

Notes for 12 Lead EKG Class
2008 WinterFire Department Class

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The 12 EKG Lead ED Receiving Station

- We will have the ability to send the 12 lead to the ED
- The new technology is digital quality
- The transmissions will be archived and retrievable by ED or Cardiologist for comparison.
- Heart disease is the # 1 health problem in America today – we have much to do to diagnosis, treat and even reverse damage
- CAD seriously effects quality and length of life
- 12 leads in the field have made a significant improvement in patient outcomes. (AHA 1992)

2 lead EKG's can be intimidating BUT let's remember the basics we already know:

* The standard Lead 1, 2 and 3 we having been using for years tells us rhythm and arrhythmias.

* A 12 Lead tells us more – injury, ischemia and necrosis
(View from 12 directions- top to bottom and front to back)

lead records injury due to:

- 1) hypoxia/ASDH
- 2) enlarged chambers due to valve problems or pulmonary disease
- 3) conduction problems
- 4) metabolic abnormalities

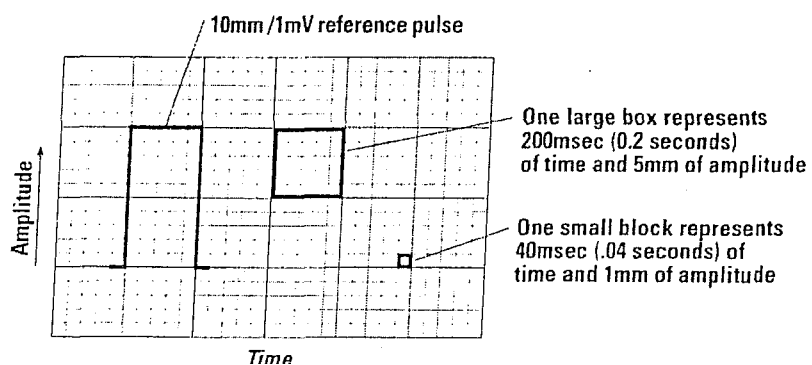
The Mechanics of it all:

- 10 leads are placed on the patient BUT 12 views are seen. The machine changes polarity independently
 - Recording electrical heart currents: if flow is to a positive electrode an upright deflection is formed. If current flow away from positive electrode is downward deflection is formed
 - The negative electrodes enhances the voltage of the positive electrodes
 - The negative electrodes provide a point of reference for the positive. The “positive electrode looks to “see” the negative.
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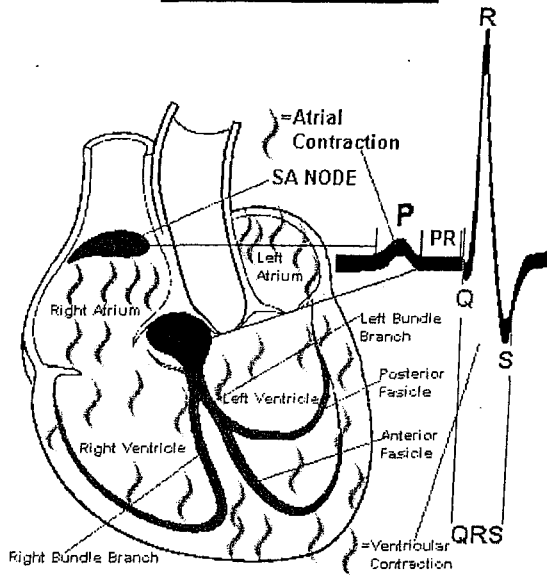
The Tracings:

Time: expressed horizontally on tracing
expressed in time (milliseconds)

Voltage: expressed vertically
1mv = 10 mm (2 big boxes)



More Basics



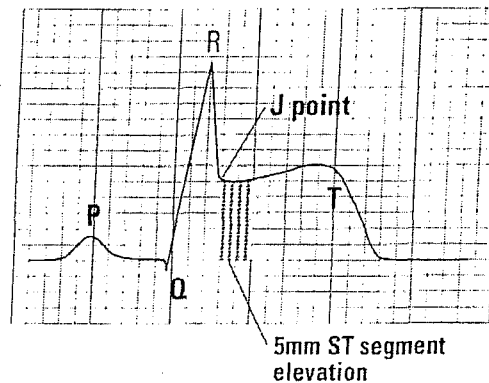
P wave is: atrial depolarization/contraction

PR interval is: short delay of conduction from SA to AV nodes / (P-R .12-.20 sec)

QRS Complex is: ventricular depolarization/contraction / (QRS .06-.11 sec a pathological Q wave is 1mm or 1 sm box or 1/2 the height of the QRS)

J point (junction point): Where the QRS stops and the ST begins

ST segment is: refractory /resting phase (level with isoelectric line)



What the 12 lead Views:

Frontal and Horizontal Planes

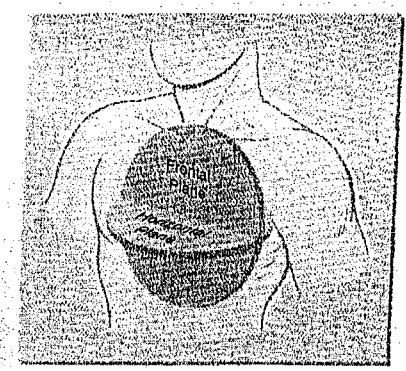


Figure C2 Frontal and Horizontal Planes

The frontal planes are derived from the 4 limb leads

But...6 views are seen (I, II, III, aVR, aVL, aVF)

