STAT 12 Lead ECG Workshop: Basics & ACS

Citrus County Fire Rescue - Session 1

WAYNE W RUPPERT, CVT, CCCC, NREMT-P

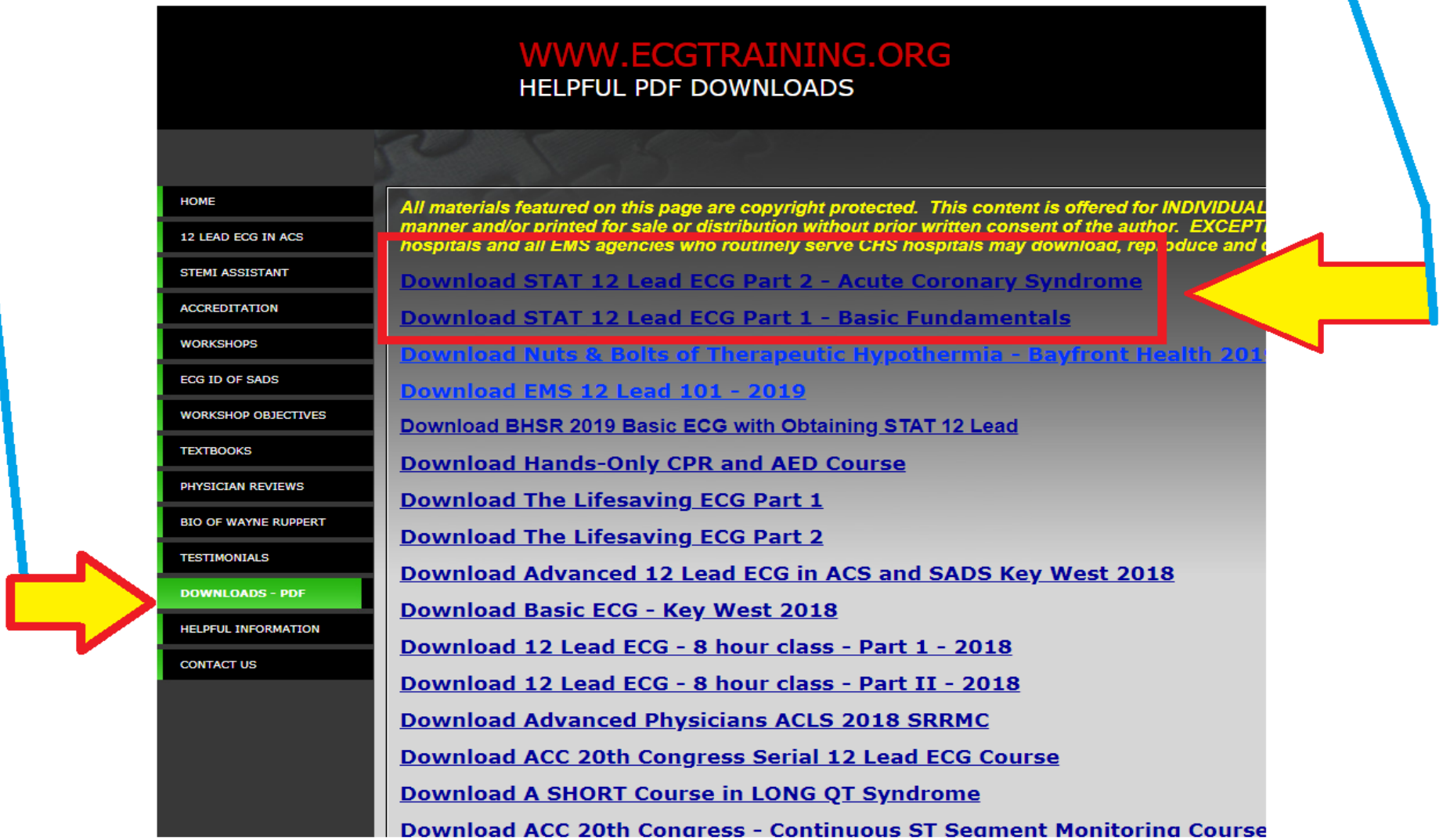
Cardiovascular Coordinator
Bayfront Health Seven Rivers
Crystal River, Florida

Interventional Cardiovascular
& Electrophysiology
Technologist

Download Class Materials:

www.ECGtraining.org

1. Go to: www.ECGtraining.org
2. Select "Downloads PDF" from menu bar
3. Select your courses



www.practicalclinicalskills.com
www.skillstat.com/tools/ecg-simulator
www.ECGtraining.org

Paramedics Christ Megoulas and Wayne Ruppert, Hershey, PA Fire Department, 1982

Cardiac Cath & Electrophysiology Technologist 1996 – Current
(Approx 13,000 cases)

Wayne Ruppert and Dr. James Irwin, St Joseph's Hospital, Tampa, 7/29/2004

Electrophysiology Lab

EP Catheters within the heart used for obtaining the Electrogram (the “internal ECG”) Tracing and for Pace-mapping, an integral component of an EP study

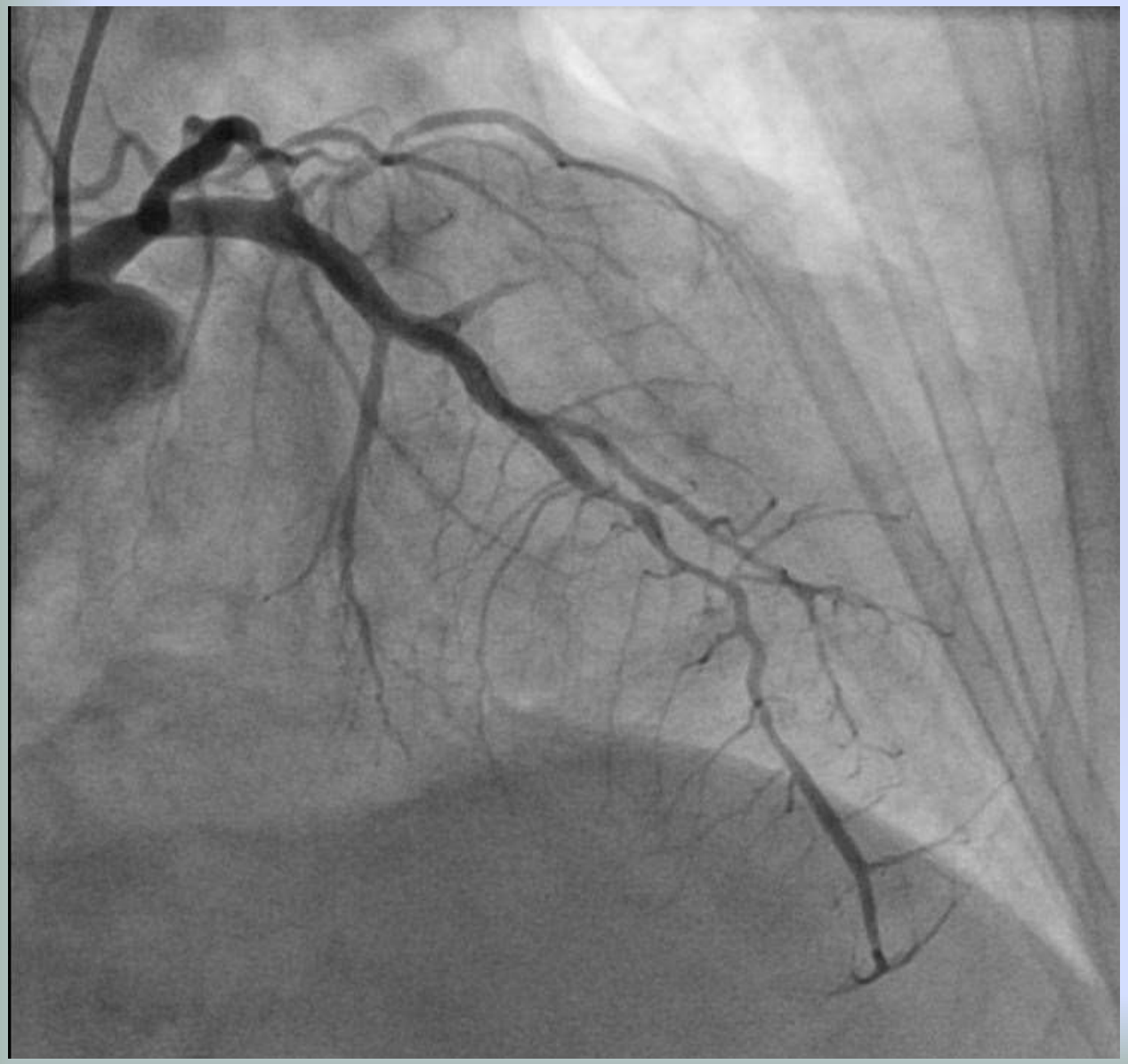
Author Wayne Ruppert conducting Pace-mapping during EP study at the St Joseph’s Hospital Heart Institute, Pediatric Electrophysiology Program, Tampa, FL in 2004


NEC
DVD+R
EnSite® System

Wayne Ruppert bio:

- Cardiovascular Coordinator 2012-present (coordinated 5 successful accreditations)
- Interventional Cardiovascular / Electrophysiology Technologist, 1995-Present.
- Author of: "**12 Lead ECG Interpretation in Acute Coronary Syndrome with Case Studies from the Cardiac Cath Lab**," 2010, TriGen publishing / Ingram Books
- Author of: "**STEMI Assistant**," 2014, TriGen publishing / Ingram Books
- **Florida Nursing CE Provider # 50-12998**
- 12 Lead ECG Instructor, 1994-present (multiple hospitals, USF College of Medicine 1994)
- Website: www.ECGtraining.org

Cardiac Cath Lab Advantage:



Allows us to CORRELATE ECG leads with SPECIFIC cardiac anatomic structures.

In the CARDIAC CATHETERIZATION LAB, we read our patients' 12 Lead ECGs and then evaluate their coronary arteries and ventricular function during angiography. Stated in plain English, *we rapidly learn how to correlate 12 lead ECG findings with what's really going on inside our patients' hearts.* Seeing ECGs from this perspective adds a new dimension to understanding the complex pathophysiologies of cardiovascular disease.

This book prepares you to:

- INTERPRET 12 Lead ECGs.
- ASSIMILATE DATA derived from the 12 Lead ECG into a comprehensive patient evaluation process designed to maximize diagnostic accuracy, while taking into consideration the 12 Lead ECGs inherent LACK of SENSITIVITY and SPECIFICITY.
- IDENTIFY 13 PATTERNS associated with myocardial ischemia and infarction, including the most subtle ECG changes often missed by clinicians and the ECG machine's computerized interpretation software.
- CORRELATE each lead of the ECG with specific regions of the heart – and the CORONARY ARTERIAL DISTRIBUTION that commonly supplies it. In cases of STEMI, this knowledge prepares you to ANTICIPATE the FAILURE OF CRITICAL CARDIAC STRUCTURES – often *BEFORE THEY FAIL.*

For those who need to master essential material quickly, this book has been written with an expedited learning" feature, *designed to make learning as easy as 1 2 3:*

1. **READ the YELLOW HIGHLIGHTED TEXT**
2. **STUDY the GRAPHIC IMAGES, PICTURES and ECGs**
3. **CORRECTLY ANSWER the REVIEW QUESTIONS at the end of each section.**

This is an invaluable resource for every medical professional who evaluates patients and reads their 12 lead ECGs:

- *Fellows in Emergency, Cardiology, and Family Medicine*
- *Medical Residents*
- *Veteran Physicians wanting a good review in ACS patient evaluation*
- *Physician Assistants and Nurse Practitioners*
- *Emergency Department Nurses*
- *Coronary Care Unit and Cardiac Telemetry Nurses*
- *Walk-in Clinic Physicians and Nurses*
- *Paramedics*

"I think this book will be a wonderful addition to the textbooks that are already available, with a fresh perspective"

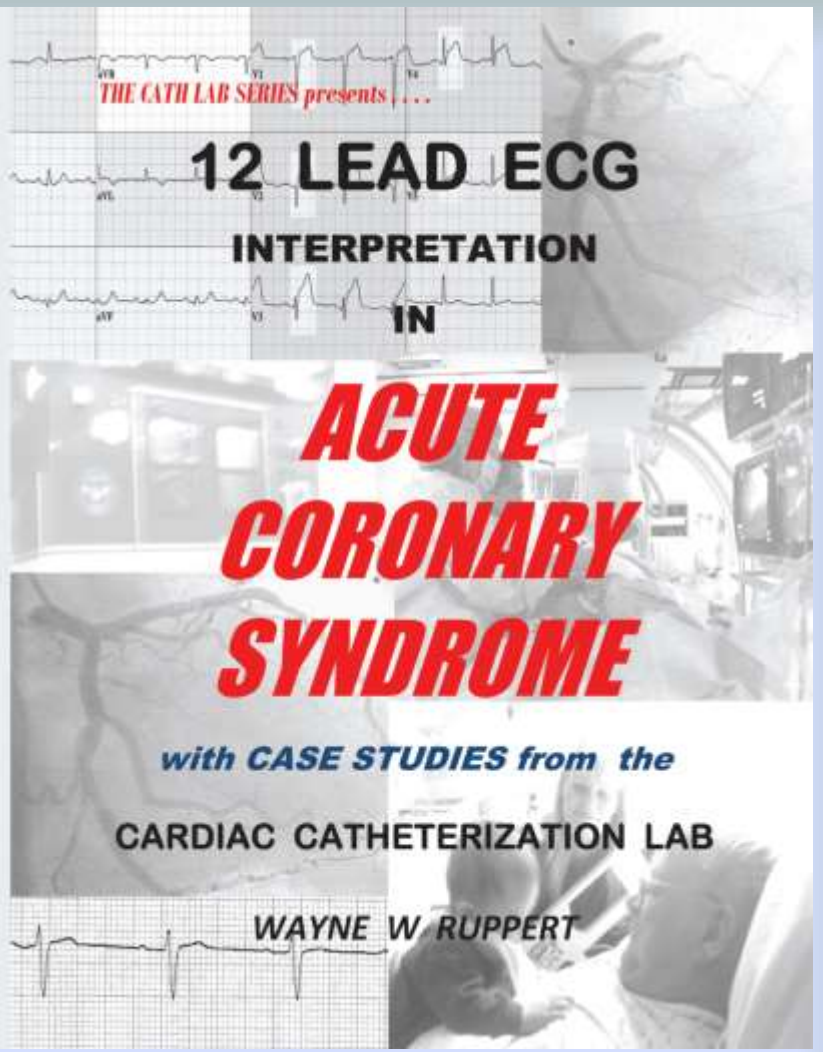
Joseph P. Ornato, MD, FACP, FACC, FACEP
- Professor and Chairman, Department of Emergency Medicine
Medical College of Virginia/Virginia Commonwealth University
- Medical Director, Richmond Ambulance Authority,
Richmond, Virginia

"This book integrates academic ECG principles with real-world clinical practice by incorporation of well chosen cath lab case studies into its curriculum. This combination lets readers see patients and their ECGs through the eyes of an experienced cath lab interventionalist, and provides a balanced approach to patient evaluation that compensates for the ECGs inherent lack of sensitivity and specificity. I highly recommend this book for all Emergency Medicine and Cardiology Fellows. For experienced clinicians, it's a superb review."

Humberto Coto, MD, FACP, FACC
- Chief of Interventional Cardiology
St. Joseph's Hospital
Tampa, Florida

ISBN 978-0-9827370-1-3
39500
9 780982 701713

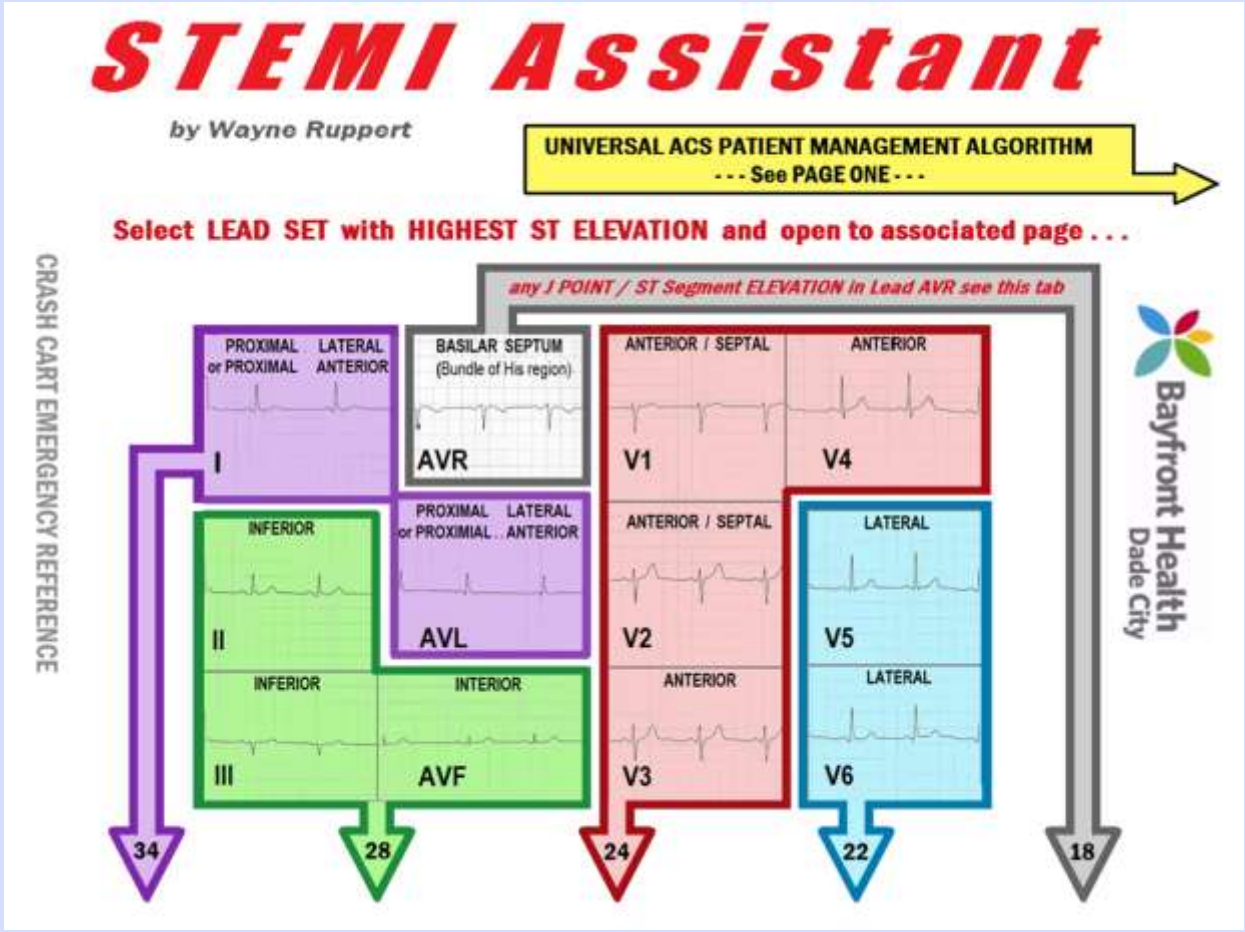
12 LEAD ECG INTERPRETATION in ACUTE CORONARY SYNDROME with CASE STUDIES from the CATH LAB – WAYNE RUPPERT



www.TriGenPress.com
www.ECGtraining.org

BarnesandNoble.com
Amazon.com

STEMI Assistant: an Emergency Crash Cart Interactive Reference Manual - free Download



STEMI Assistant – Information Video

Today's Objectives:

- Review Citrus County FD Chest Pain and STEMI Protocols

Today's Objectives:

- Review Citrus County FD Chest Pain and STEMI Protocols
- 12 Lead EKG in ACS

Today's Objectives:

- Review Citrus County FD Chest Pain and STEMI Protocols
- 12 Lead EKG in ACS
  - **Lead Placement**
  - **Correlation of Leads with Coronary Anatomy**
  - **Identify EKG Indicators of ACS**
  - **Bundle Branch Blocks and Identifying STEMI**

Today's Objectives:

- Review Citrus County FD Chest Pain and STEMI Protocols
- 12 Lead EKG in ACS
- Identify and Manage Patients with STEMI and possible Ischemia

Today's Objectives:

- Review Citrus County FD Chest Pain and STEMI Protocols
- 12 Lead EKG in ACS
- Identify and Manage Patients with STEMI and possible Ischemia
  - **Using the 12 Lead EKG as a "Crystal Ball" to determine what to complications to anticipate**
  - **STEMI Alert Procedures**

Some Basic Vocabulary:

- **Ischemia** = Inadequate blood supply to cells, but cells are still getting blood. Cellular Oxygen Demand is HIGHER than the Oxygen Supply.
- **Infarction** = blood supply to cells has been cut off. Cells are no longer receiving oxygen or glucose. Cells survive by consuming available glycogen reserves, convert to ANAEROBIC metabolism. Unless blood supply is restored, cells die when glycogen reserves are depleted.

