads they appear

~ ST should be at baseline in EVERY lead

~ T waves should be upright in all leads except aVR

ACUTE CORONARY SYNDROME:

Stable Angina: stable unless exerting themselves

*Chest pain, no ST changes, no changes in Trop/CK

Unstable Angina: symptoms at rest, come and go, increasing frequency

*Chest pain, ST depression, no changes in Trop/CK

* Non-occlusive clot, no infarct

NSTEMI: symptoms at rest, may come and go with increasing frequency or persist/remain until treated

*Chest pain. ST depression, Trop and CK elevated

* Platelet rich, partially-occlusive clot, infarct occurs

STEMI: symptoms at rest, usually remain once they appear until treated

*Chest pain, ST elevation, Trop and CK elevated

*Platelet rich, occlusive clot, infarct occurs

TREATMENT: “NOAH” or “MONA”

Oxygen

ASA

Heparin/Anticoagulants

Morphine

Nitro * do not give if on Viagra/Cialis, or suspect a Right Heart Infarct (ie: inferior lead changes = 15 lead, should receive fluid)