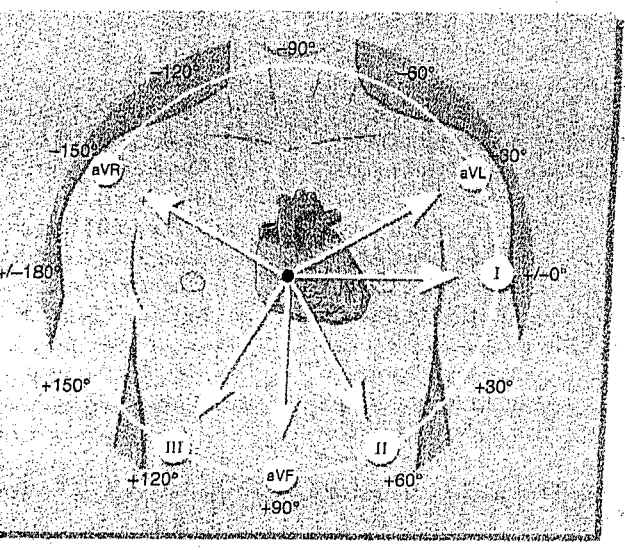
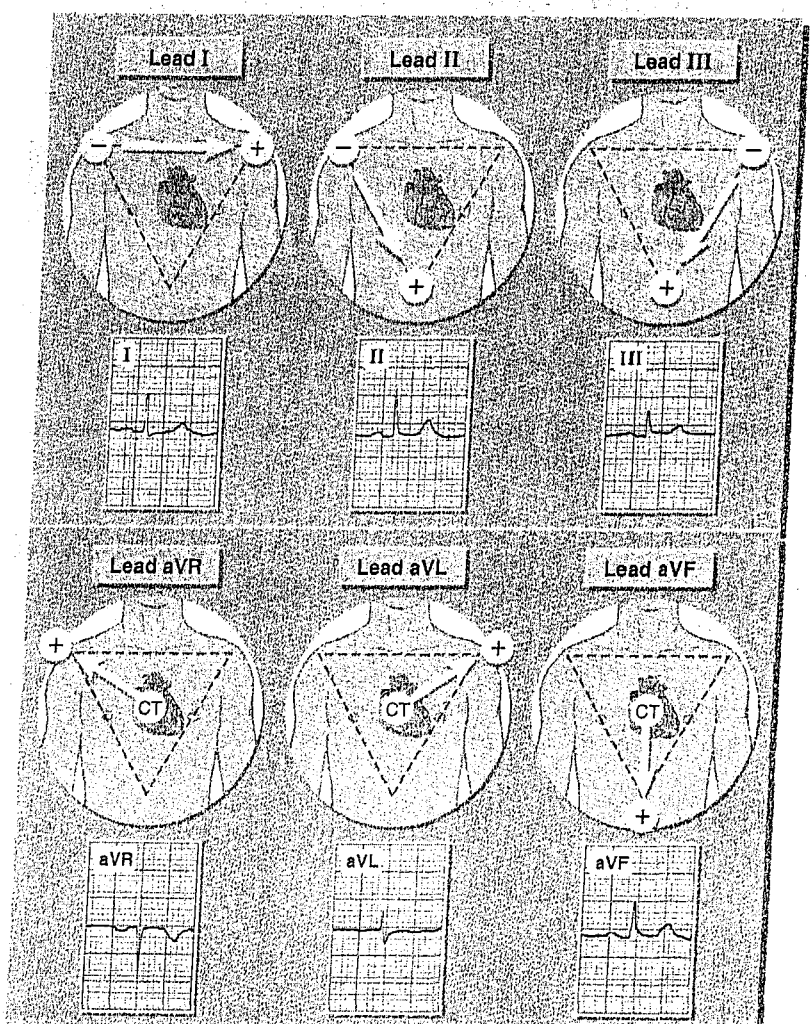


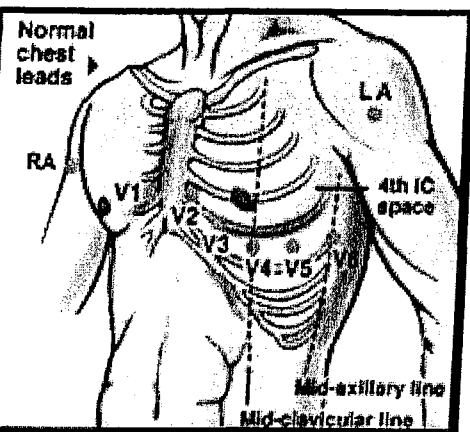
Figure C10 Frontal Plane Vectors

Limb Lead Electrode (4) placement
 inside of the wrists and ankles *or*
 over arms/thighs..... (not on the torso)