Some Basic Vocabulary:

- **Acute Coronary Syndrome (ACS) is made up of the following cardiac conditions:**
  - **Unstable Angina**
  - **Non-ST Segment Elevation Myocardial Infarction (NSTEMI)**
  - **ST Segment Elevation Myocardial Infarction (STEMI)**
- **Low Risk Chest Pain**

Before we go any farther, you should know . . .

Sometimes,

ECGs

LIE to us !

ECGs and USED CAR SALESMEN often have MUCH in common !

THE ECG in PERSPECTIVE:

PROBLEMS with ECG:

↓ SENSITIVITY

(FALSE NEGATIVES)

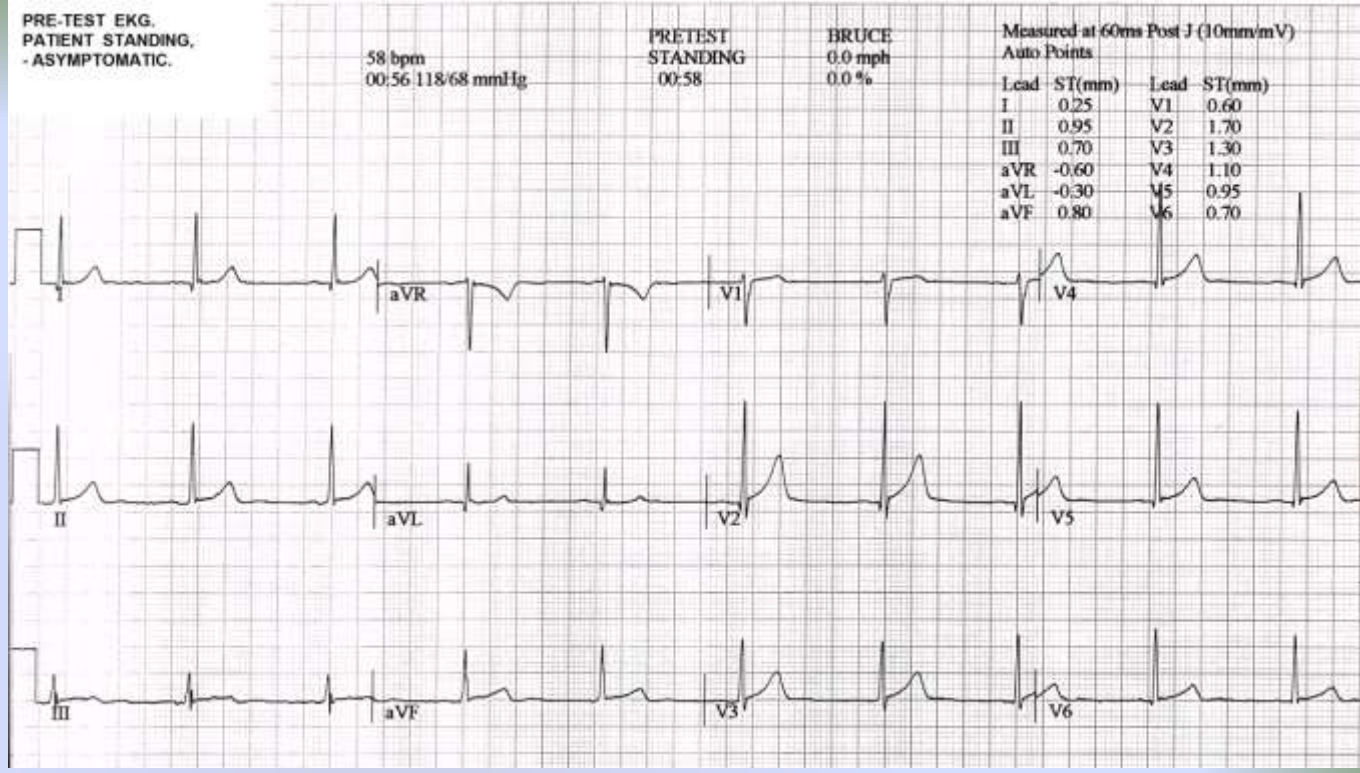
↓ SPECIFICITY

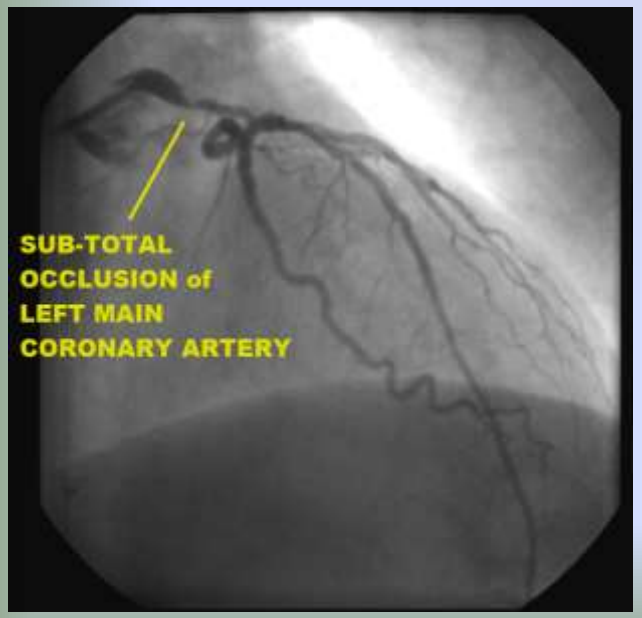
(FALSE POSITIVES)

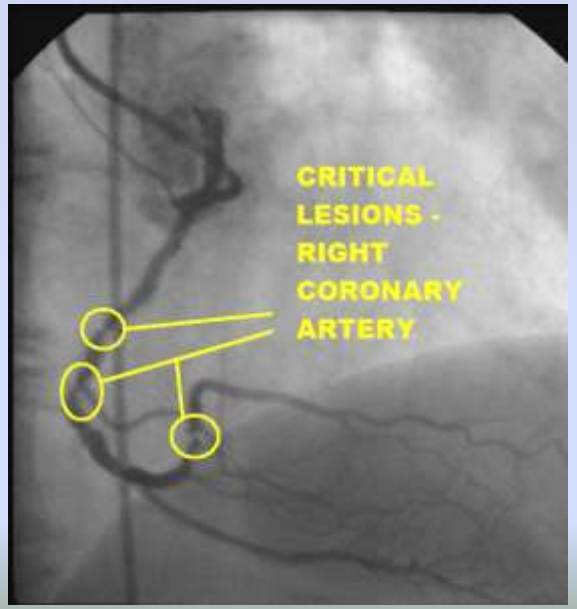
PROBLEMS WITH SENSITIVITY . . .

NORMAL ECG.

But . . . . .



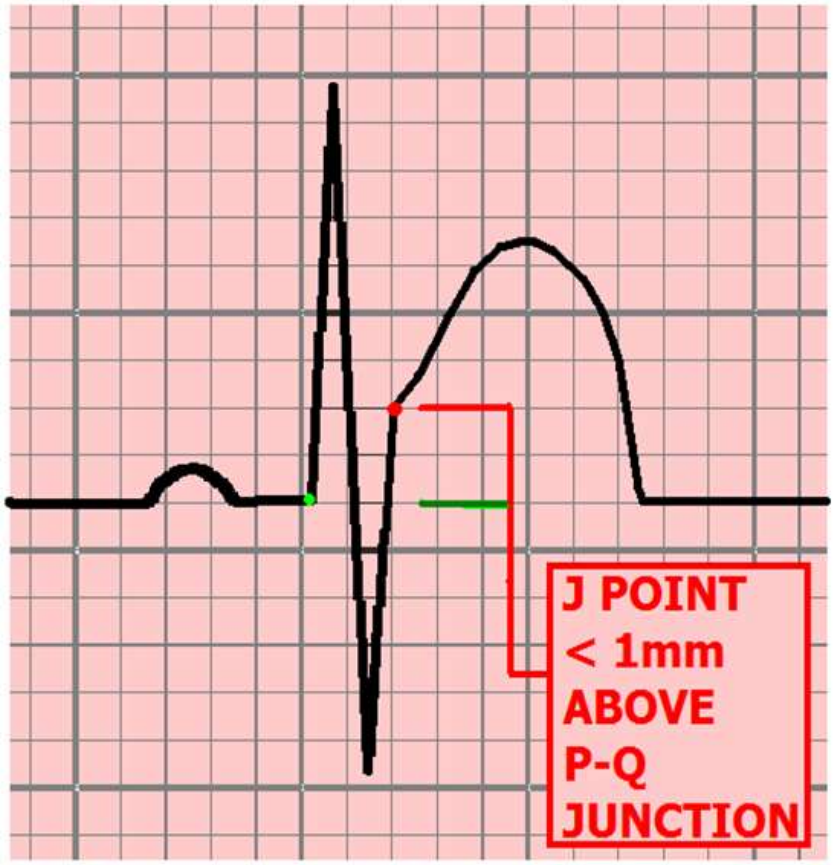




LETHAL TRIPLE VESSEL DISEASE

PROBLEMS WITH SPECIFICITY . . .

S-T SEGMENT ELEVATION - COMMON ETIOLOGIES:

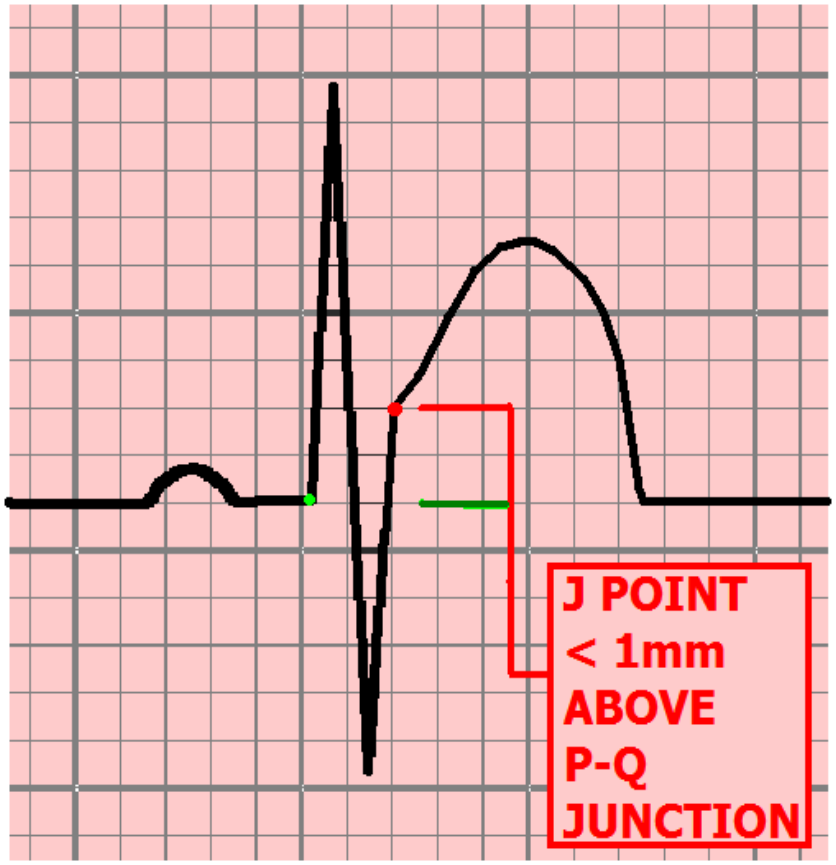


CONDITION:

- **ACUTE INFARCTION (STEMI)**

PROBLEMS WITH SPECIFICITY . . .

S-T SEGMENT ELEVATION - COMMON ETIOLOGIES:



CONDITION:

- ACUTE INFARCTION
- HYPERKALEMIA
- BRUGADA SYNDROME
- PULMONARY EMBOLUS
- INTRACRANIAL BLEED
- MYOCARDITIS / PERICARDITIS
- L. VENT. HYPERTROPHY
- PRINZMETAL'S ANGINA
- L. BUNDLE BRANCH BLOCK
- PACED RHYTHM
- EARLY REPOLARIZATION & "MALE PATTERN" S-T ELEV.

77 Years Male 7/2/2015 9:44:46

1North (06)

Rate	83	. SINUS RHYTHM.....normal P axis, V-rate 50- 99
		. RIGHT BUNDLE BRANCH BLOCK.....QRSd>120, terminal axis(90,270)
PR	152	. ANTEROLATERAL INFARCT, ACUTE.....Q >35mS, ST >0.20mV, V2-V6
QRSD	122	
QT	412	
QTc	485	

--AXIS--

P	59
QRS	14
T	33

12 Lead; Standard Placement

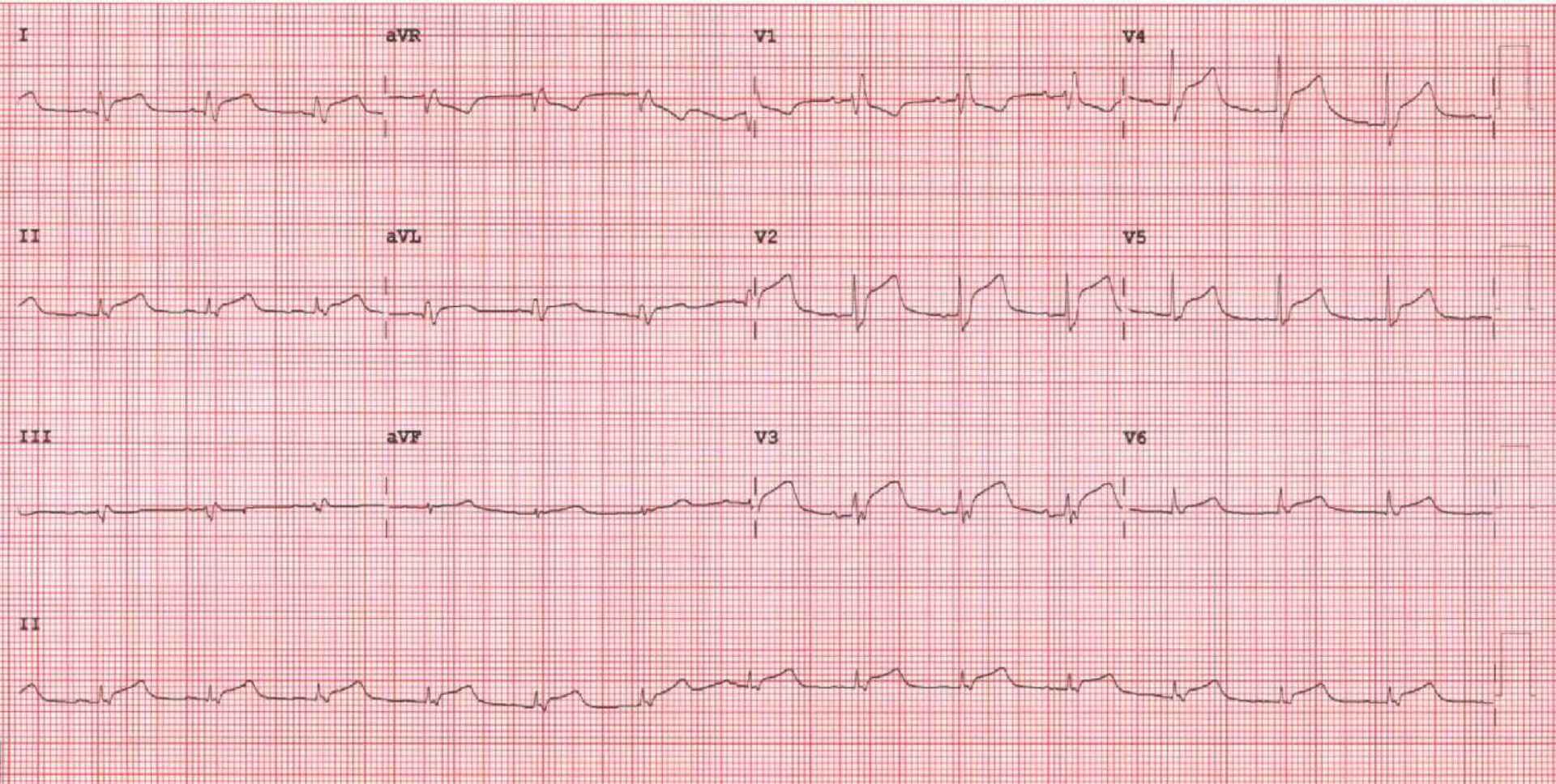
- ABNORMAL ECG -

>>> Acute MI <<<

Requested by:

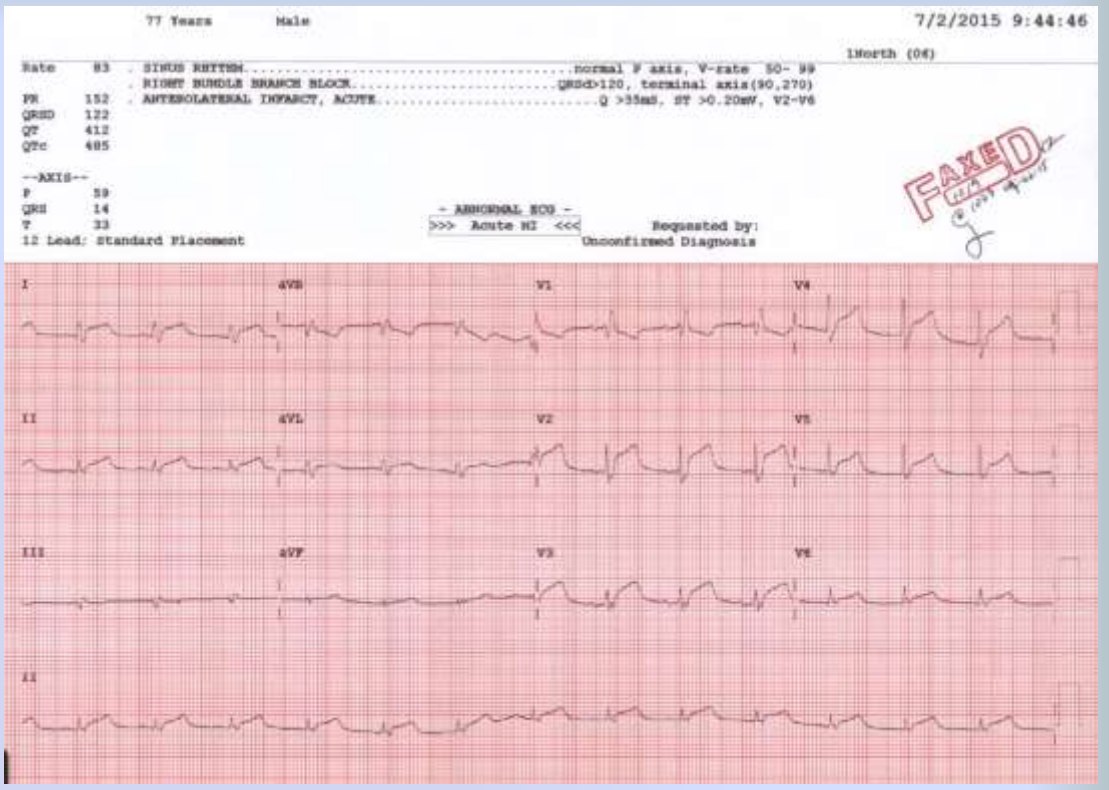
Unconfirmed Diagnosis

FAXED 10/9 @ 1023 CA 10.15



Patient:

- **Asymptomatic**
- **Troponin normal**
- **Cardiac Cath angiography = "no obstructive CAD."**
- **Discharge diagnosis:**

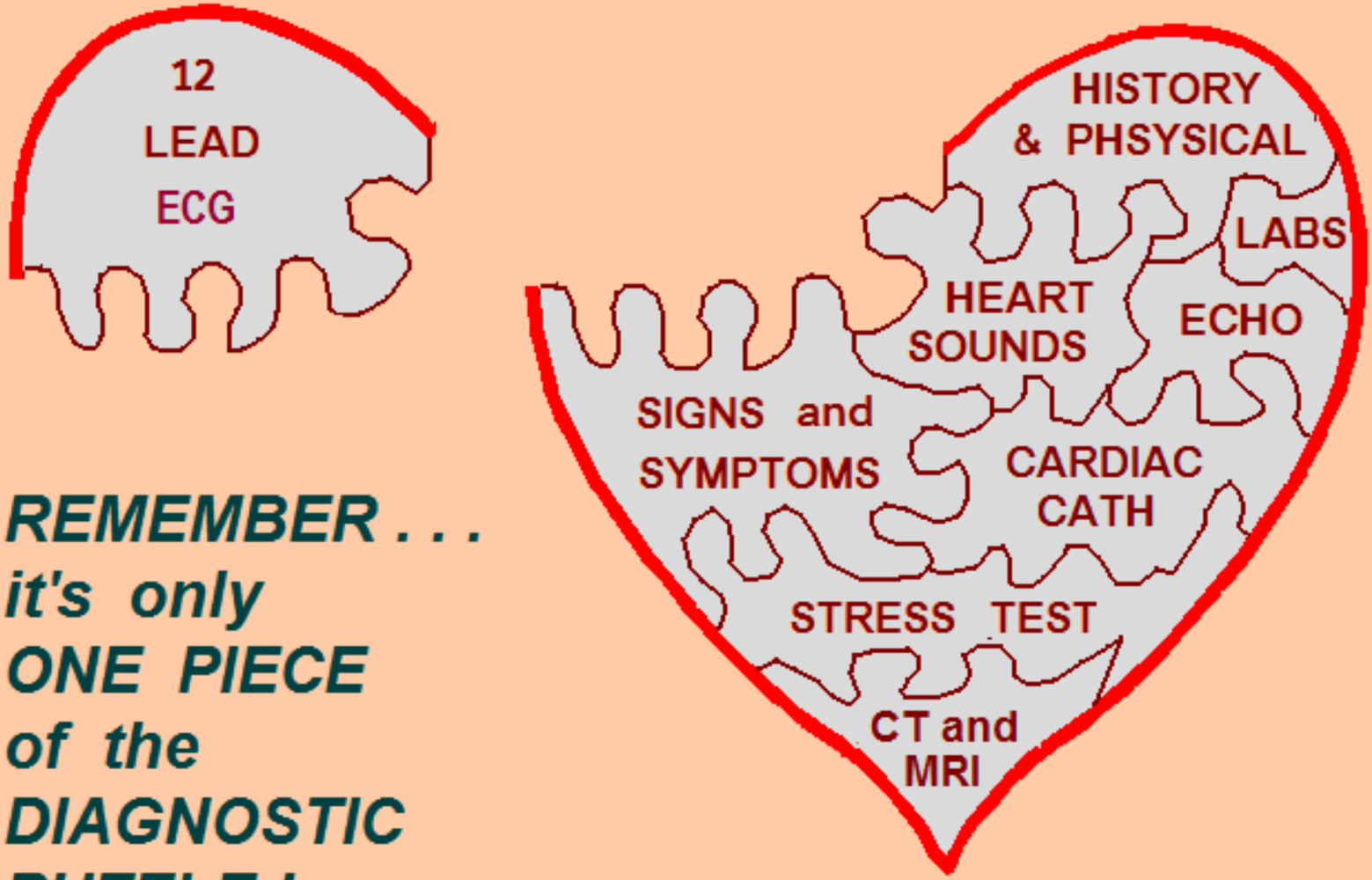


EARLY REPOLARIZATION. This degree of ST Elevation in early repolarization is VERY RARE: The only such ECG I have seen in approximately 13,000 cardiac catheterizations.

Despite the ECG's problematic issues with
Lack of Sensitivity
&
Lack of Specificity,
The 12 Lead ECG remains one of our QUICKEST, most cost-efficient front-line Triage Tools that we have today.

So how do we know when the ECG is telling us the truth ???

REMEMBER . . . . Keep the ECG Results in PROPER PERSPECTIVE . . . .



REMEMBER . . .
it's only
ONE PIECE
of the
DIAGNOSTIC
PUZZLE !

- ***In the hospital we utilize ACS Risk Stratification tools – such as The HEART Score. We also have Troponins, Echo, CT and Cardiac Cath. In the field, you have far fewer resources!!***

- ***What do you have in the field?***
  - ***Symptoms***
  - ***ECG***
  - ***Risk Factors***

The QUADRAD of ACS

- ☐ PRESENTING SYMPTOMS
- ☐ ECG ABNORMALITIES
- ☐ RISK FACTOR PROFILE
- ☐ CARDIAC MARKERS

The QUADRAD of ACS

- ☐ PRESENTING SYMPTOMS
- ☐ ECG ABNORMALITIES
- ☐ RISK FACTOR PROFILE
- ☐ CARDIAC MARKERS

A POSITIVE finding in TWO or MORE of the above categories indicates it is EXTREMELY LIKELY that ACS is present . . . . steps must be AGGRESSIVELY TAKEN to definitively RULE OUT the PRESENCE of ACS !

EMS 12 Lead ECG

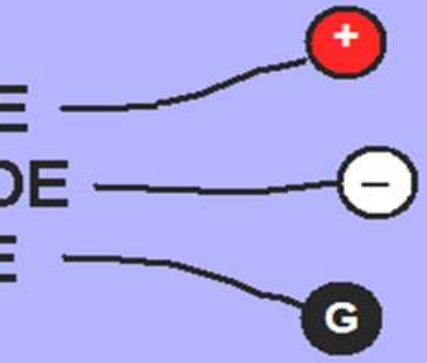
10 wires . . .

- 4 limb leads
- 6 chest (“V”) leads

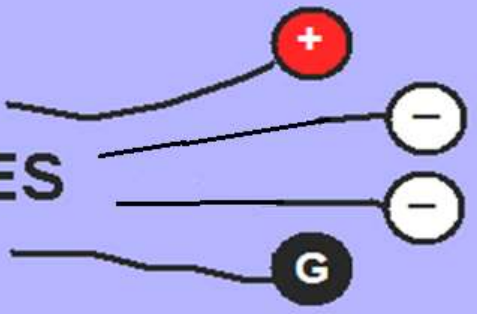
THE ECG MACHINE

STANDARD 12 LEADS - USES 10 WIRES
(6 CHEST and 4 LIMB)

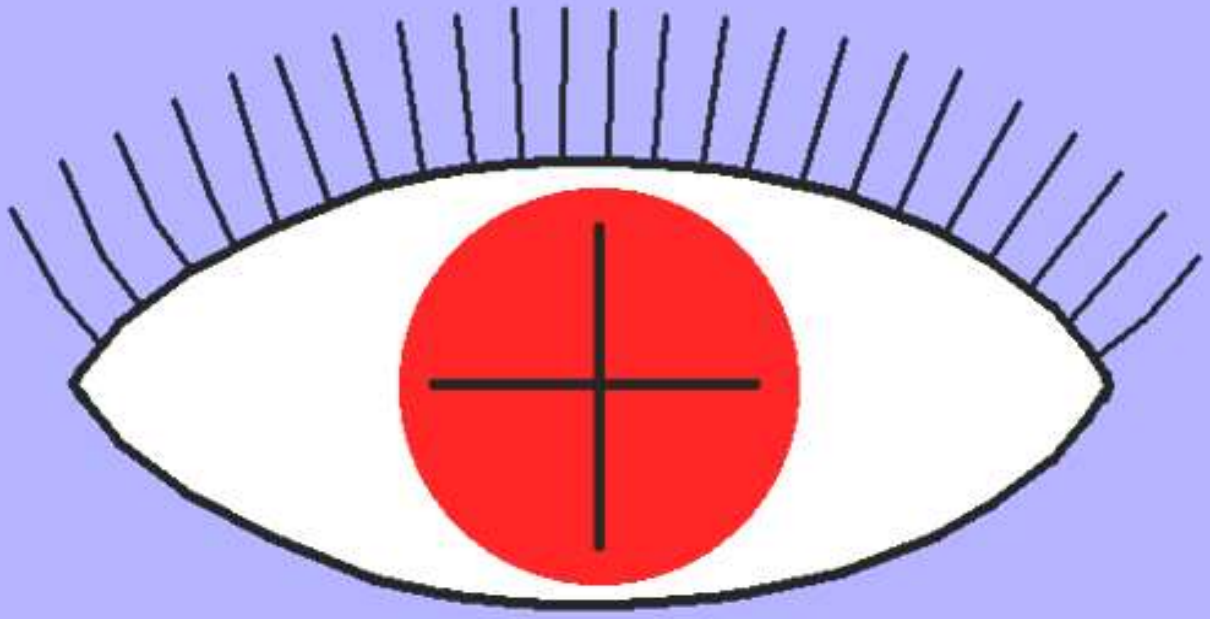
- LEADS I, II, III, and V1, V2, V3, V4, V5, V6



- LEADS AVR, AVL, and AVF

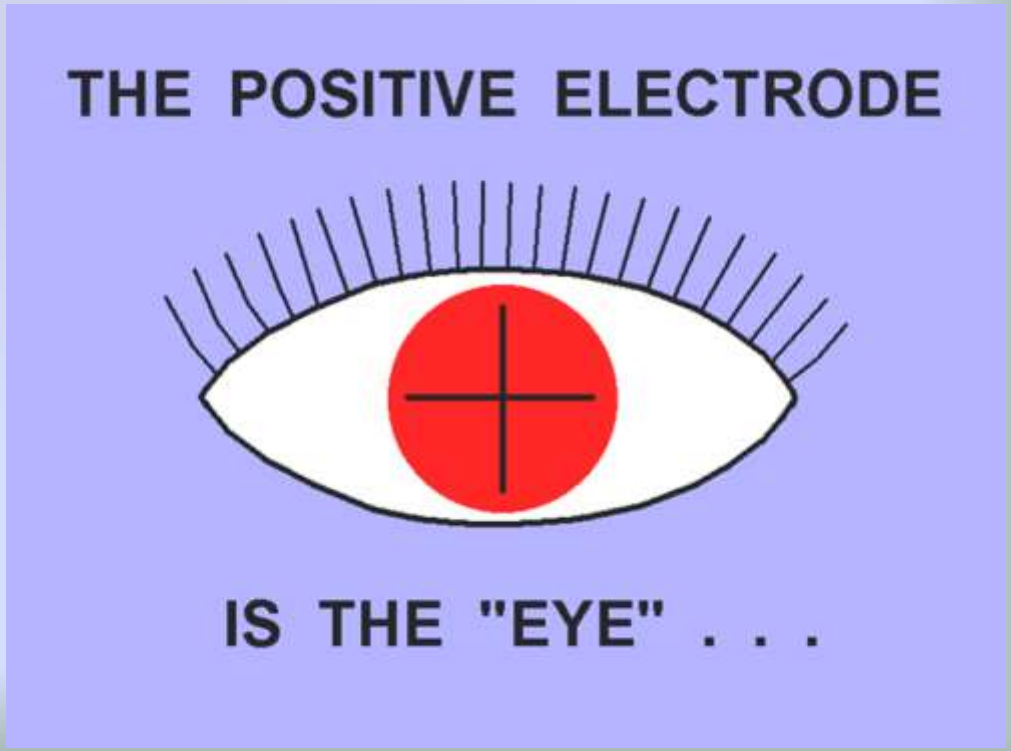


THE POSITIVE ELECTRODE



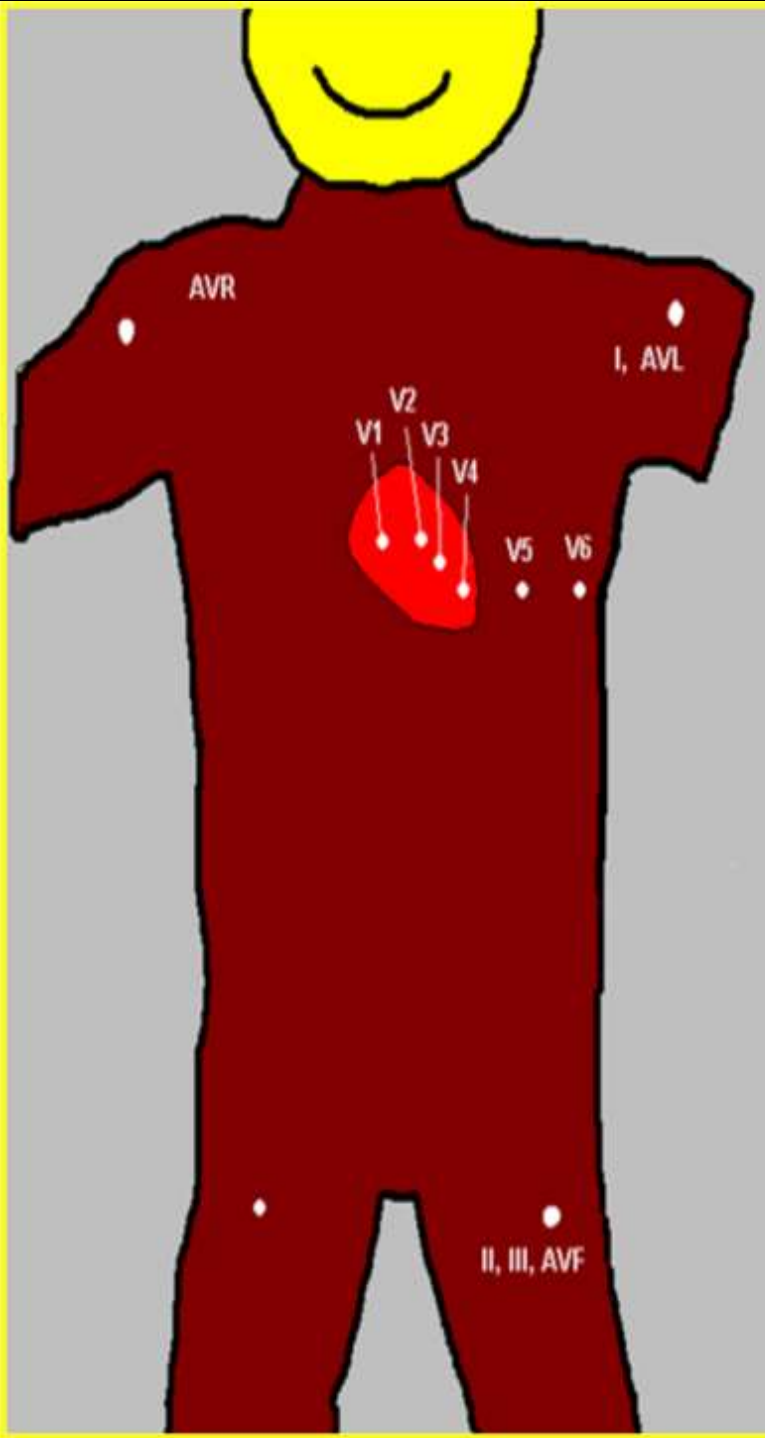
IS THE "EYE" . . .

What part of the HEART would each lead SEE ?



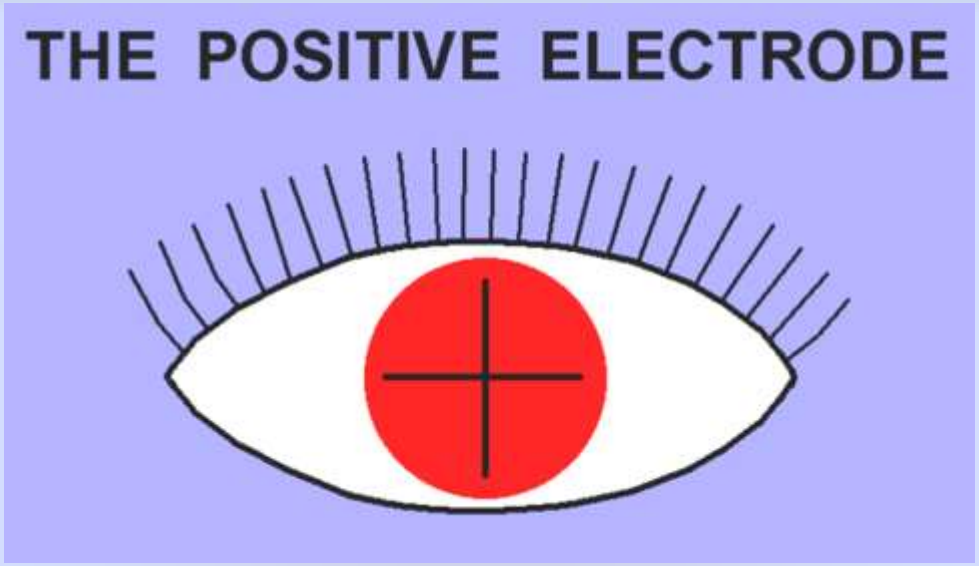
Imagine a body made of clear glass, with only a HEART inside. We dip this body in liquid chocolate, and then scratch holes in each spot where we normally place the ECG leads . . . . .

AREAS VIEWED by 12 LEAD ECG



AVR
AVL, I
V1, V2
V3, V4
V5, V6
II, III, AVF

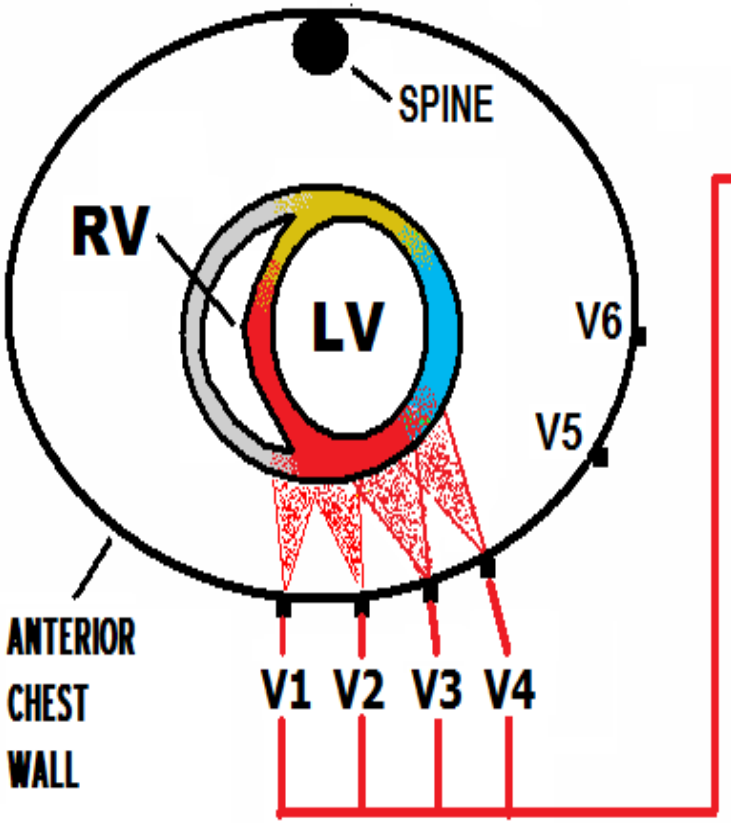
Fill in the blanks as we proceed!



What each of the 12 Leads “see,” in more detail . . . .