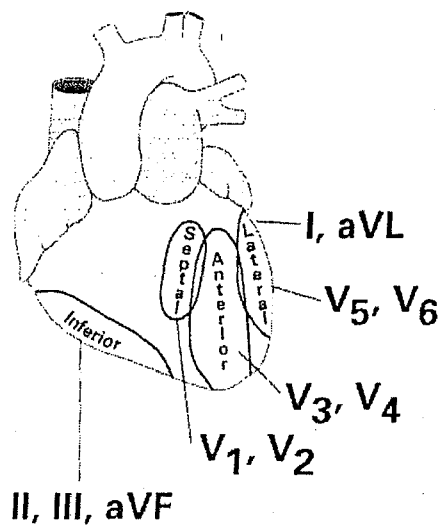
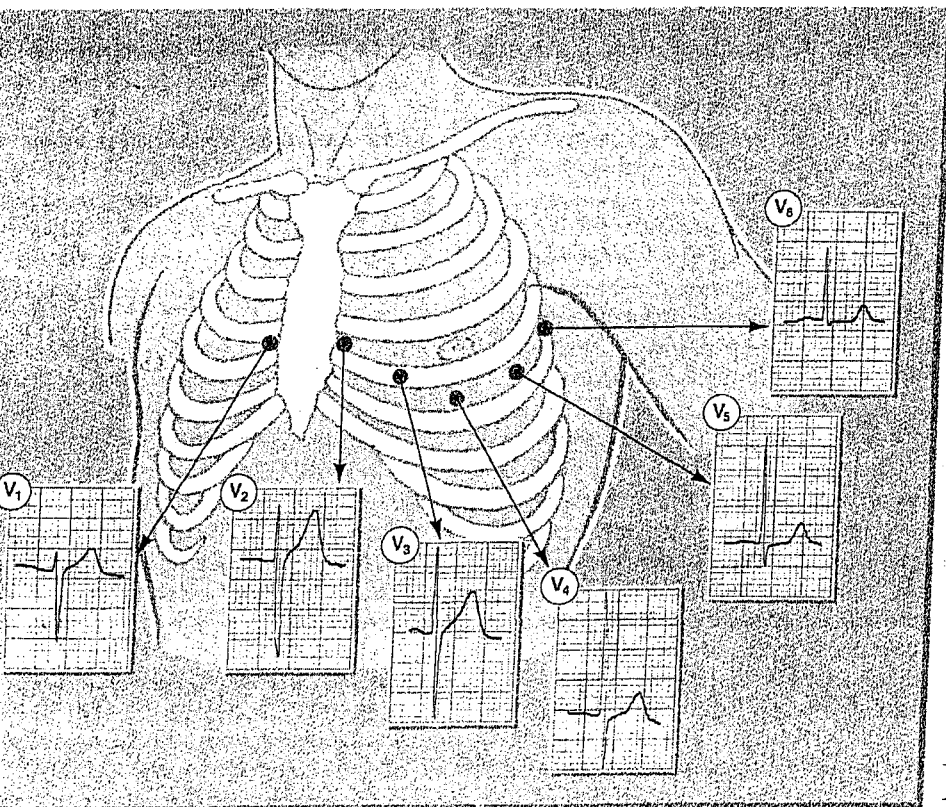
The Horizontal (Precordial) planes are derived from the precordial leads

Precordial or Chest Leads



- V₁ 4th intercostal (right)
- V₂ 4th intercostal (left)
- V₃ Between V₂ & V₄
- V₄ Midclavicular
(mid-collarbone)
- V₅ 5th intercostal space
(anterior axillary line)
- V₆ 5th intercostal
(midaxillary line)