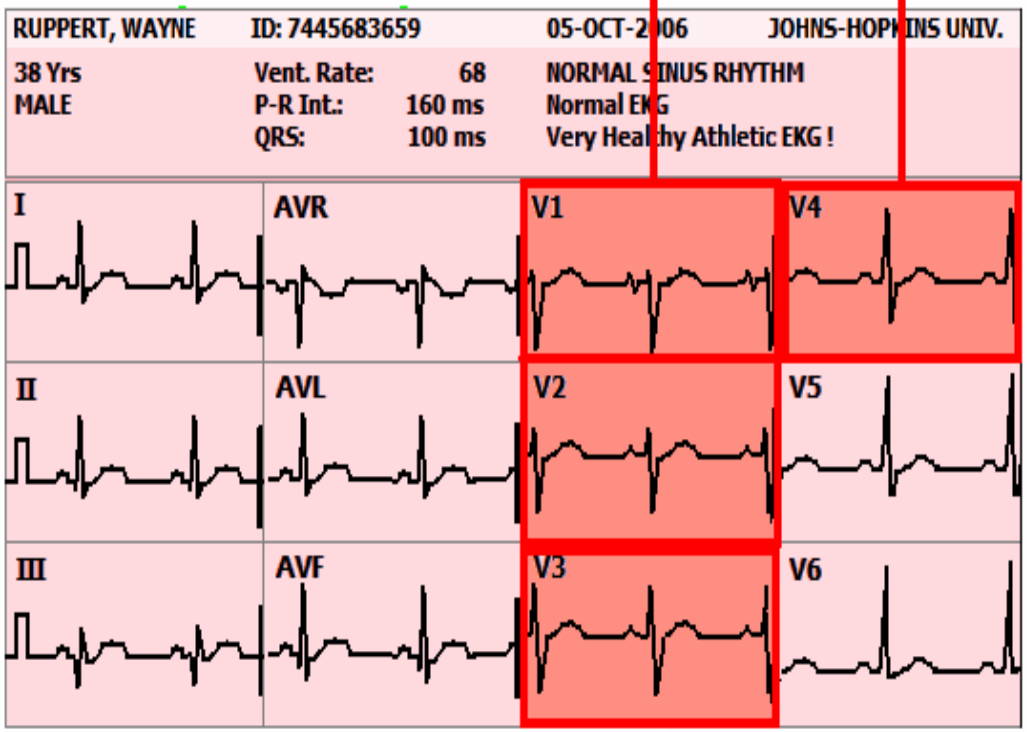
V1 - V4 VIEW THE ANTERIOR-SEPTAL WALL

of the LEFT VENTRICLE



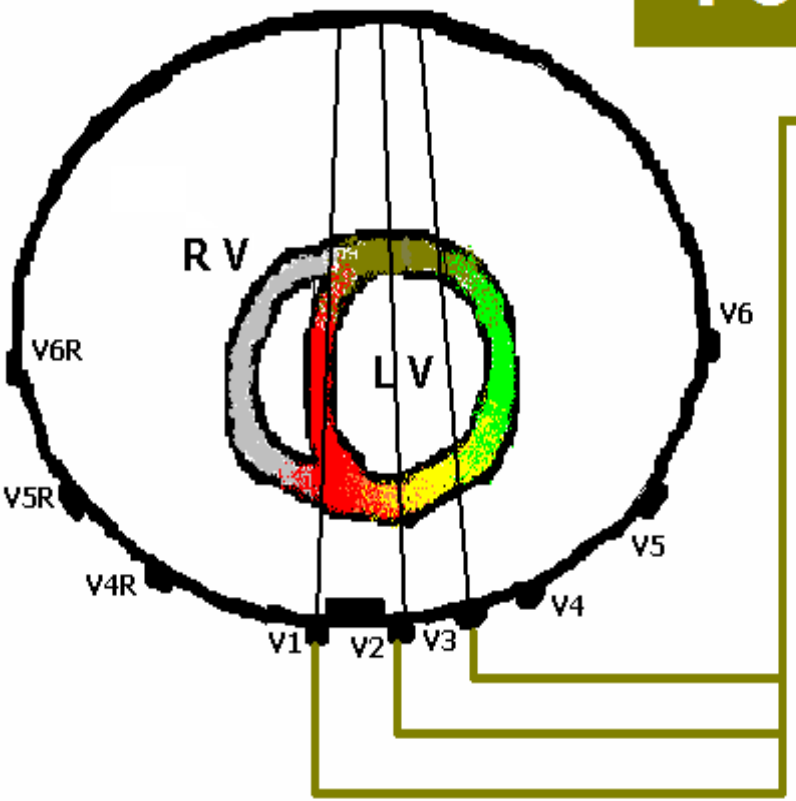
V1, V2 - ANTERIOR / SEPTAL

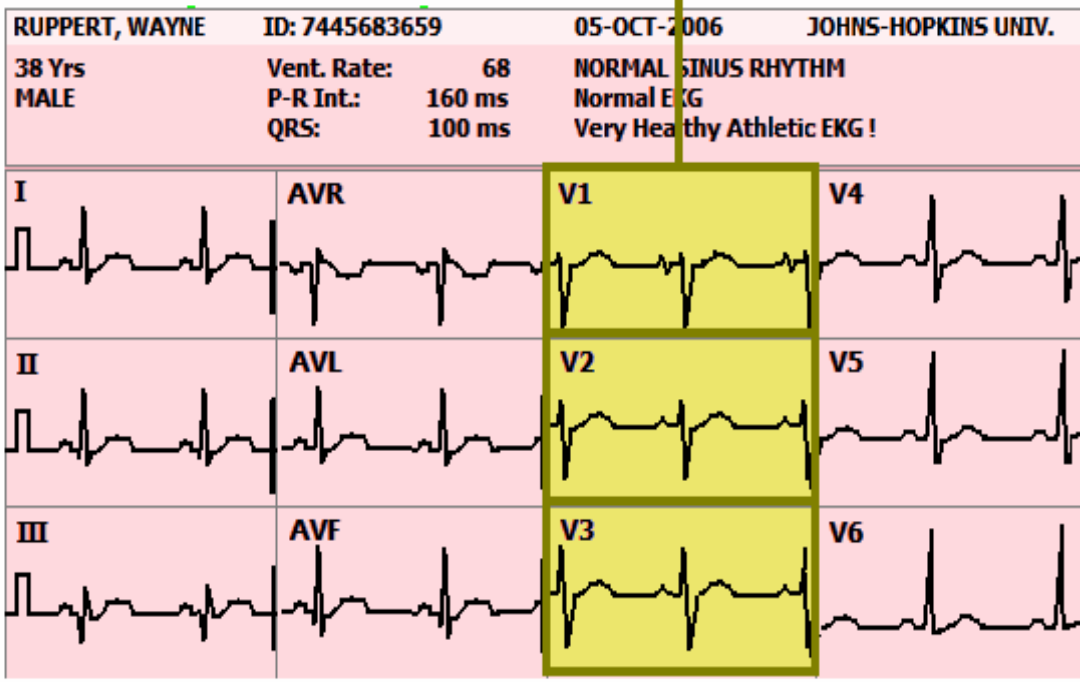
V3, V4 - ANTERIOR



LEADS V1 - V3 *view the*

POSTERIOR WALL



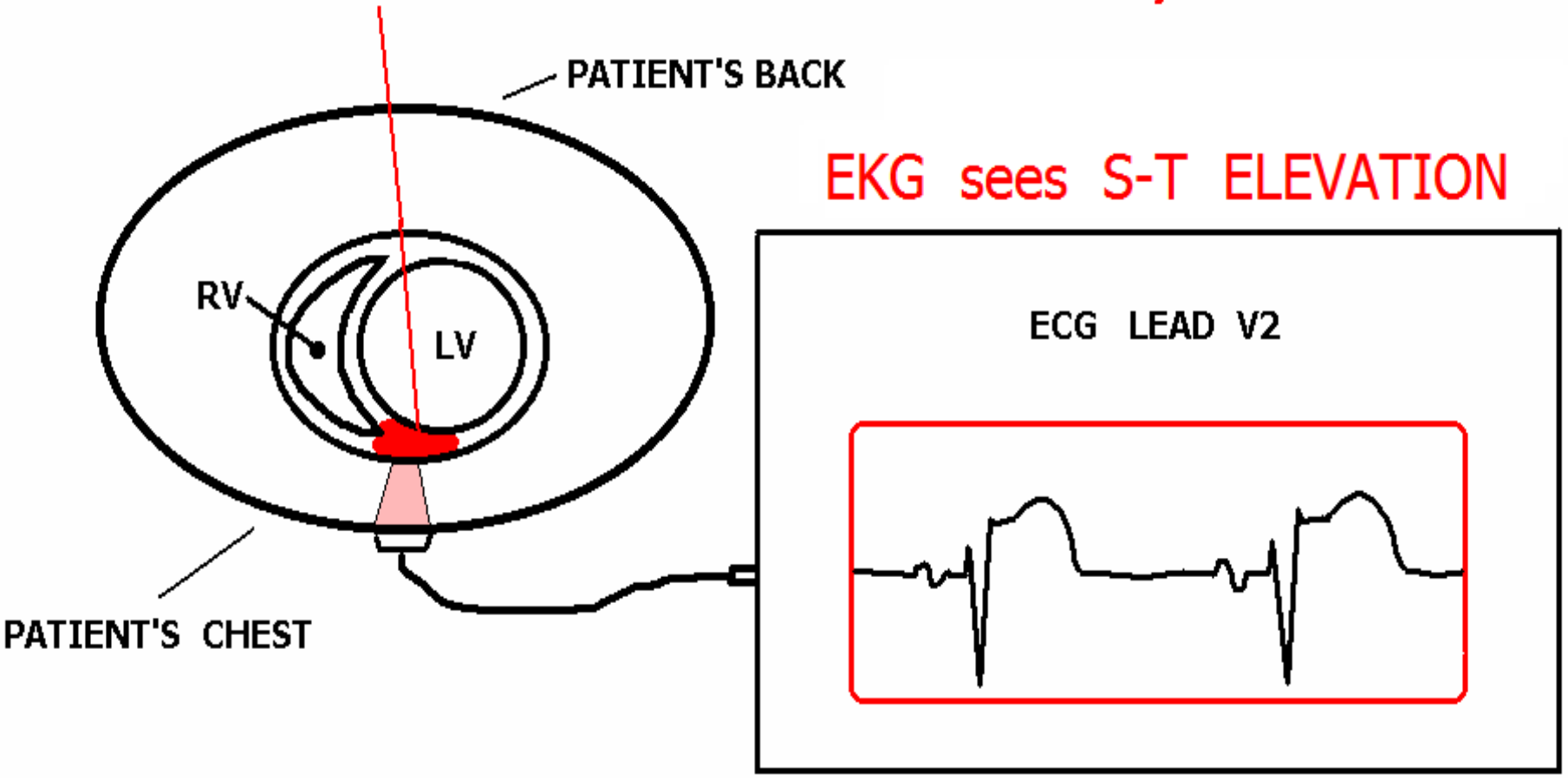


via RECIPROCAL CHANGES.

HOW EKG VIEWS INDICATIVE CHANGES

EXAMPLE:

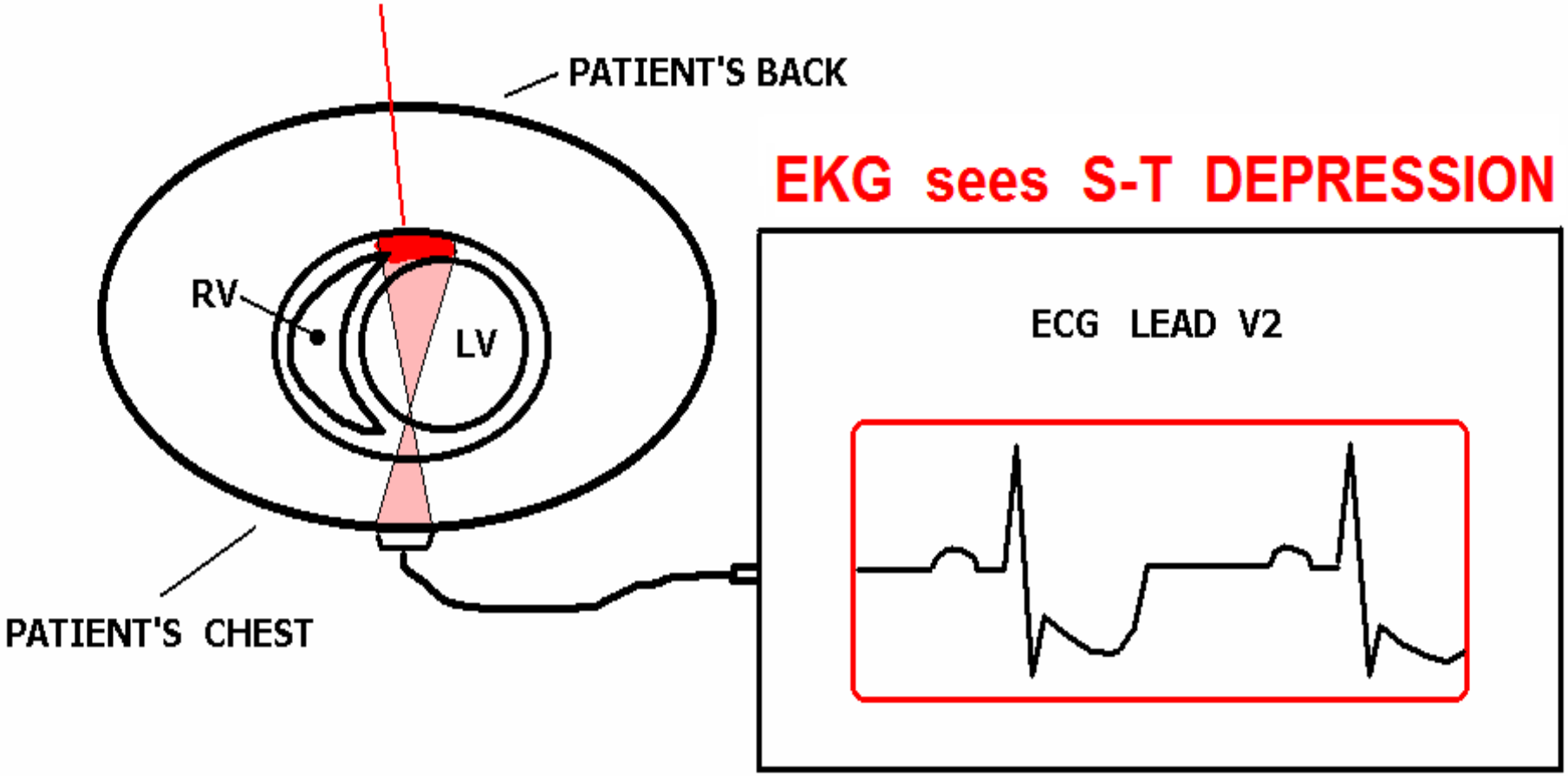
AREA OF ACUTE INFARCTION - ANTERIOR/SEPTAL



HOW EKG VIEWS RECIPROCAL CHANGES

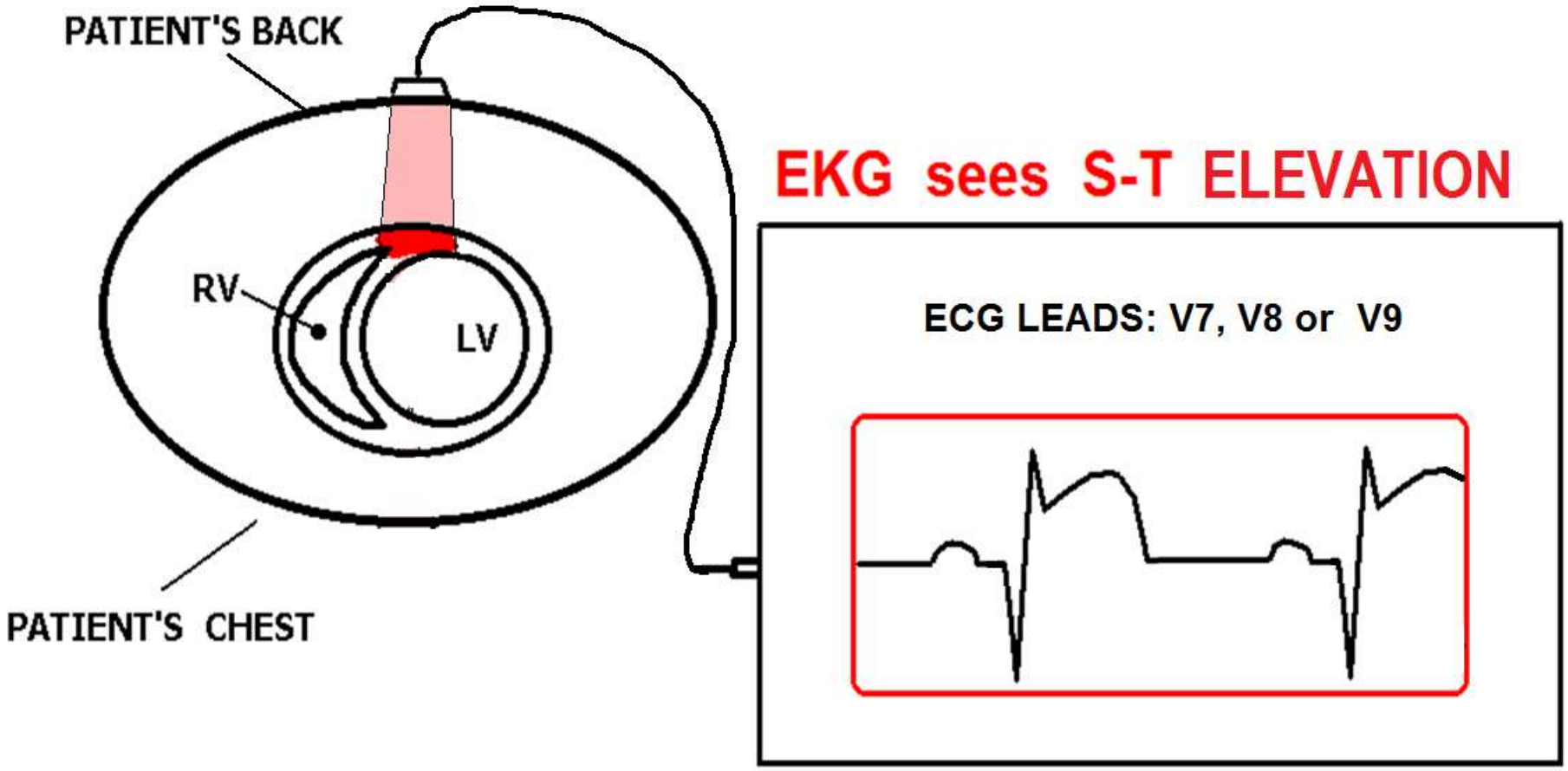
EXAMPLE:

AREA OF ACUTE INFARCTION - POSTERIOR WALL



If we put ECG leads on the BACK of a PATIENT who is having an

ACUTE POSTERIOR WALL MI . . . . .



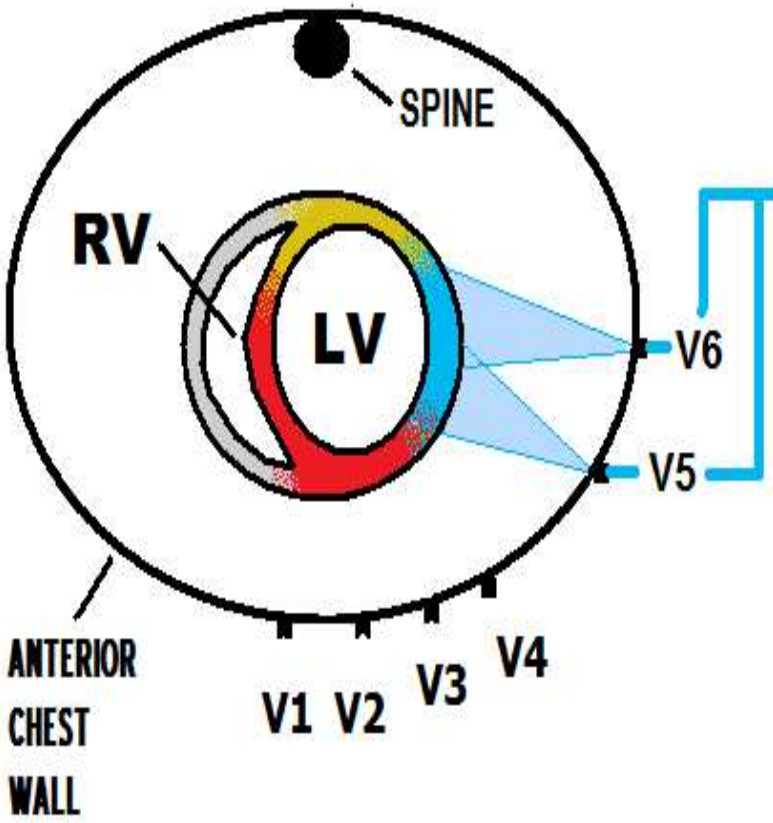
Leads V1-V4:

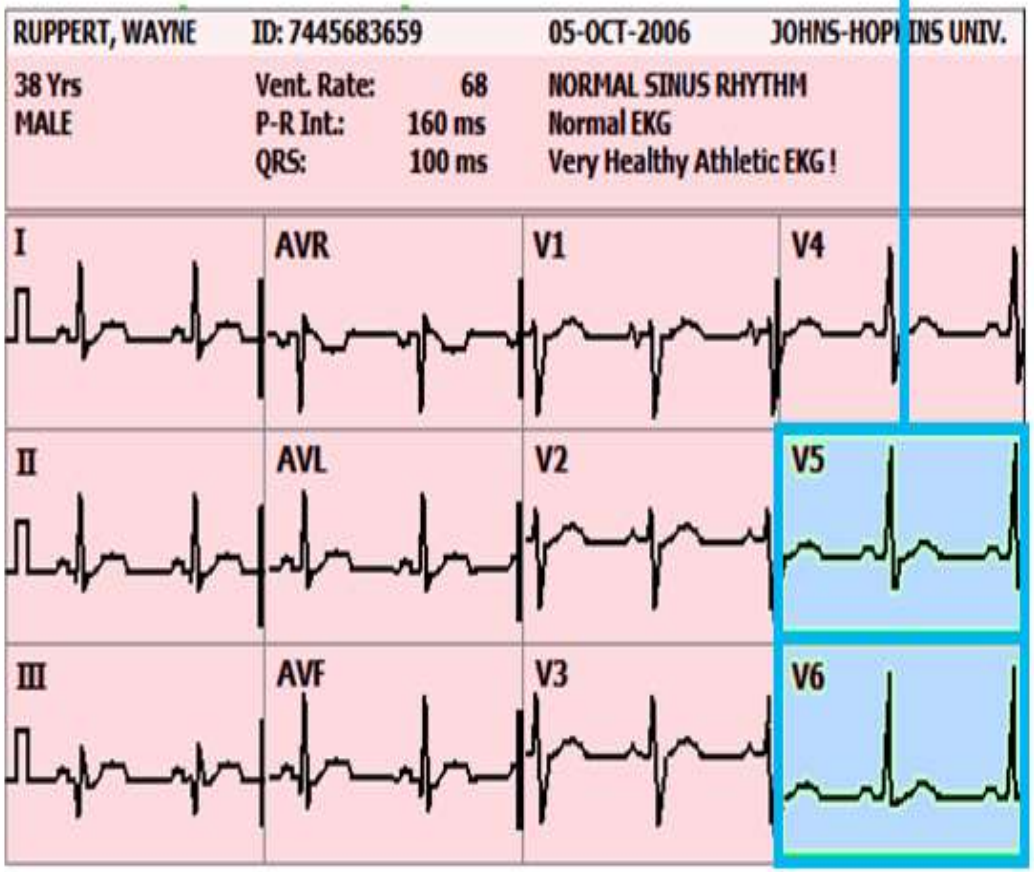
- V1 – V4 view the **ANTERIOR WALL** of the Left Ventricle.
- V1 and V2 also view the **SEPTAL WALL**
- V1 – V3 view the **POSTERIOR WALL** via Reciprocal Changes.

Leads V1-V4:

- V1 – V4 view the _____of the Left Ventricle.
- V1 and V2 also view the _____
- V1 – V3 view the _____via Reciprocal Changes.

V5 - V6 VIEW THE LATERAL WALL
of the LEFT VENTRICLE





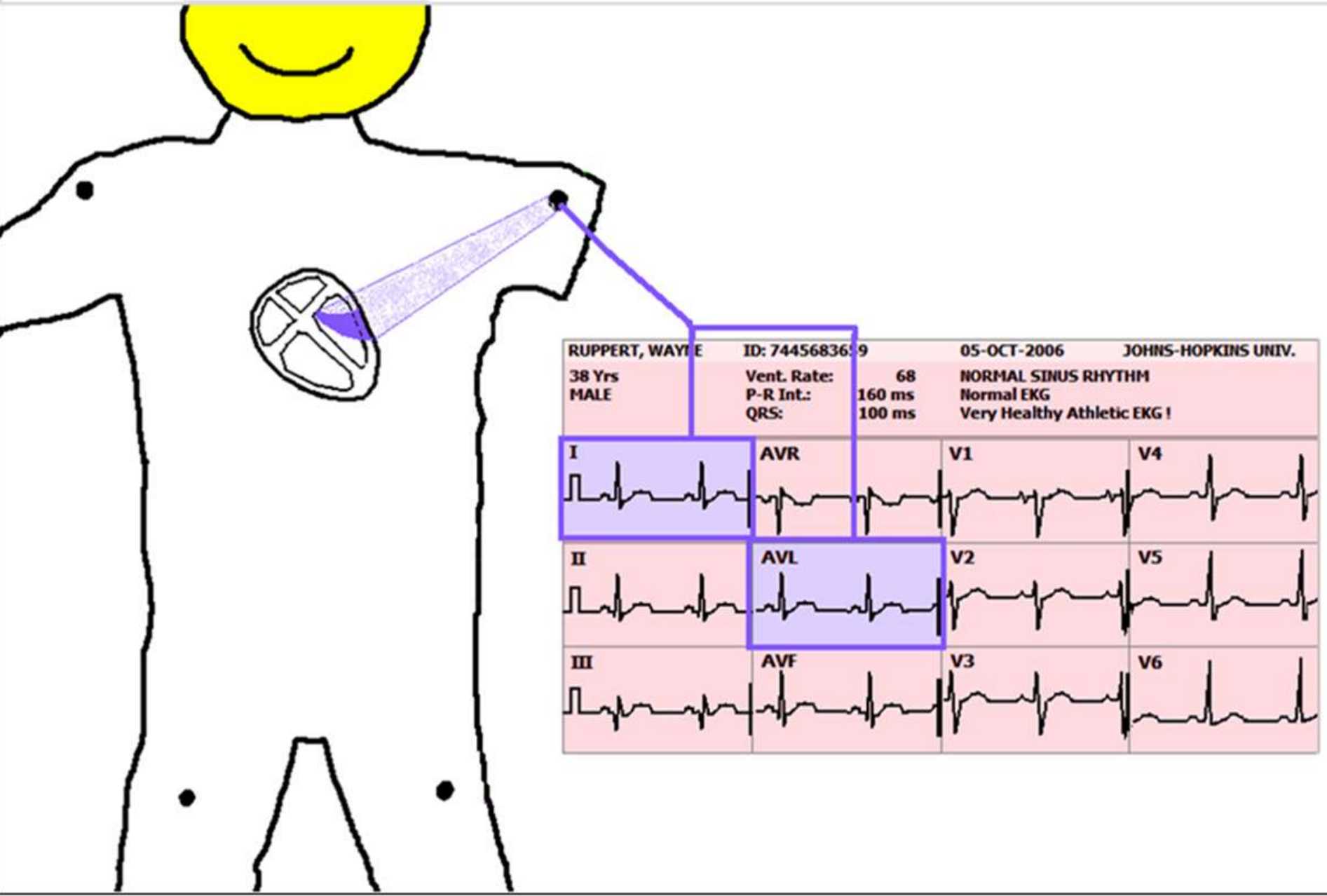
Leads V5 & V6:

- V5 & V6 view the **LATERAL WALL** of the Left Ventricle.

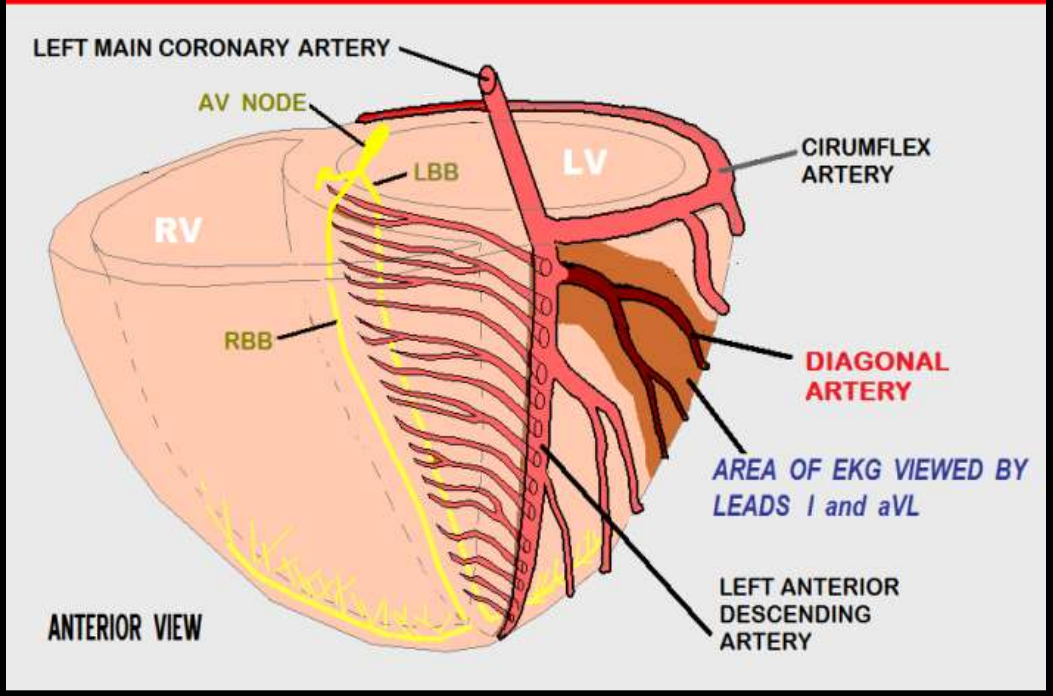
Leads V5 & V6:

- V5 & V6 view the _____of the Left Ventricle.

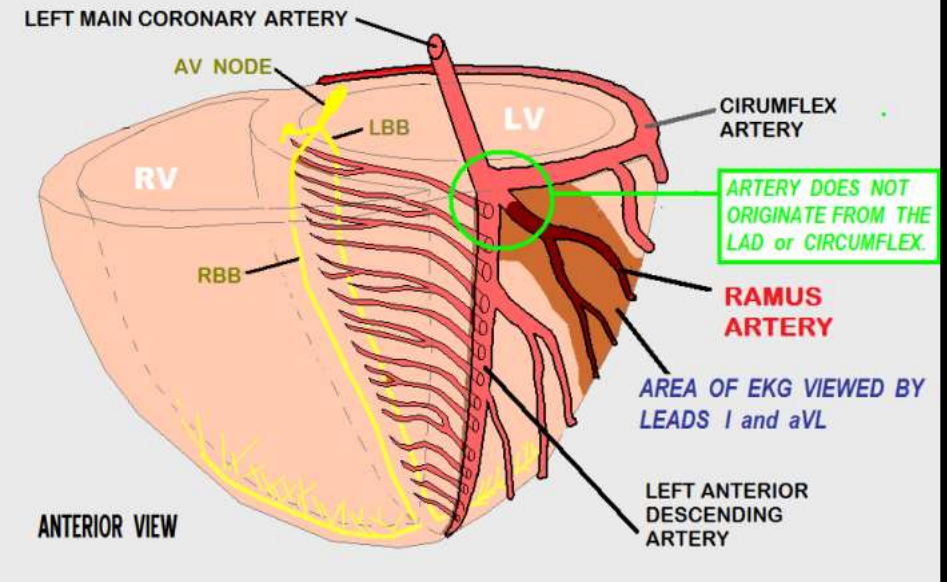
Leads I & AVL View: Proximal Lateral / Anterior Wall



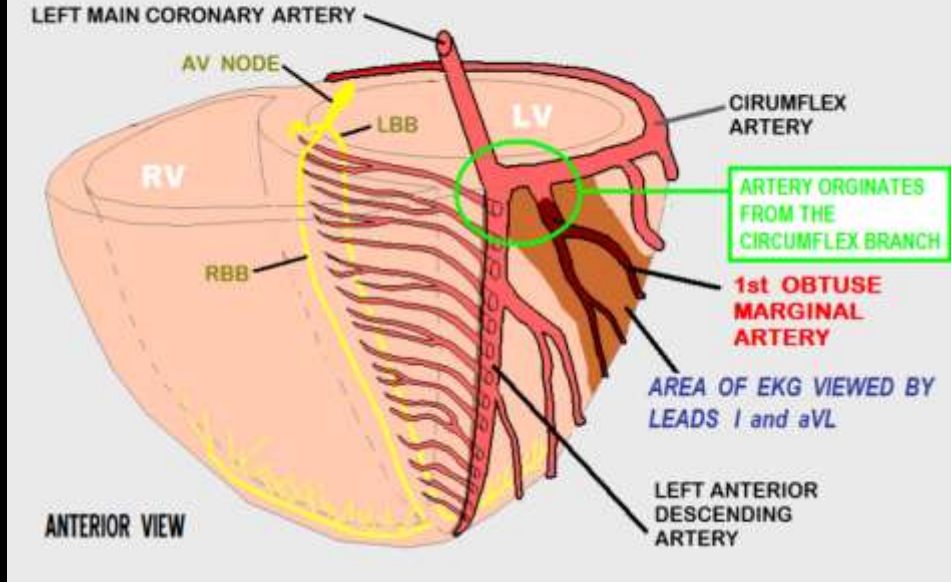
OCCLUSION of DIAGONAL ARTERY



OCCLUSION of RAMUS ARTERY



OCCLUSION of OBTUSE MARGINAL ARTERY



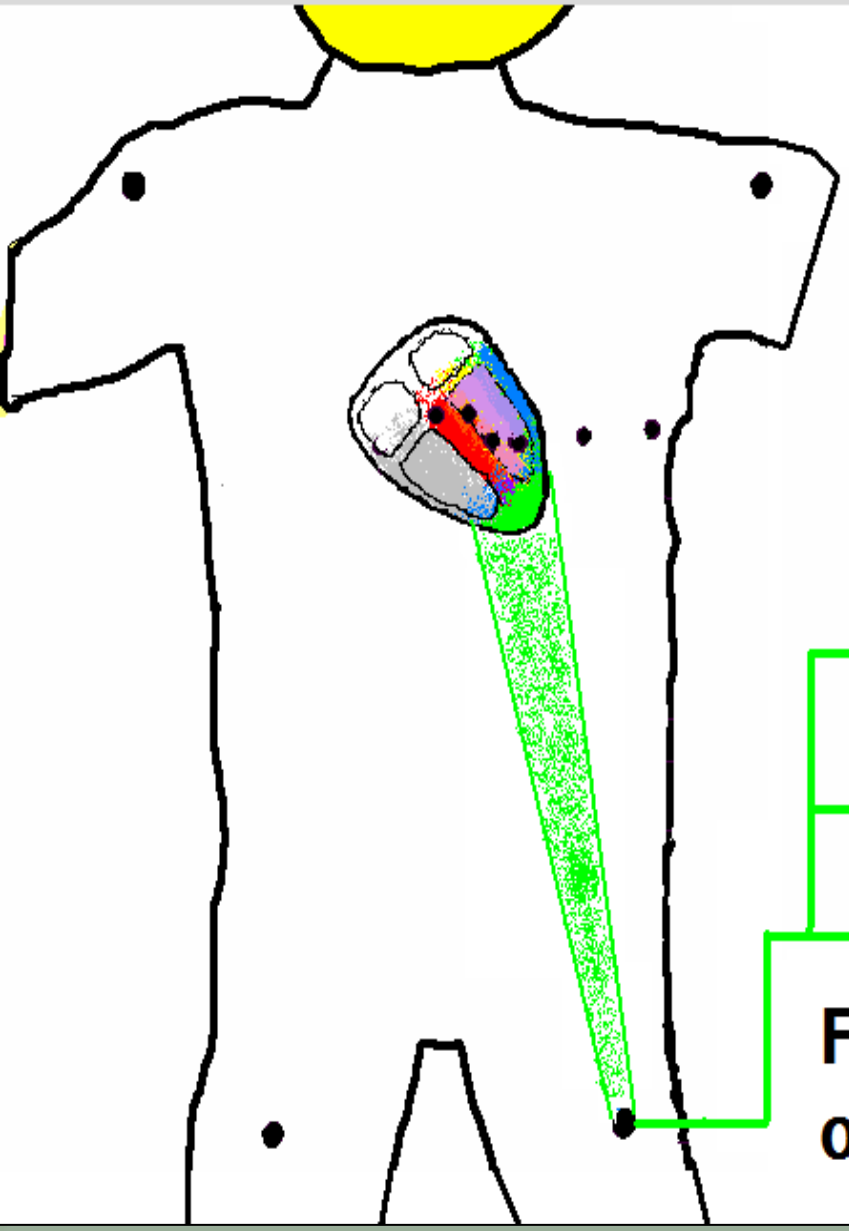
Leads I and AVL:

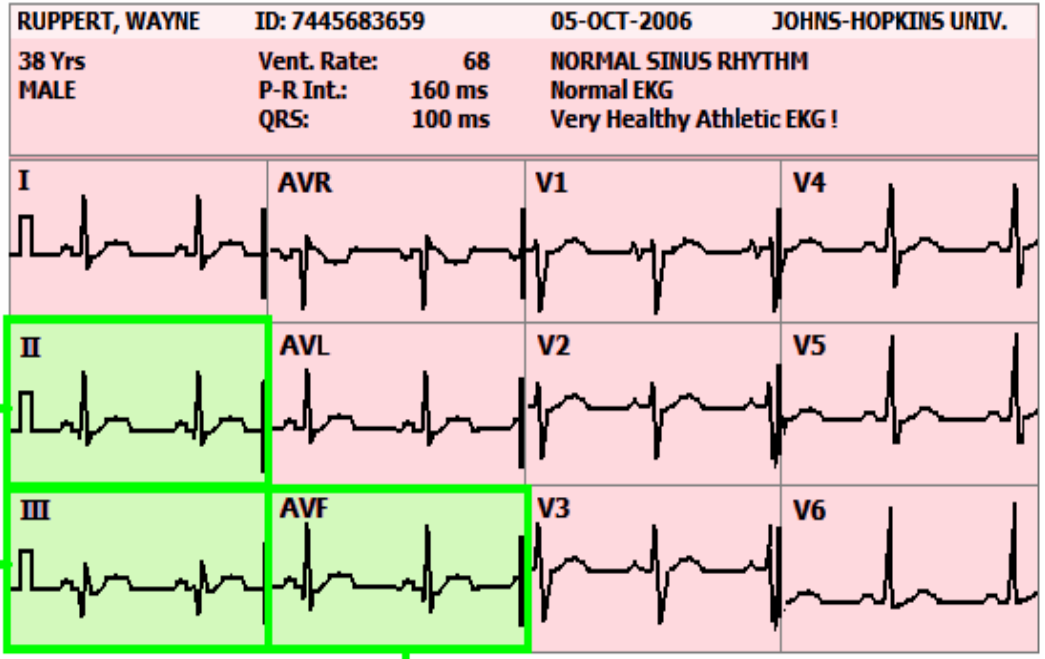
- Leads I and AVL view the **PROXIMAL aspect** of the **LATERAL** and **ANTERIOR WALLS**
- I and AVL can be associated with EITHER the **LATERAL WALL**, the **ANTERIOR WALL**, or BOTH.

Leads I and AVL:

- Leads I and AVL view the **PROXIMAL aspect** of the _____ and _____ **WALLS**
- I and AVL can be associated with EITHER the _____, the _____, or BOTH.

LEADS II, III, and aVF VIEW
INFERIOR WALL of the LEFT VENTRICLE





FED by the RCA (75 - 80 % pop)
or the CIRCUMFLEX (10 - 15 %)

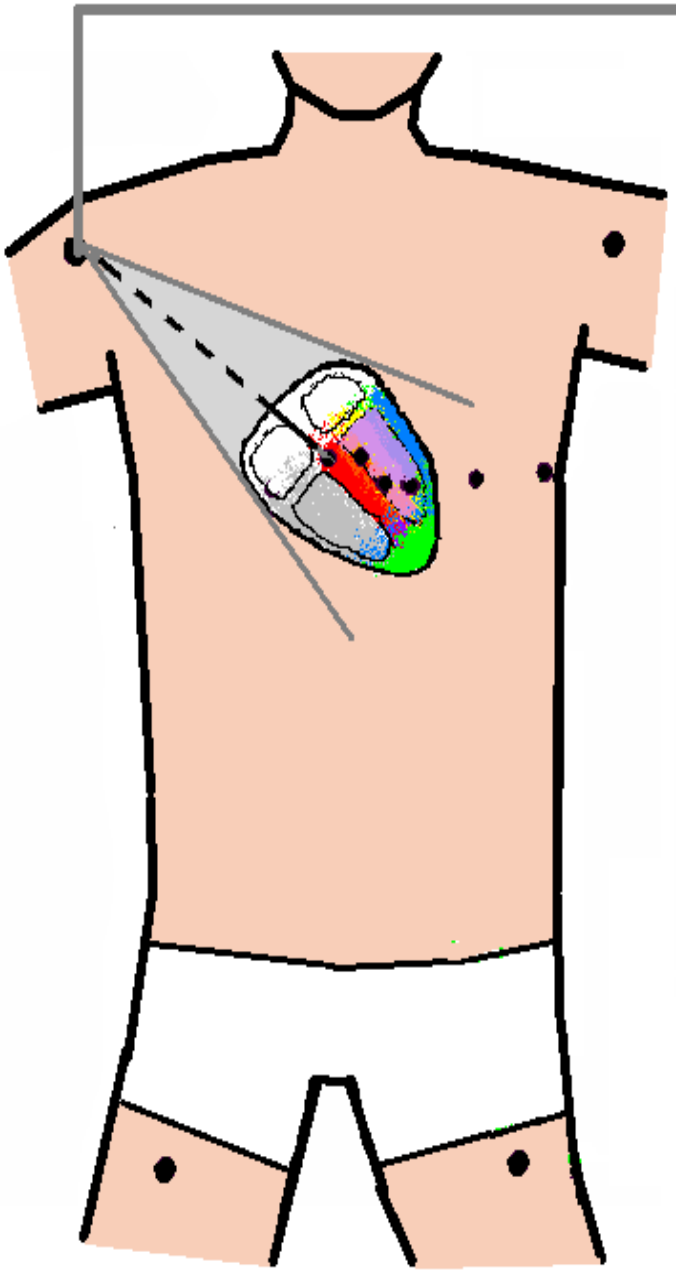
Leads II, III, and AVF:

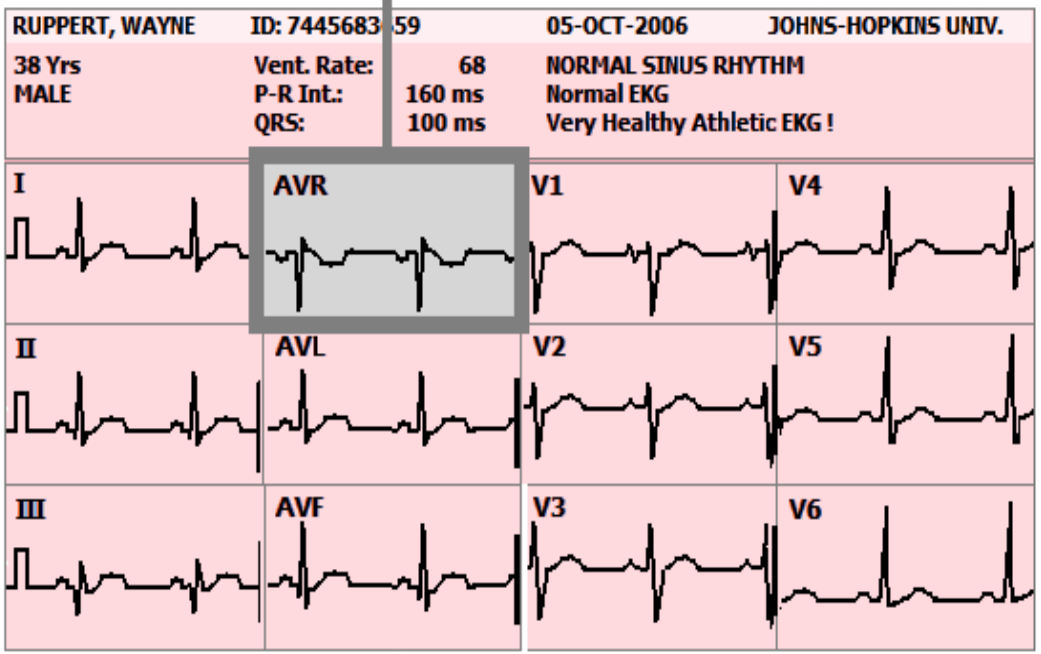
- Leads, II, III, and AVF view the **INFERIOR WALL** of the Left Ventricle.