Each Horizontal (Precordial) Lead: what you see

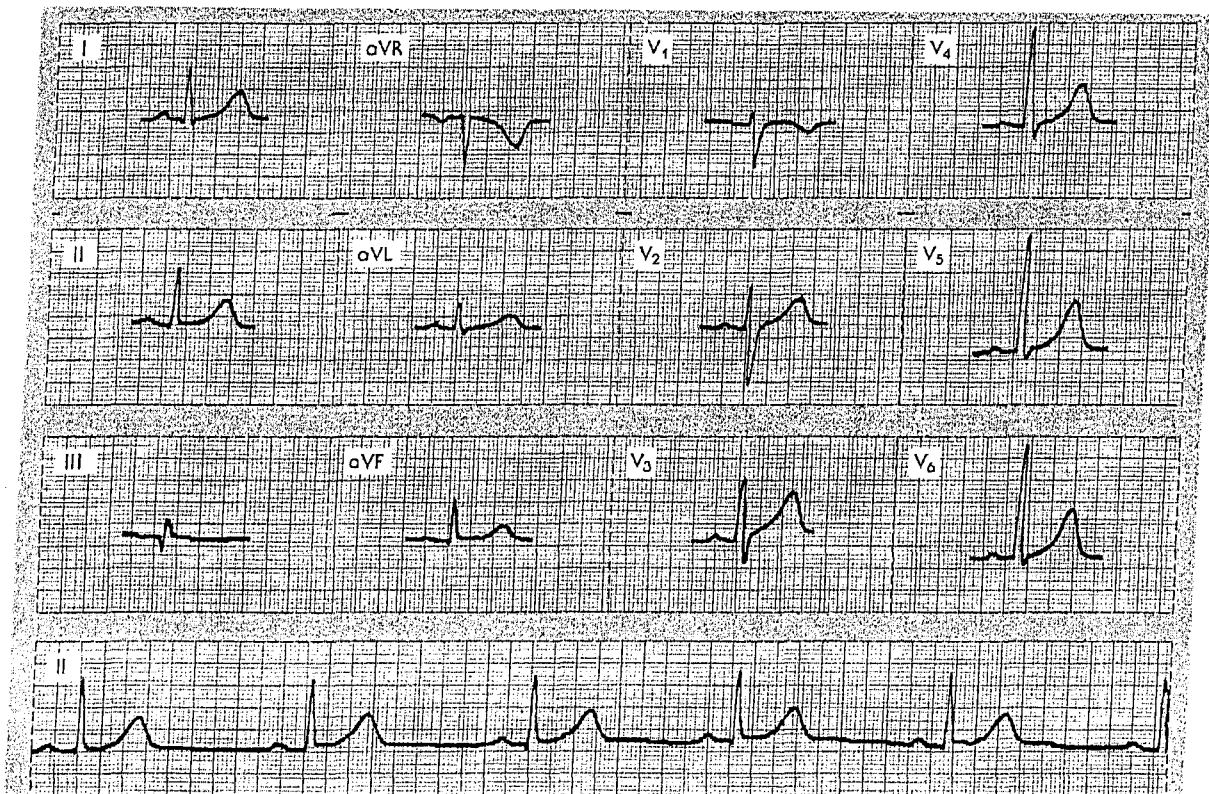
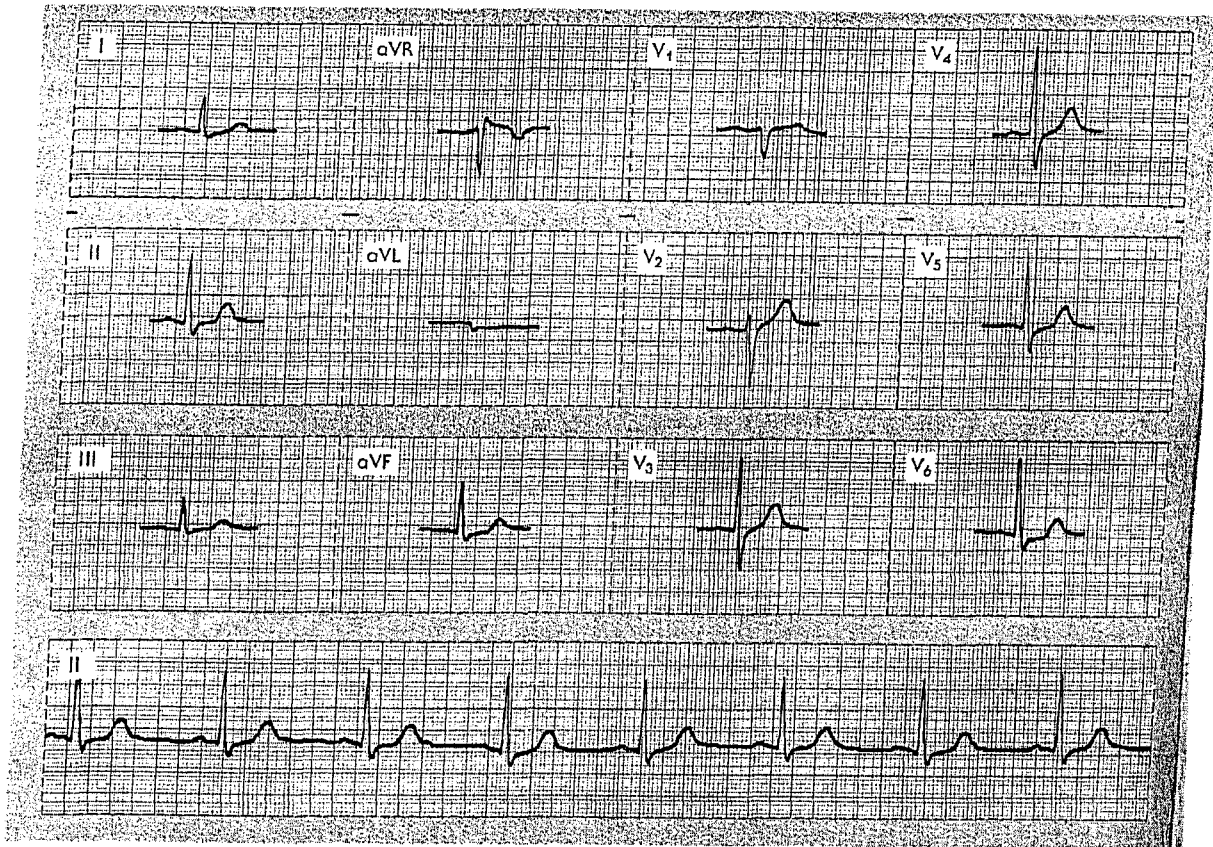


ES''

Figure C7 Horizontal Plane Leads

Leads	Location
I, aVL, V5 and V6	Lateral wall of left ventricle
II, III, aVF	Inferior wall of the left ventricle
V1, V2	Septal area (some of left ventricle)