Leads II, III, and AVF:

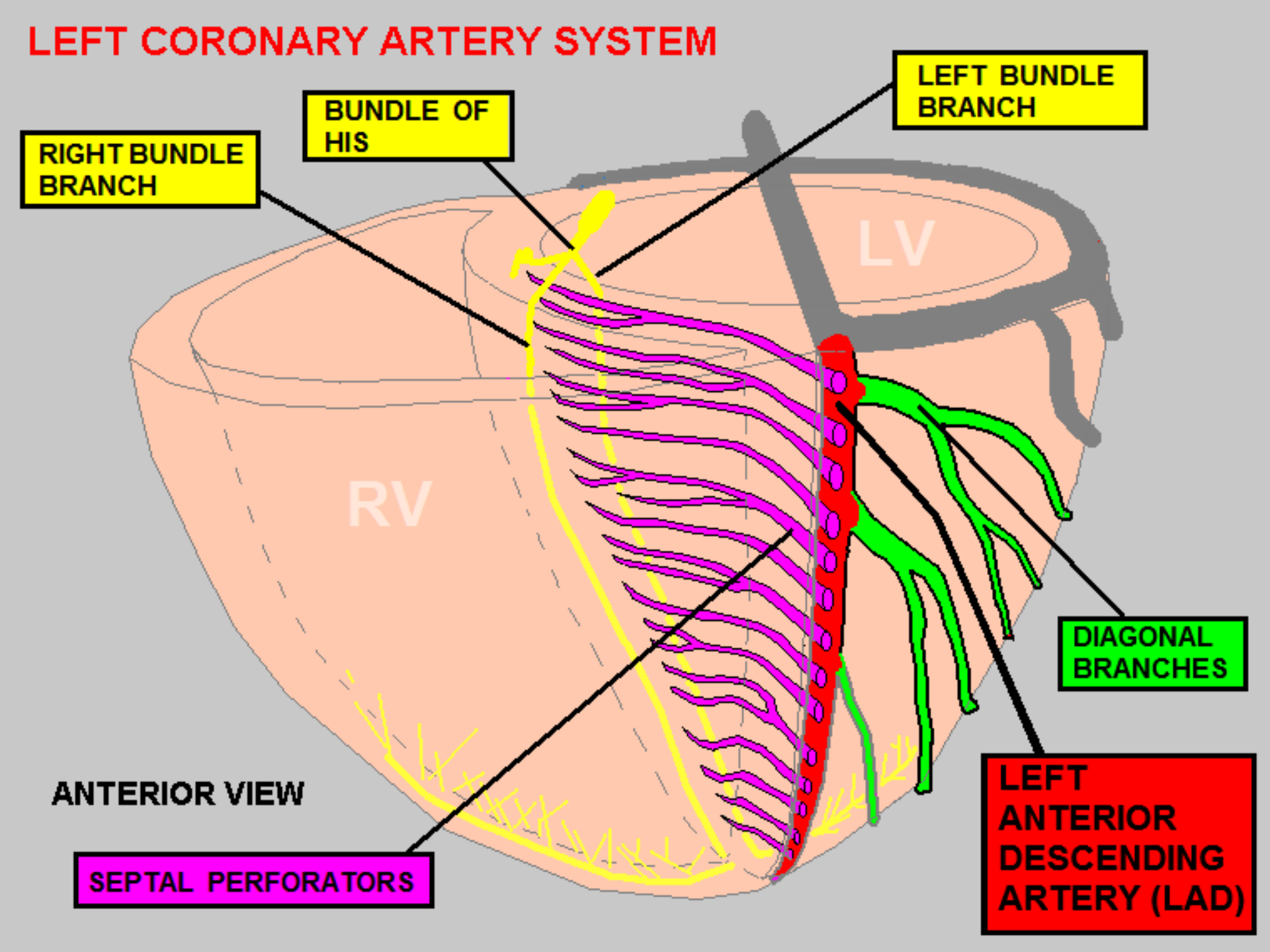
- Leads, II, III, and AVF view the _____ of the Left Ventricle.

Lead AVR Views the BASILAR SEPTUM (region of the Bundle of His)





LEFT CORONARY ARTERY SYSTEM



Lead AVR:

- Lead AVR views the **BASILAR SEPTUM.**
- The **BASILAR SEPTUM** is the area where the **BUNDLE of HIS** is typically located.

Lead AVR:

- Lead AVR views the _____.
- The _____is the area where the _____ is typically located.

Lead AVR:

- **ST Elevation in Lead AVR during Acute STEMI is associated with LEFT MAIN CORONARY ARTERY obstruction, which has a 75% mortality Rate.**
- **ST Elevation of Lead AVR when STEMI is NOT present is often associated with CRITICAL TRIPLE VESSEL disease, and/or CRITICAL OCCLUSION of the LEFT MAIN CORONARY ARTERY: both require Coronary Artery Bypass Graft (CABG) Surgery!!**

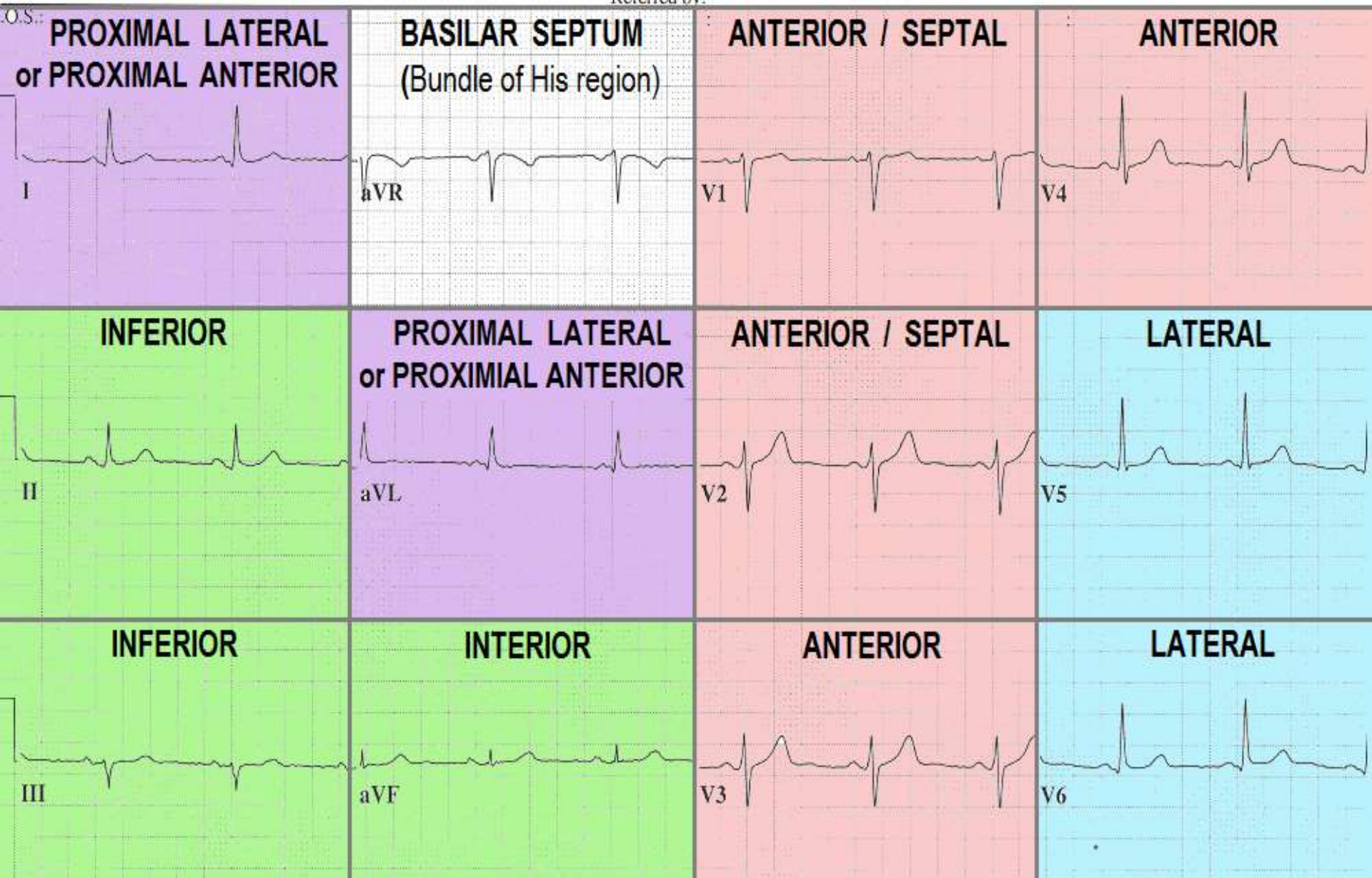
Lead AVR:

- ST Elevation in Lead AVR during Acute STEMI is associated with _____ _____ obstruction, which has a __% mortality Rate.
- ST Elevation of Lead AVR when STEMI is NOT present is often associated with _____ _____ disease, and/or CRITICAL OCCLUSION of the _____ _____: both require Coronary Artery Bypass Graft (CABG) Surgery!!

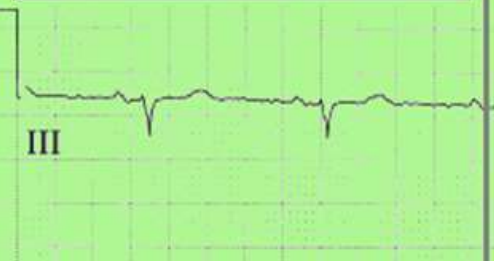
Vent. rate	64	BPM
PR interval	130	ms
QRS duration	96	ms
QT/QTc	396/408	ms
P–R–T axes	40 11	61

Normal sinus rhythm
Normal ECG
No previous ECGs available

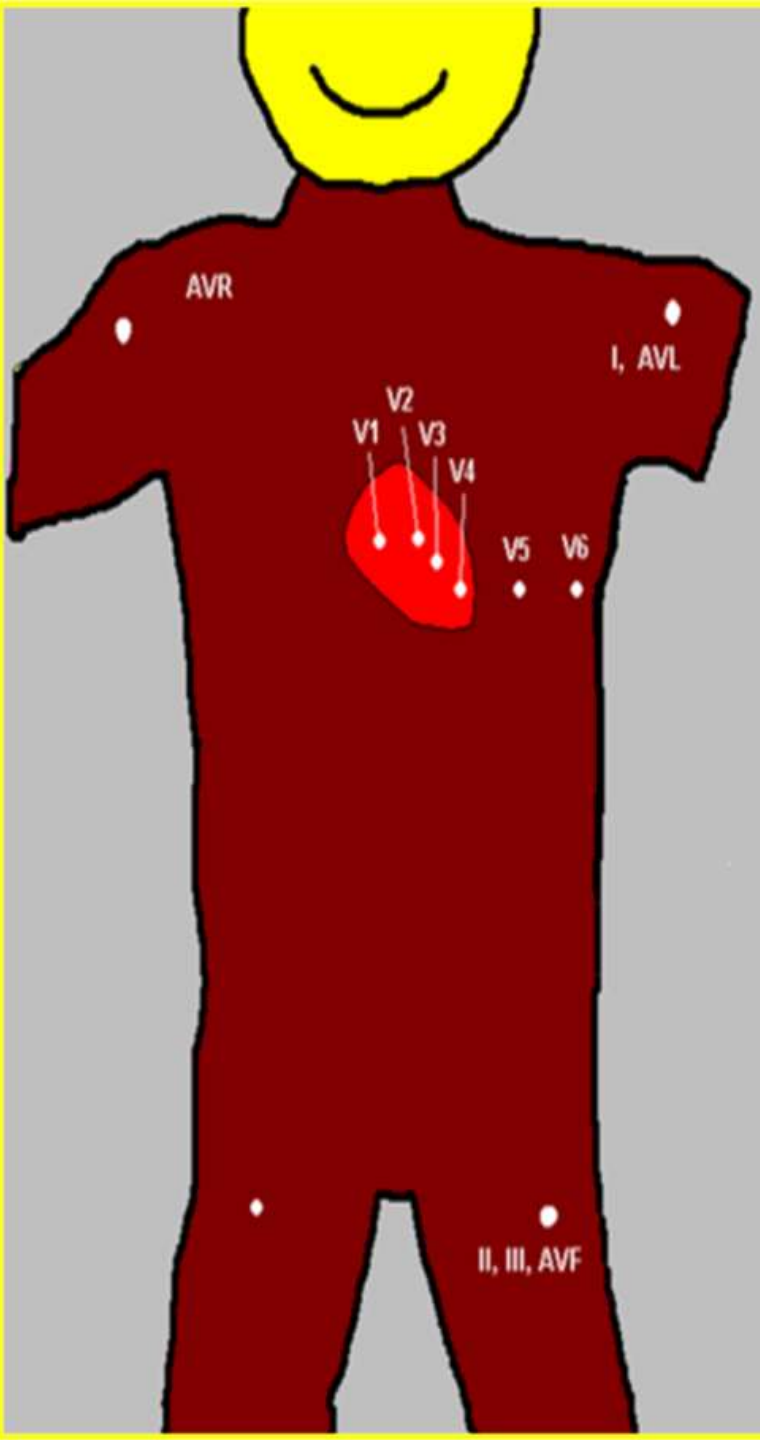
Referred by:



What REGION of the HEART does EACH LEAD VIEW ? ?

Lead I views: _____ 	Lead AVR views: _____ 	Lead V1 views: _____ 	Lead V4 views: _____ 
Lead II views: _____ 	Lead AVL views: _____ 	Lead V2 views: _____ 	Lead V5 views: _____ 
Lead III view: _____ 	Lead AVF views: _____ 	Lead V3 views: _____ 	Lead V6 views: _____ 

AREAS VIEWED by 12 LEAD ECG



AVR	*BASILAR SEPTAL*
AVL, I	*PROXIMAL* LATERAL-ANTERIOR
V1, V2	ANTERIOR
	SEPTAL
	POSTERIOR (recip.)
V3, V4	ANTERIOR
V5, V6	LATERAL
II, III, AVF	INFERIOR

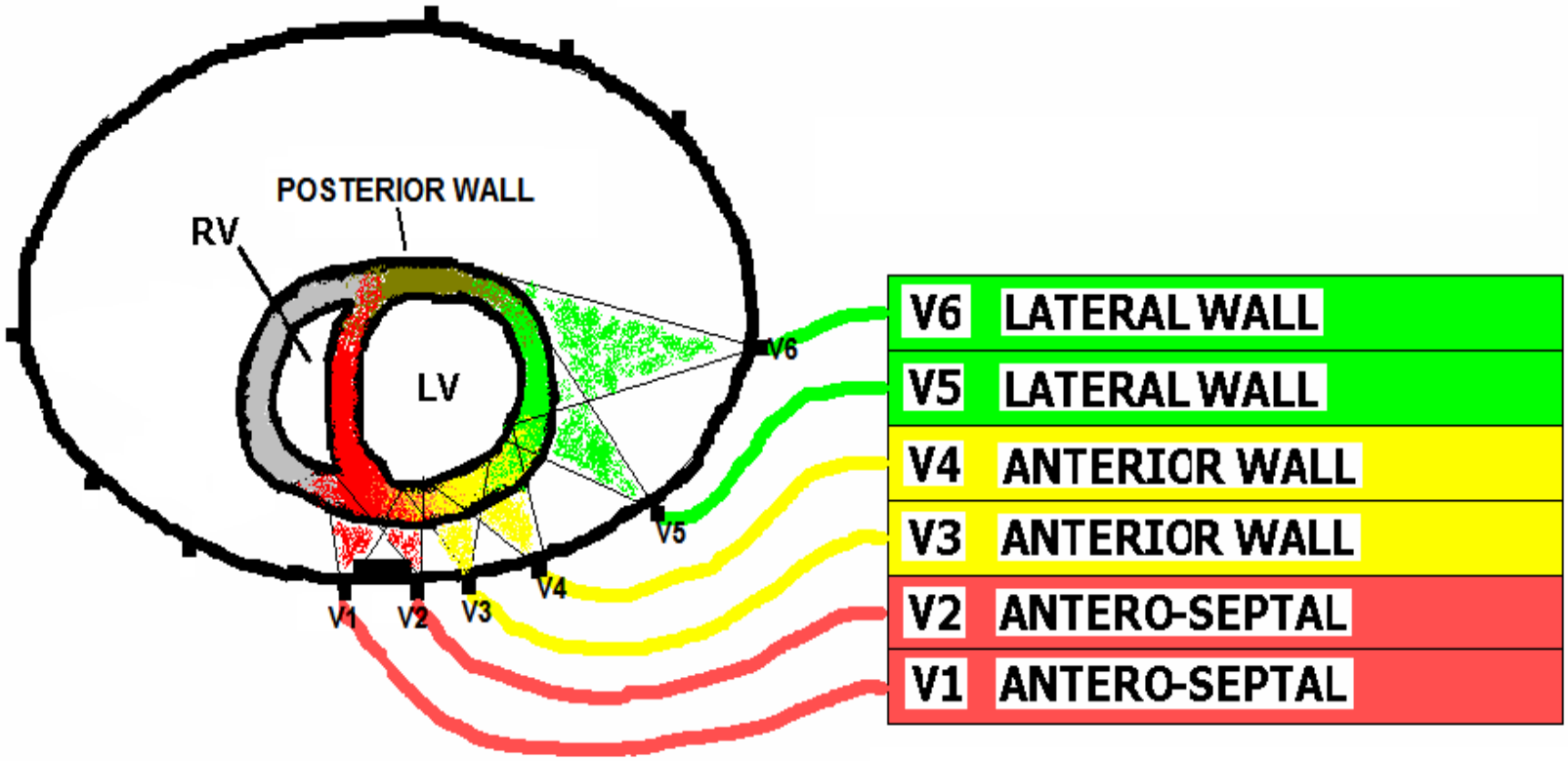
AREAS VIEWED by 12 LEAD ECG

AVR
AVL, I
V1, V2
V3, V4
V5, V6
II, III, AVF

THE 12 LEAD ECG HAS TWO MAJOR BLIND SPOTS . .