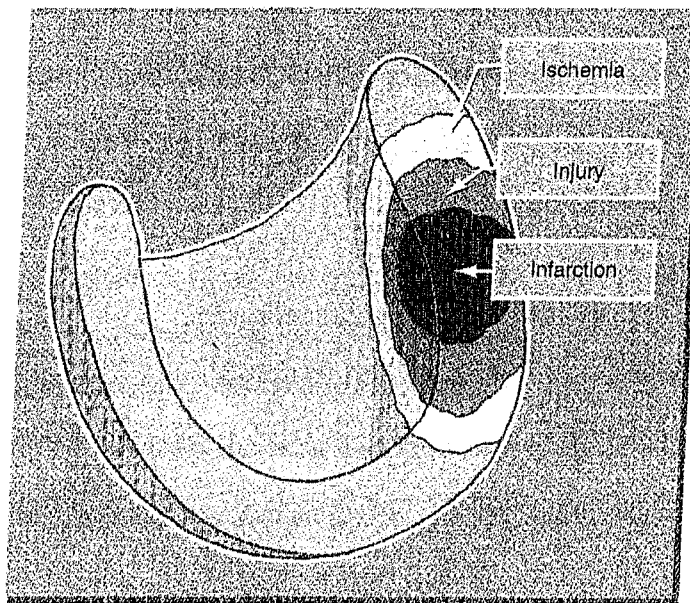
Gain confidence with normal EKG's



*** If the coronary arteries are not able to deliver the needed blood supply, ischemia develops as a result of lack of O₂ supply.
The result is: ANGINA....Chest PainDamage

Ischemia develops first and if allowed to continue (T wave inversion)
Injury in sues to the myocardium if allowed to continue (T wave elevation)
Infarction and irreversible tissue death occurs (Q Wave)

There is about a 6 hour window of time for irreversible damage



Analysis of the 12 lead:

- 1) What is the rate and rhythm?
- 2) Are there any ischemic changes?
If so, which leads and which wall?

	Find the J point	(where QRS stops and ST begins)
❖ <u>Look at:</u>	ST Segment	*depression *elevation
	T Wave	*peaking *flattening *inversion (always inverted in aVR)
	Q Wave	*deeping and widening of Q waves * loss of R wave resulting in deep QS wave *Q wave = one sm. box or $\frac{1}{2}$ of the QRS Complex

Deep and wide Q –necrotic tissue, inert and generates no electrical force. (the exploring electrode meets this “hole/window of dead tissue it will deflect down and away). Can develop in as short as 1 hour and up to a few days past the infarct.

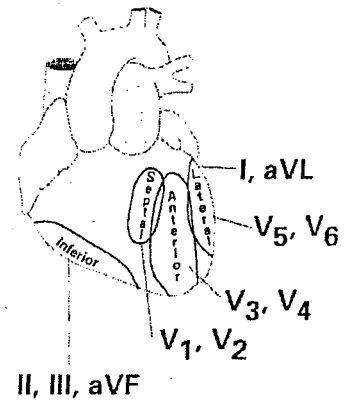
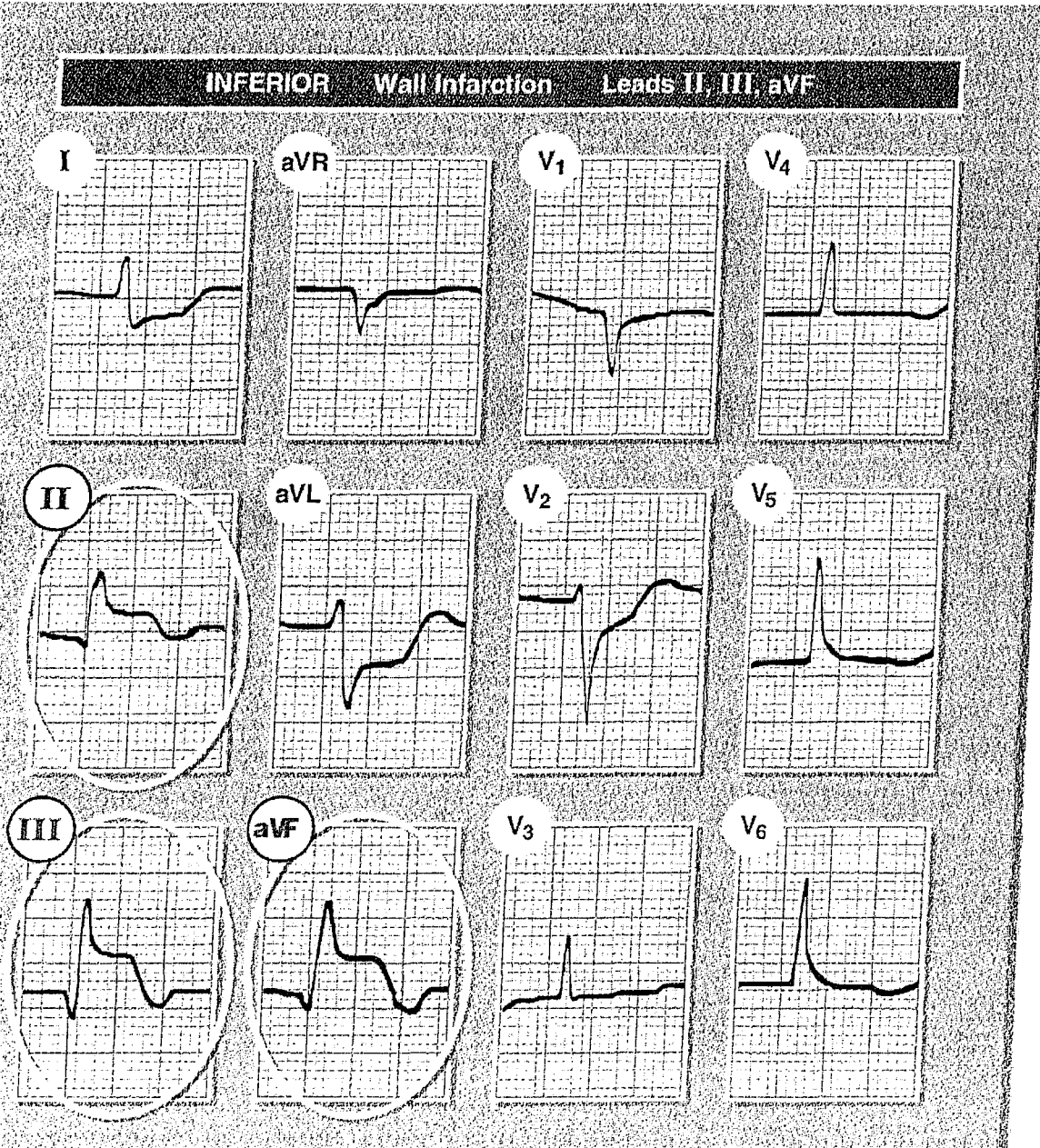
What is R wave Progression?

Between V1 and V6 the QRS complex undergoes a transformation from negative to a positive complex as current changes (flips @ V3 and

MI's

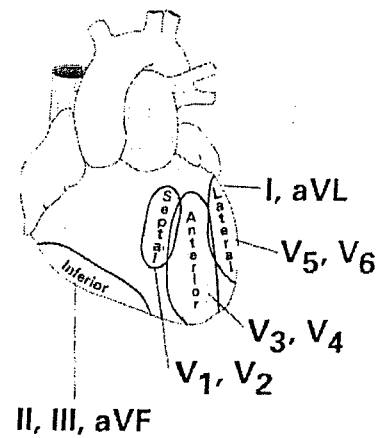
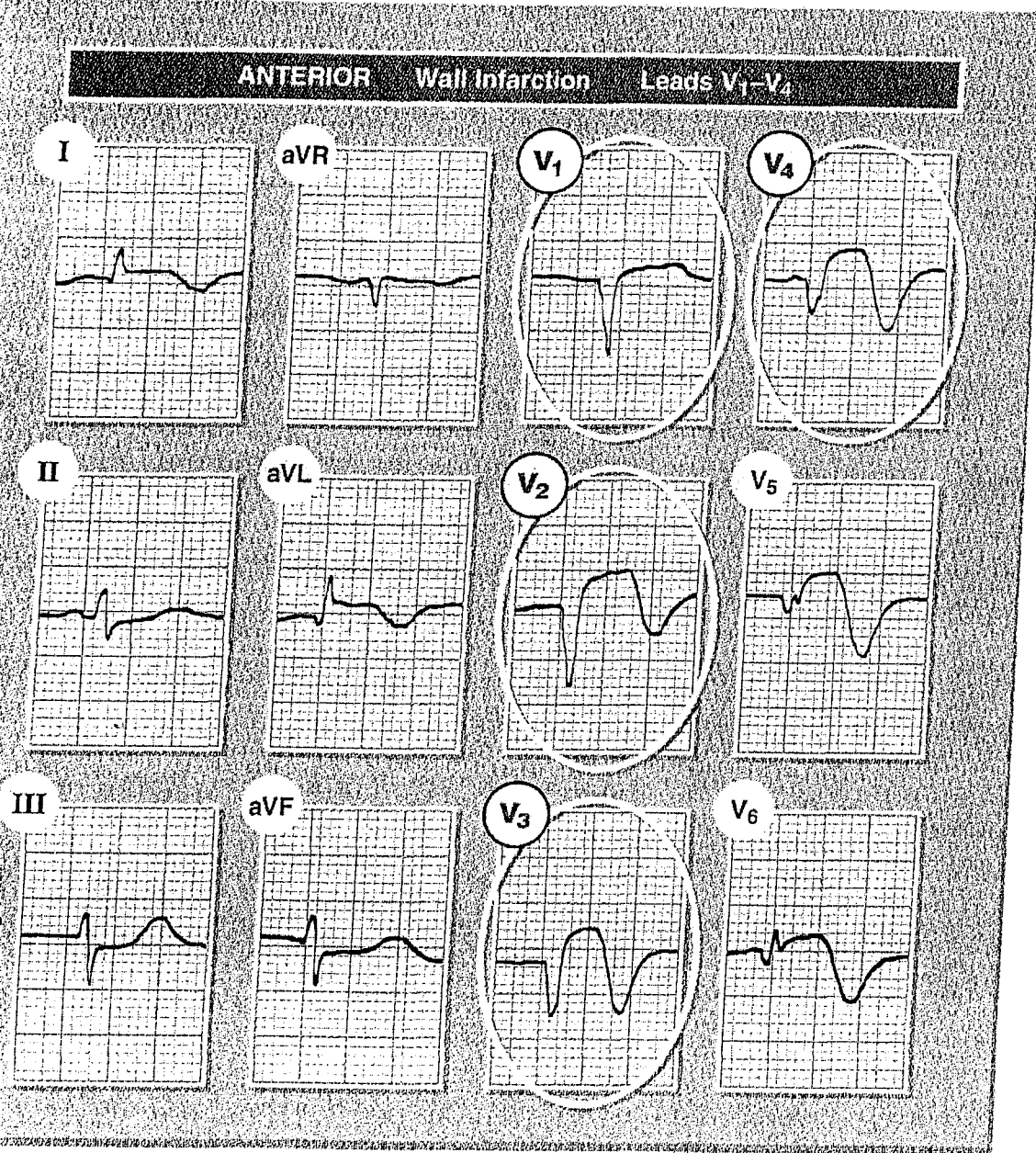
** Inferior and anterior infarcts of the left ventricle are the most common MI's