CHEST LEADS V1 - V6

WHAT EACH LEAD "SEES" . . .



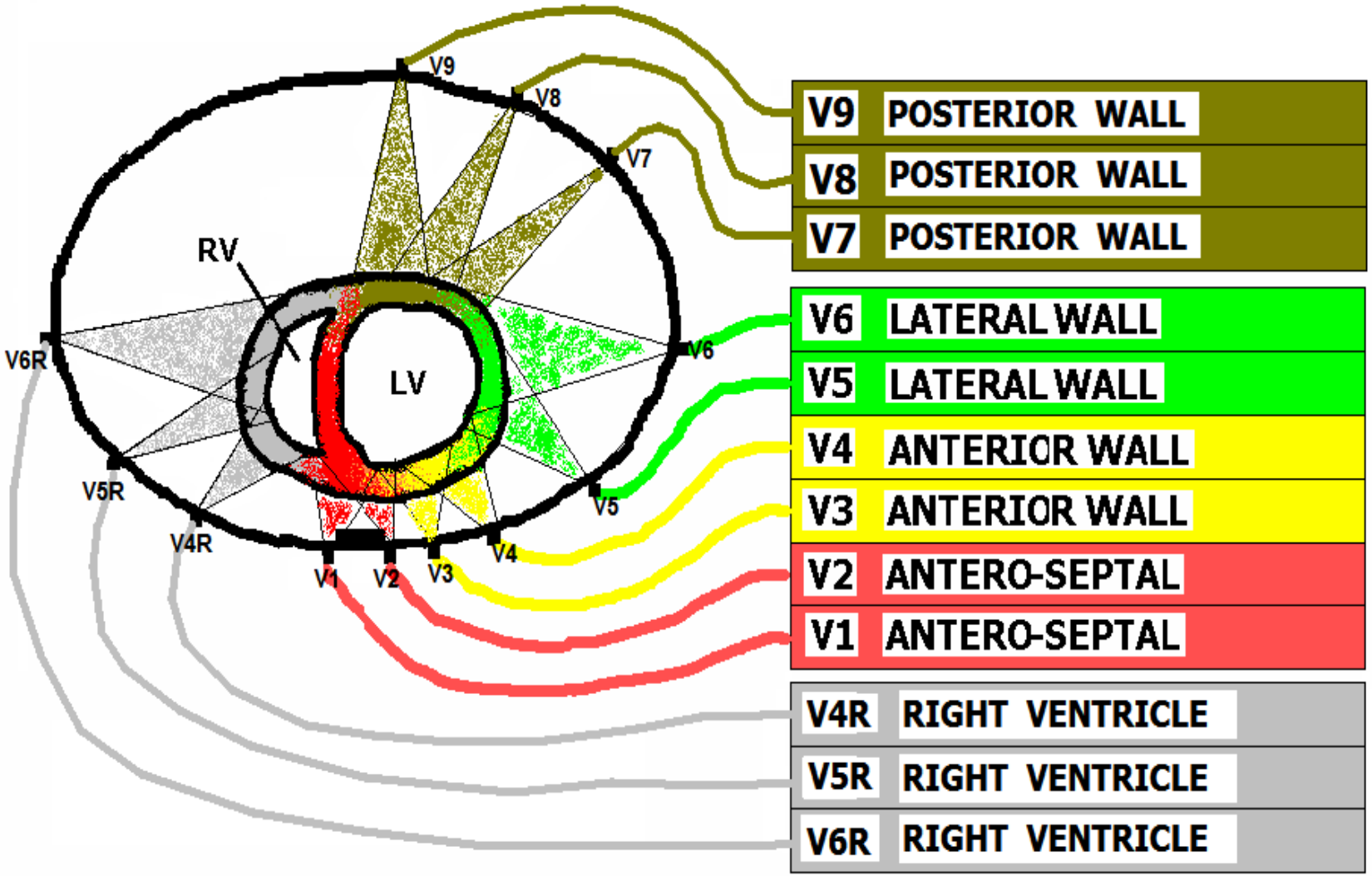
The TWO major BLIND SPOTS of the 12 Lead ECG are the POSTERIOR WALL and the RIGHT VENTRICLE.

The TWO major BLIND SPOTS of the 12 Lead ECG are the _____and the _____.

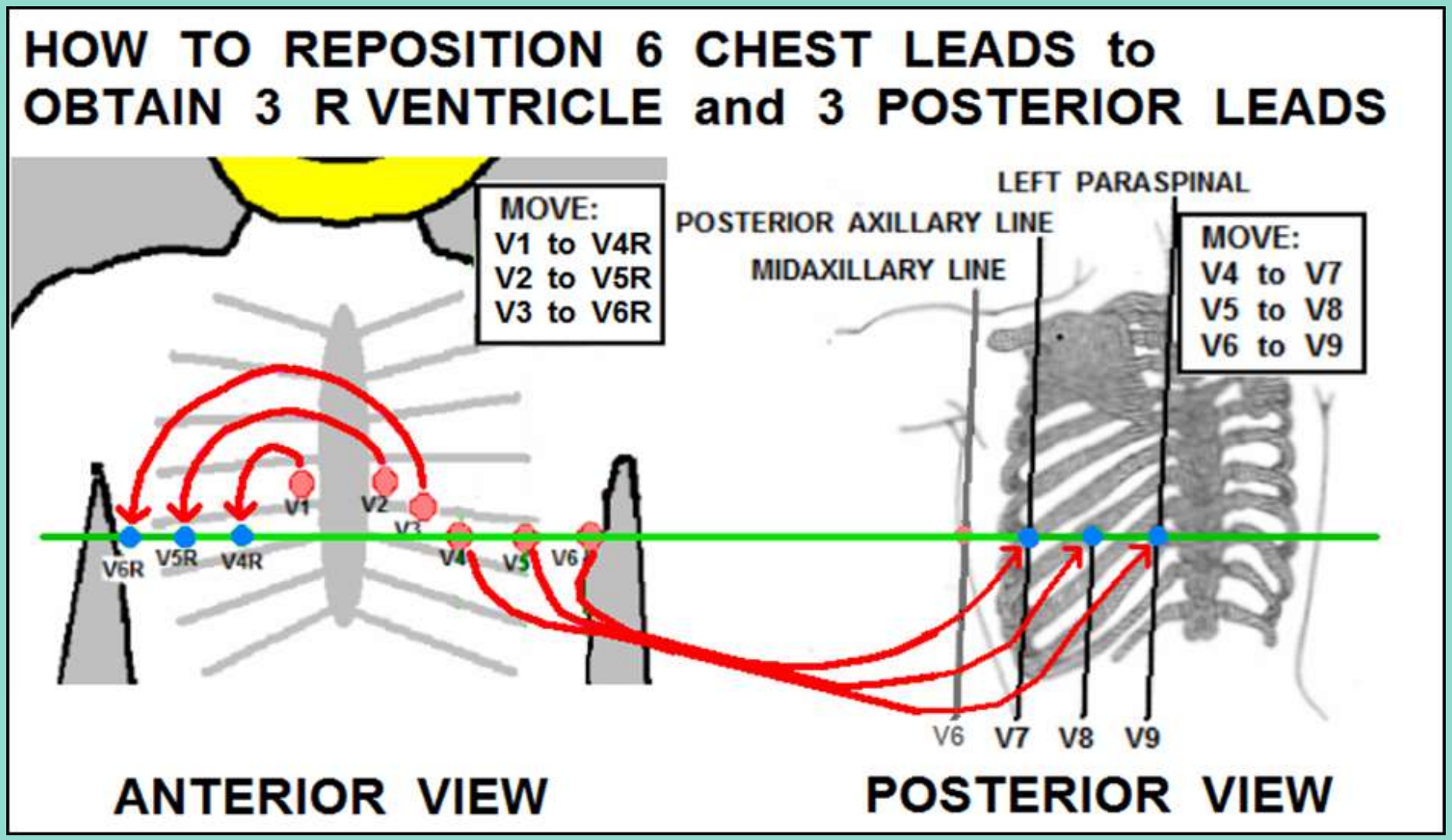
THE 18 LEAD ECG COVERS THE ENTIRE HEART . .

CHEST LEADS V1 - V6 *PLUS* V4R, V5R, V6R, and V7, V8, V9

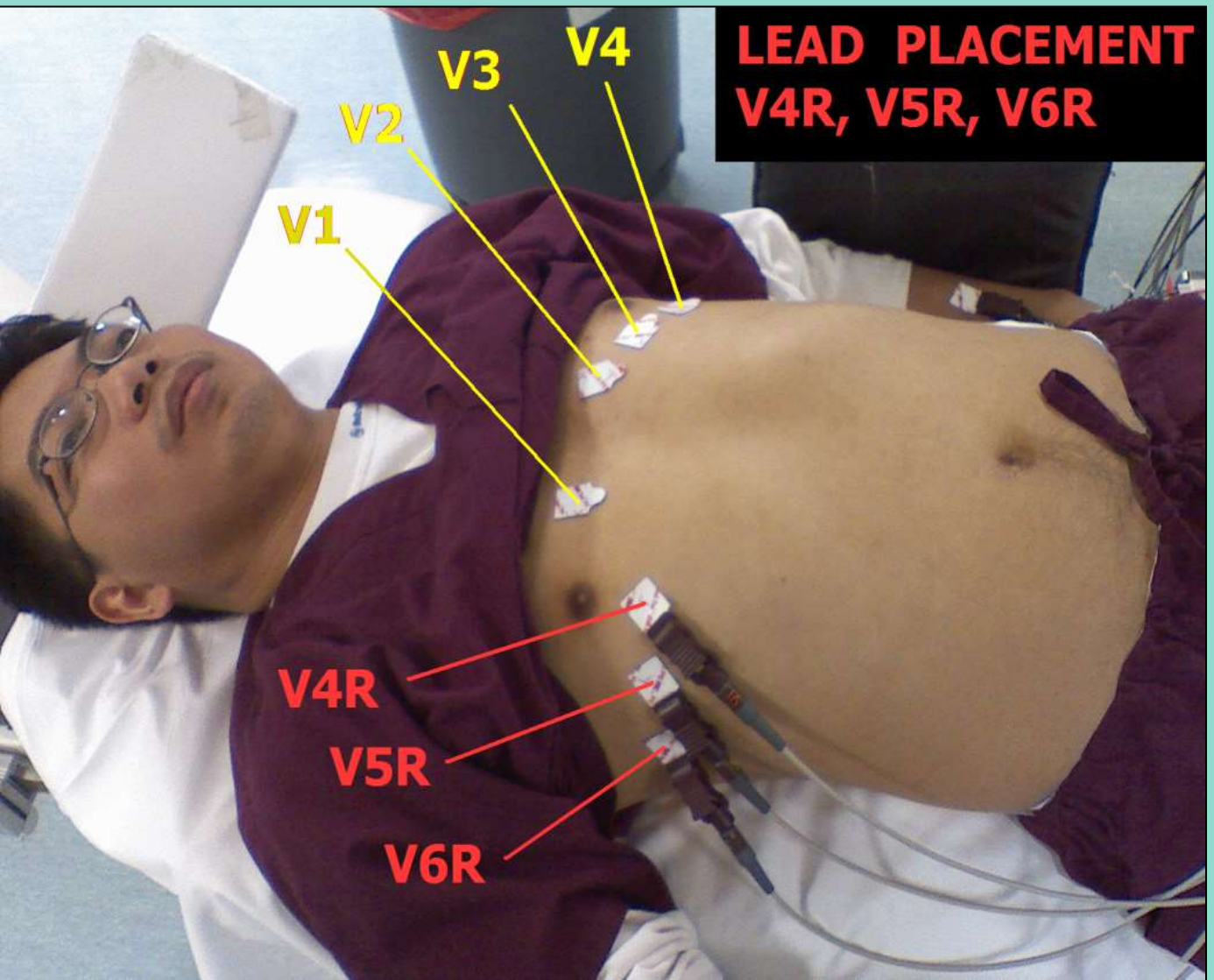
WHAT EACH LEAD "SEES" . . .



To do 18 Lead ECG with 12 Lead machine – after you obtain 12 Lead, reposition CHEST LEADS to this configuration, then print !



LEAD PLACEMENT for obtaining RIGHT VENTRICULAR ECG:



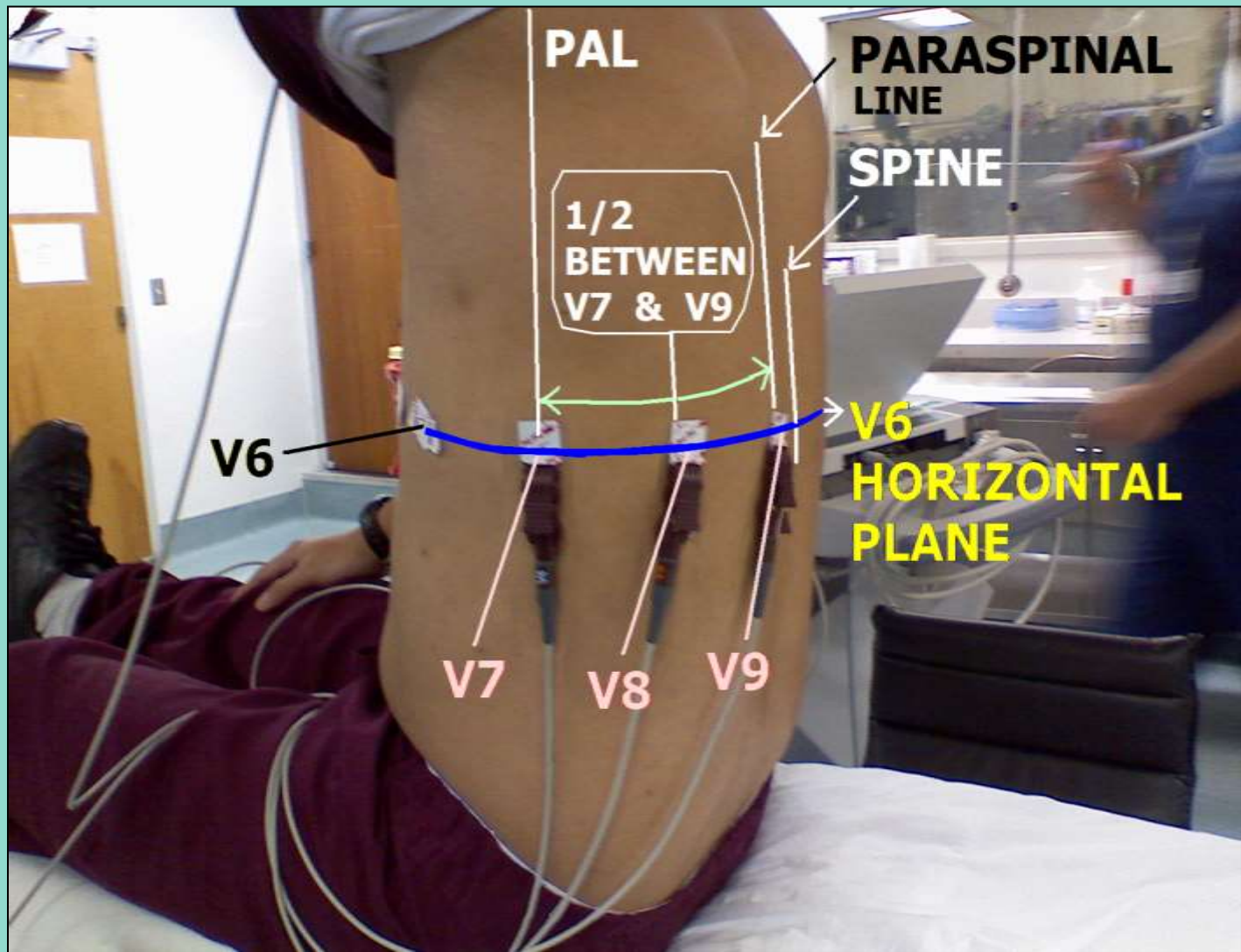
V4R – V6R

The INDICATION for obtaining a RIGHT VENTRICULAR ECG is INFERIOR WALL STEMI.

The INDICATION for obtaining a RIGHT VENTRICULAR ECG is _____.

LEAD PLACEMENT for obtaining a POSTERIOR ECG.

Leads
V7 – V9



The INDICATION for obtaining a POSTERIOR LEAD ECG is ST Depression in Leads V1-V4.

The INDICATION for obtaining a POSTERIOR LEAD ECG is

_____.

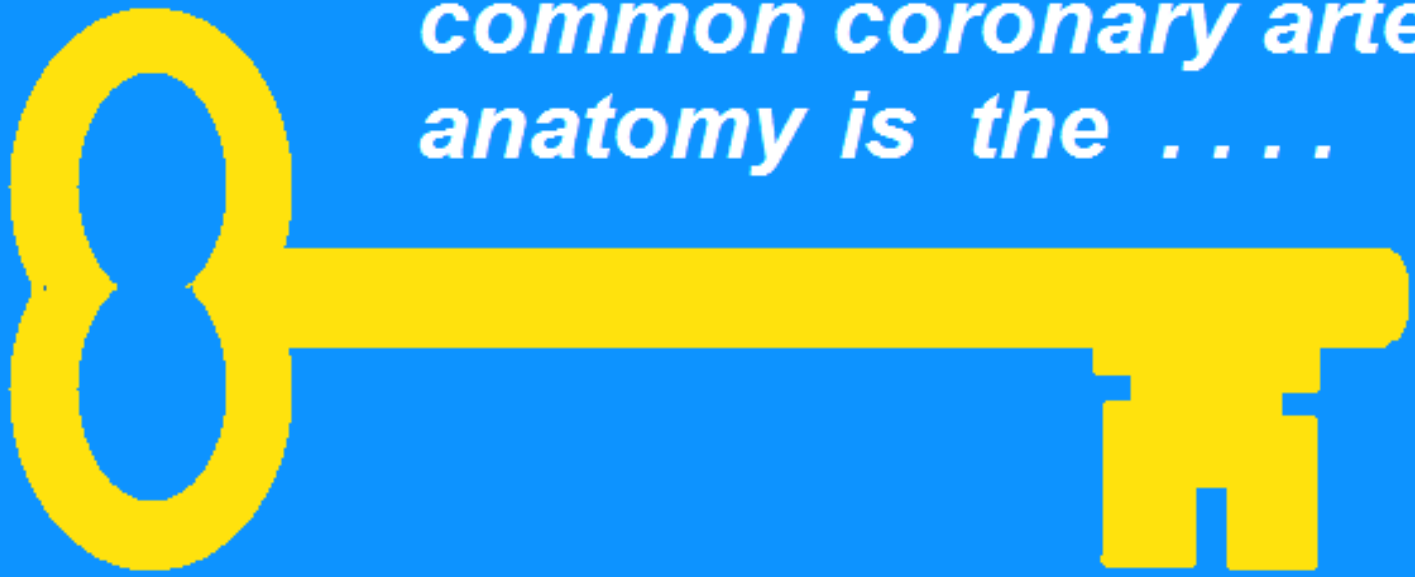
Coronary Artery Anatomy

The New England Medical Journal

THE CORONARY

ARTERIES

"Having knowledge of common coronary artery anatomy is the . . . .



to understanding the PHYSIOLOGICAL CHANGES that occur during ACUTE MI."

"INVALUABLE ASSET for ALL MEDICAL PROFESSIONALS who provide direct care to STEMI patients !"

The 12 Lead ECG becomes your "crystal ball !!"

INTERPRET THE EKG, THEN:

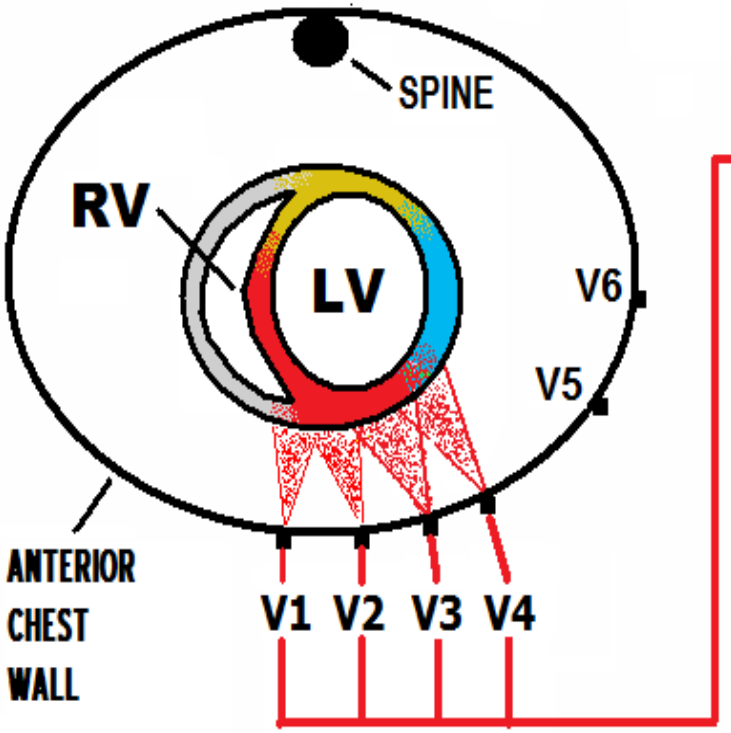
- IDENTIFY THE AREA OF THE HEART WITH A PROBLEM . . .
- RECALL THE ARTERY WHICH SERVES THAT REGION . . .
- RECALL OTHER STRUCTURES SERVED BY THAT ARTERY . . .
- ANTICIPATE FAILURE OF THOSE STRUCTURES . . .
- ***INTERVENE APPROPRIATELY !***

There are MUTLITPLE anatomic variations in Coronary Artery Anatomy.