Inferior Wall MI (watch for hypotension and conduction abnormalities / pacing)

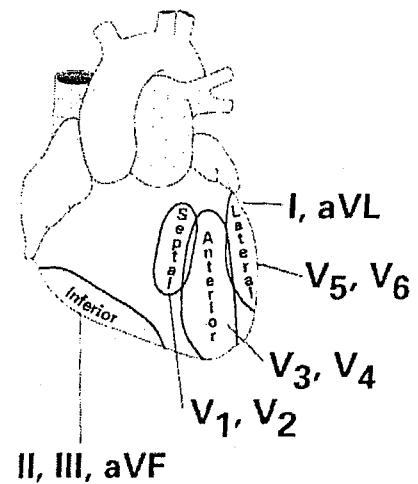
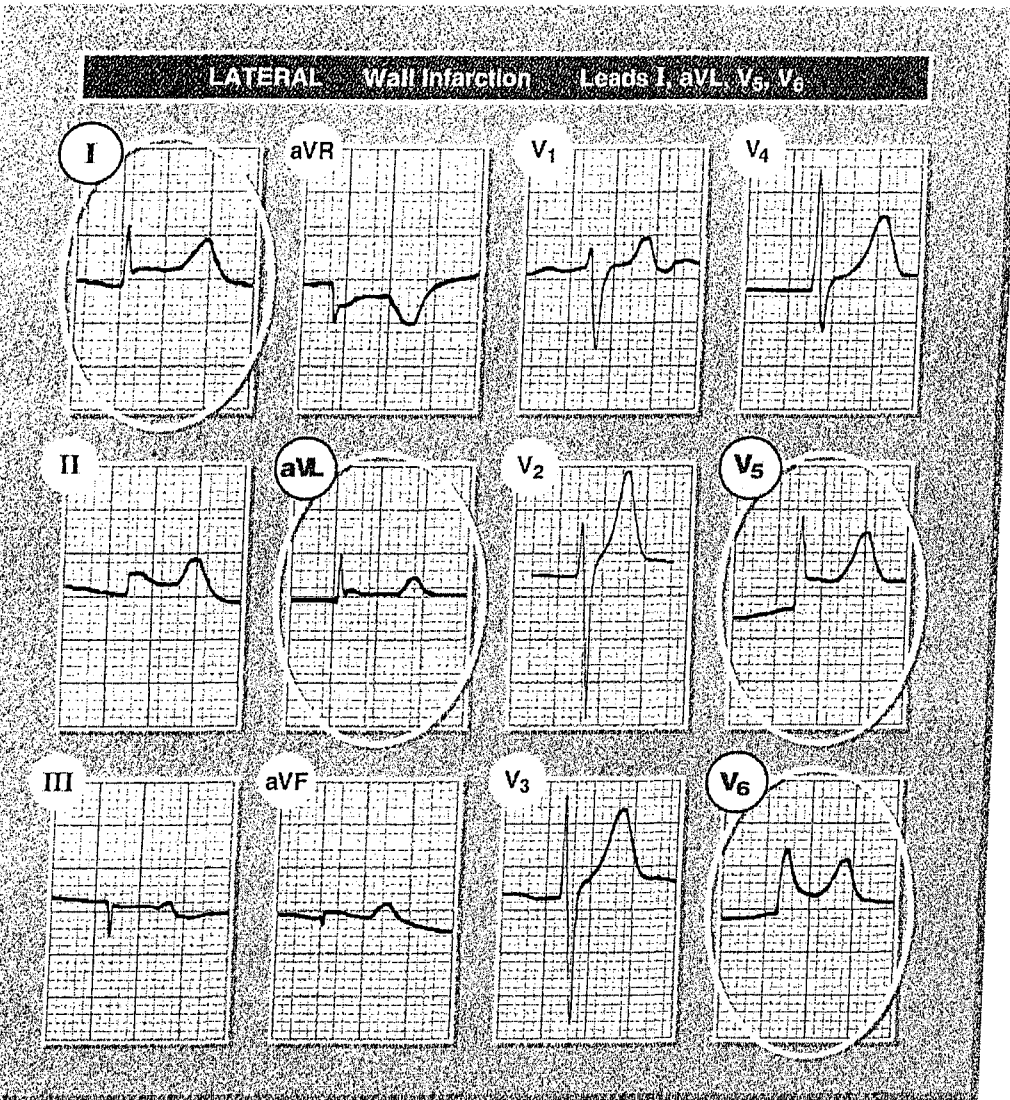


**** Inferior and Anterior infarcts of the left ventricle are the most common MI's**

Anterior Wall MI (watch for CHF, heart blocks and PVC's)



Lateral Wall MI (watch for CHF, heart blocks and PVC's)



Posterior Wall MI is a Mirror of Anterior Wall MI)

** Please leave the leads on the patient's chest as it is critical to accuracy of successive ECG's

Patient Care

12 leads and beneficial for:

1. Chest Pain
2. CHF/pulmonary edema
3. Sudden onset of SOB/resp. distress/diaphoresis
4. High risk individuals - diabetics *especially* the elderly and women smokers and CAD

Treatment:

1. See Acute Coronary Syndrome Protocol
2. Nitro, ASA, O2, clot busters, balloons and stents.
3. Manage rhythms and symptoms

Patient Monitoring

Monitor records in two frequencies (monitor/diagnostic)

1. *Monitor mode* is useful in the reduction of some artifact, motion and vibration
2. *Monitor mode* however can cause distortions that are not pathological
3. Always use *diagnostic mode* for accurate 12 leads

Artifact: How to get good tracings.....our biggest challenges!

Muscle Movement (irregular distortion of baseline/wandering)

- remove from skin: oils, loose skin cells, moisture and muscle tension (use towel, gauze)
- position arms/legs in comfortable position (try to avoid self-support of limbs/the more relaxed the better the reading)

Wandering Baseline (complexes all over page)

- have the patient hold their breath
- avoid acceleration/deceleration

Electrical Interference / 60 cycle (dark course small complexes)

- outside electrical source
- check leads / avoid noisy environment
- move from power cords / AC equipment
- switching to battery power not AC might help

ACUTE CORONARY SYNDROME

B	EMT-B	B
P	EMT-I	P
M	EMT-P	M
	MED CONTROL	

**UNIVERSAL PATIENT CARE
PROTOCOL**

**Oxygen
10-15 L NRB**

Apply Cardiac Monitor

Go to Appropriate Dysrhythmia Protocol

**Obtain 12 – Lead EKG
(Look for ST Elevation)**

IV PROTOCOL

**ASPIRIN
324 mg chew and swallow
(81 mg / tab x 4)**

**NITROGLYCERIN 0.4 mg SL every 5 minutes x3
(If BP greater than 90 Systolic with IV)
(If BP greater than 110 Systolic without IV)
*Basic EMT's may assist pt. with 1 of their own nitro.**

**Hypotension / Dysrhythmias
Treat per Appropriate Protocol**

Reassess and Monitor

Continued Pain?

**Consider Nitrous Oxide if no relief from
Morphine**

CONTACT MEDICAL CONTROL

ACUTE CORONARY SYNDROME

History	Signs and Symptoms	Differential Diagnosis
<ul style="list-style-type: none"> • Age • Medications • Past medical history (MI, Angina, Diabetes) • Recent physical exertion • Onset Palpatation 	<ul style="list-style-type: none"> • CP (pain, pressure, aching, vice like tightness) • Location (substernal, arm, jaw, epigastric, neck, shoulder) • Radiation of pain • Pale, diaphoresis • Shortness of breath • Nausea, vomiting, dizziness 	<ul style="list-style-type: none"> • Trauma vs. Medical • Angina vs. Myocardial infarction • Pericarditis • Pulmonary embolism • Asthma / COPD • Pneumothorax • Aortic dissection or aneurysm • GE reflux or Hiatal hernia • Esophageal spasm • Chest wall injury or pain • Pleural pain

GENERAL CONSIDERATIONS:

- Exam: Mental Status, Skin, Neck, Lung, Heart, Abdomen, Back, Extremities, Neuro
- Be suspicious of a “Silent MI” in the elderly, diabetics, and women. Diabetics and geriatric patients often have atypical pain, or only generalized complaints.
- Consider other causes of chest pain such as aortic aneurysms, pericarditis, and pulmonary embolisms.
- Oxygen administration is first, 12-Lead EKG, continuous cardiac monitoring, and an IV are indicated for patient’s who’s chest pain was relieved prior to your arrival.
- All patients complaining of chest discomfort must be administered at least 4 lpm of oxygen by nasal cannula. Administer oxygen by non-rebreather or assist the patient’s ventilations as indicated.
- Aspirin is administered to achieve a therapeutic dose of 324 mg (4 chewable, 81 mg tabs), unless allergic reaction or peptic ulcer disease.
- Nitroglycerin can be administered to a patient by EMS up to 3 doses. If the patient has already taken 3 of their own prior to your arrival, document if the patient had any changes in their symptoms or a headache after taking their own Nitroglycerin. **DO NOT** administer Nitroglycerin to a patient who took an erectile dysfunction medication (Viagra, Cialas, Levitra, etc.) within the last 48 hours due to potential severe hypotension.
- If patient has taken nitroglycerin without relief, consider potency of the medication. Check and document the expiration date of the patient’s prescribed nitroglycerin.
- Nitroglycerin can be administered to a hypertensive patient complaining of chest discomfort without Medical Direction permission.
- Nitroglycerin can be administered without an IV as long as the patient takes Nitroglycerin at home and has a BP greater than 120 mmHg or BP greater than 150 mmHg if over 70 years old.
- **DO NOT** treat the PVC’s with Lidocaine or Amiodarone, if the patient is bradycardic.
- If positive ECG changes, establish a second IV while en route to the hospital.
- Monitor for hypotension after administration of nitroglycerin and morphine.
- If pain continues after O₂, ASA and Nitro, administer Morphine 2 mg IV every 4-5 minutes up to 10 mg. Titrate to response and respirations.
- If the patient becomes hypotensive from Nitroglycerin administration, place the patient in the Trendelenburg position and administer a 200 - 400 mL Normal Saline bolus.