This curriculum reviews the TWO most common, which account for approximately 90% of the population.

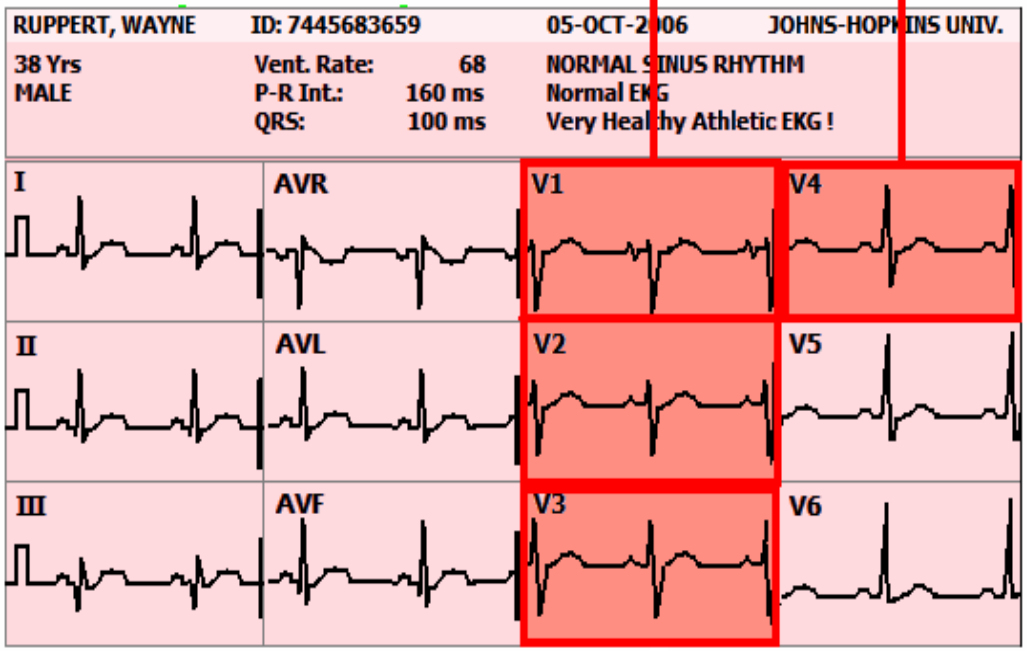
V1 - V4 VIEW THE ANTERIOR-SEPTAL WALL

of the LEFT VENTRICLE



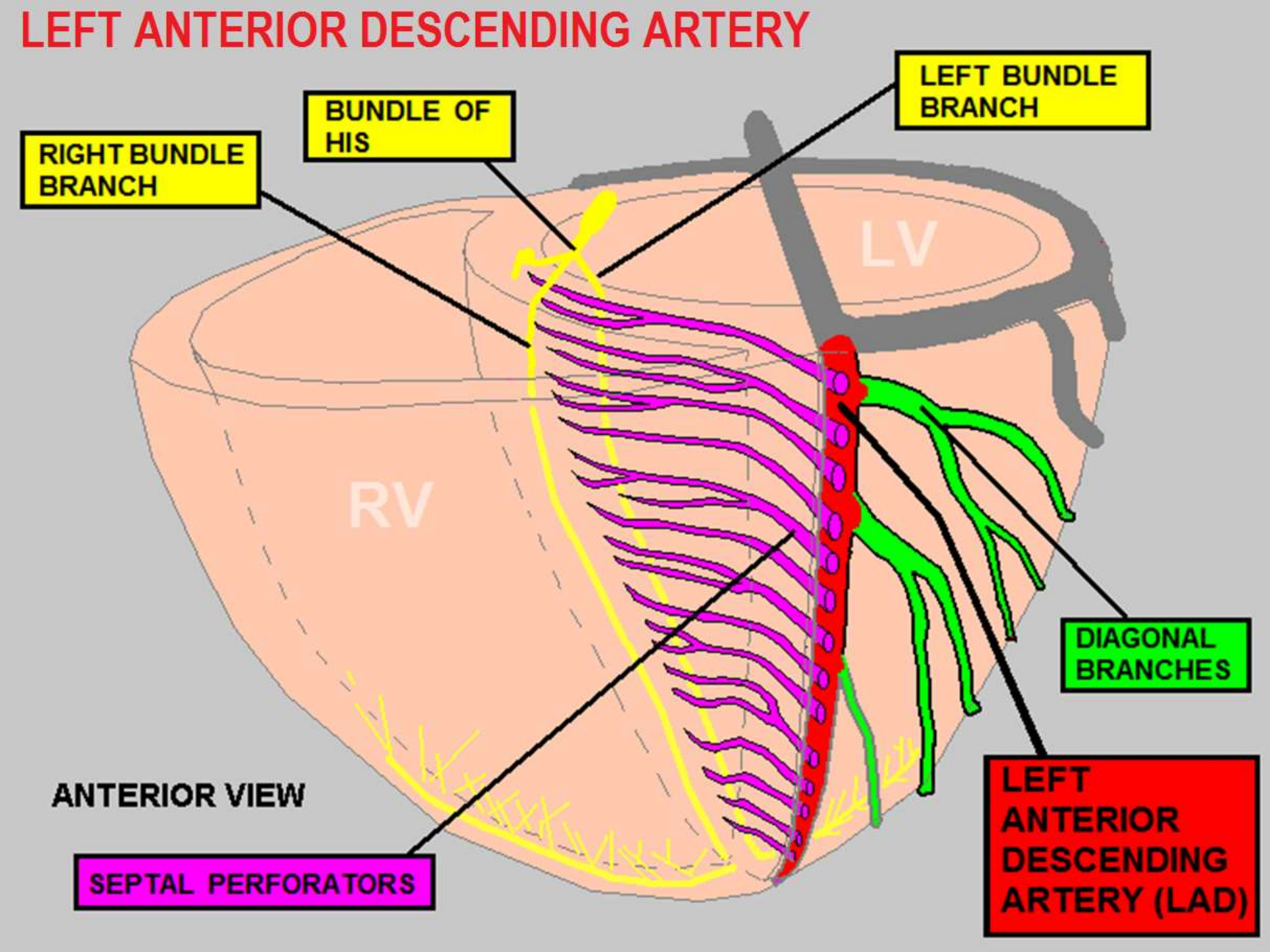
V1, V2 - ANTERIOR / SEPTAL

V3, V4 - ANTERIOR



Leads V1 – V4 are associated with the Left Anterior Descending Artery

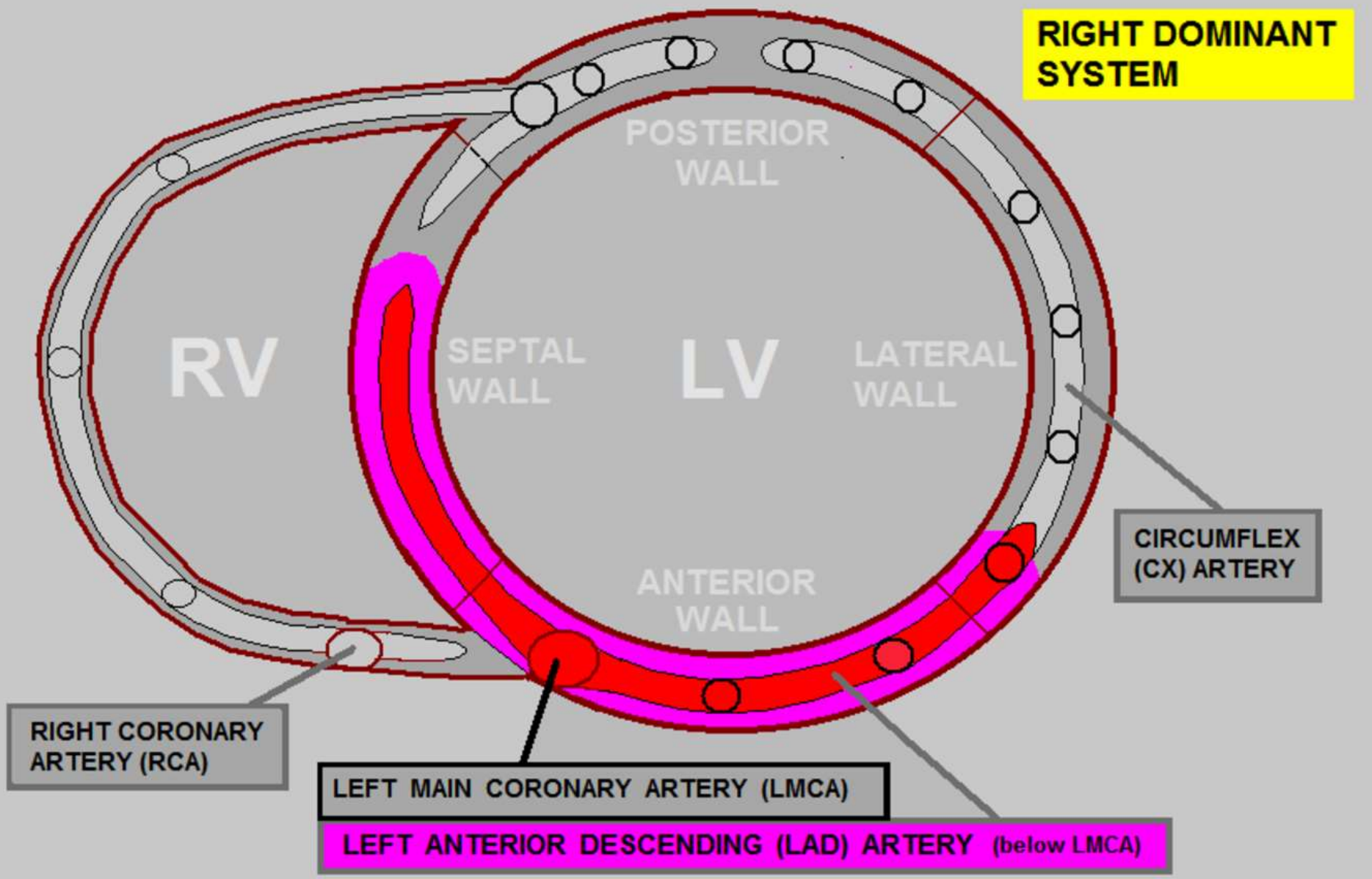
LEFT ANTERIOR DESCENDING ARTERY



cutaway view of the

LEFT ANTERIOR DESCENDING ARTERY (LAD)

SUPPLIES APPROX. 45% of the LV MUSCLE MASS



Left Anterior Descending Artery

The LAD supplies blood to the ANTERIOR and SEPTAL walls, and includes the following CRITICAL STRUCTURES:

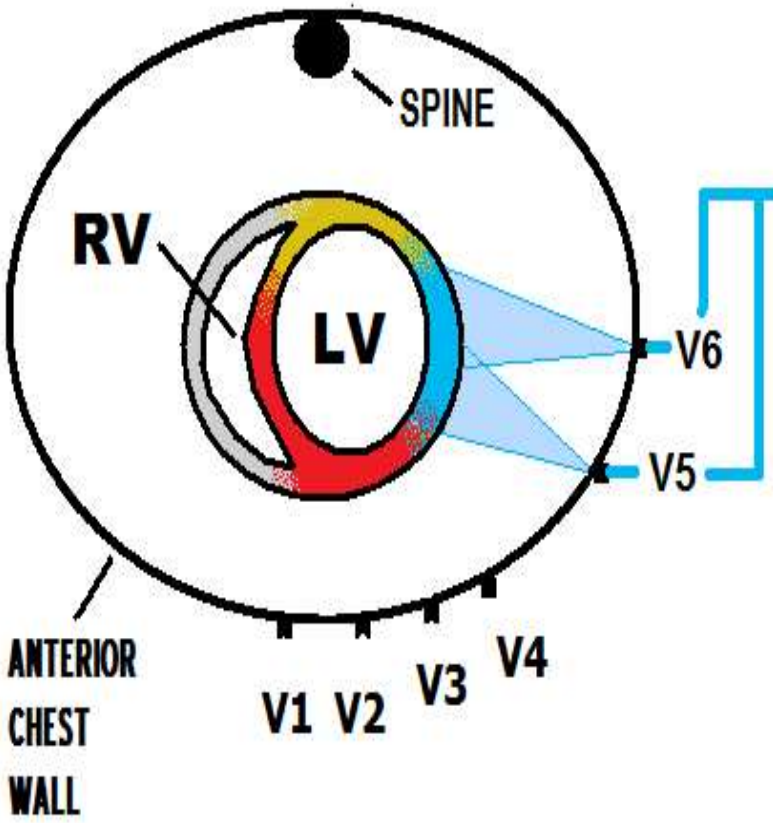
- **Approximately 45% of the Left Ventricle**
- **Bundle of His**
- **Bundle Branches**

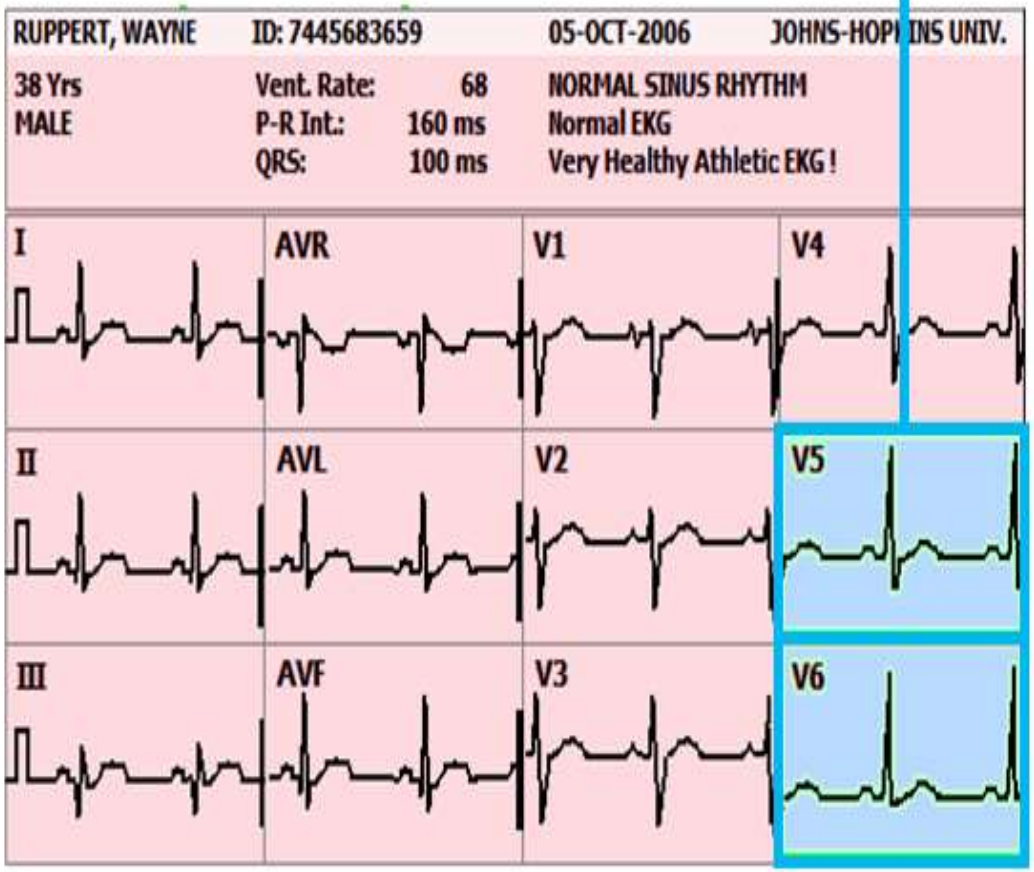
Left Anterior Descending Artery

The LAD supplies blood to the ANTERIOR and SEPTAL walls, and includes the following CRITICAL STRUCTURES:

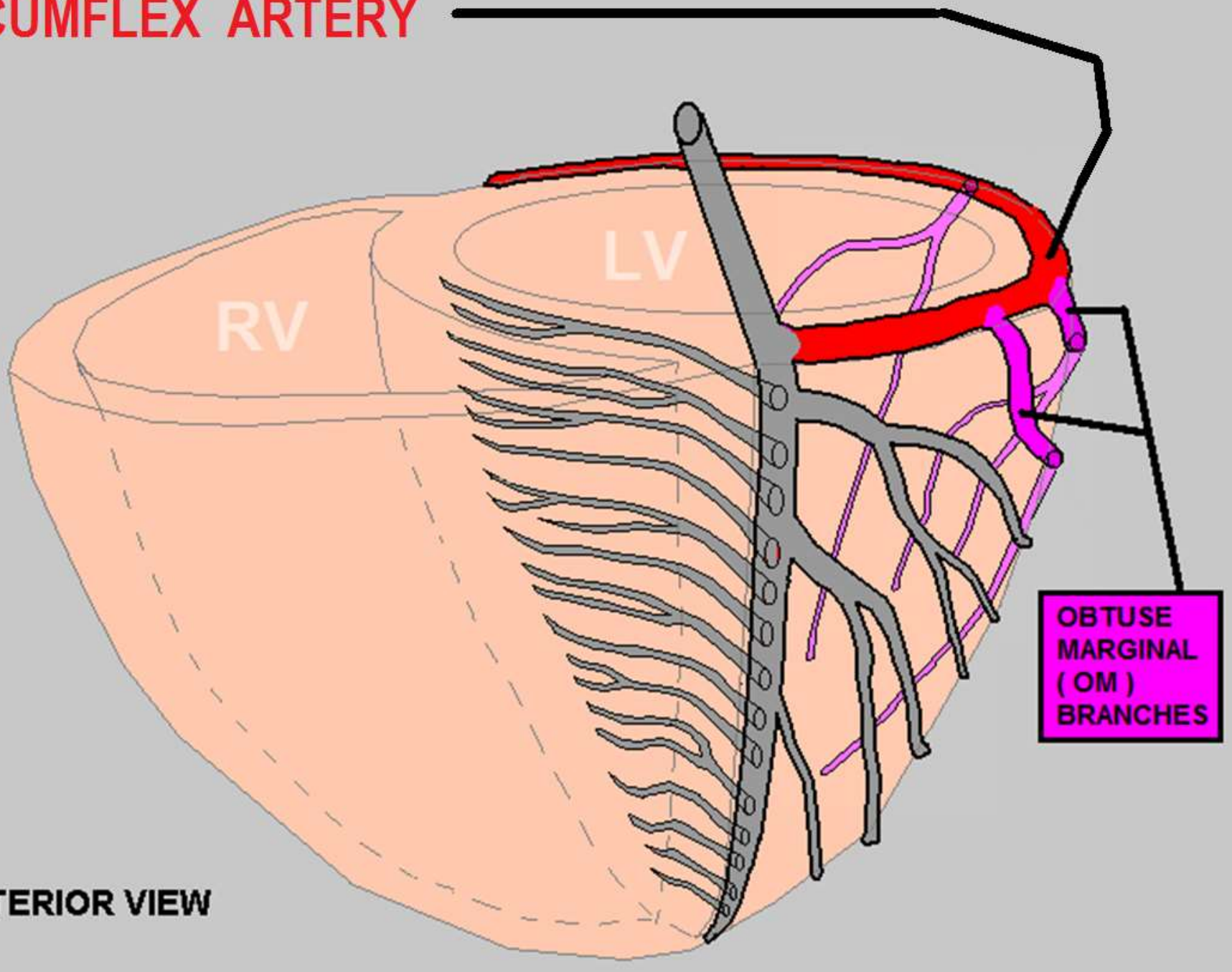
- **Approximately ____of the Left Ventricle**
- **_____**
- **_____**

V5 - V6 VIEW THE LATERAL WALL
of the LEFT VENTRICLE





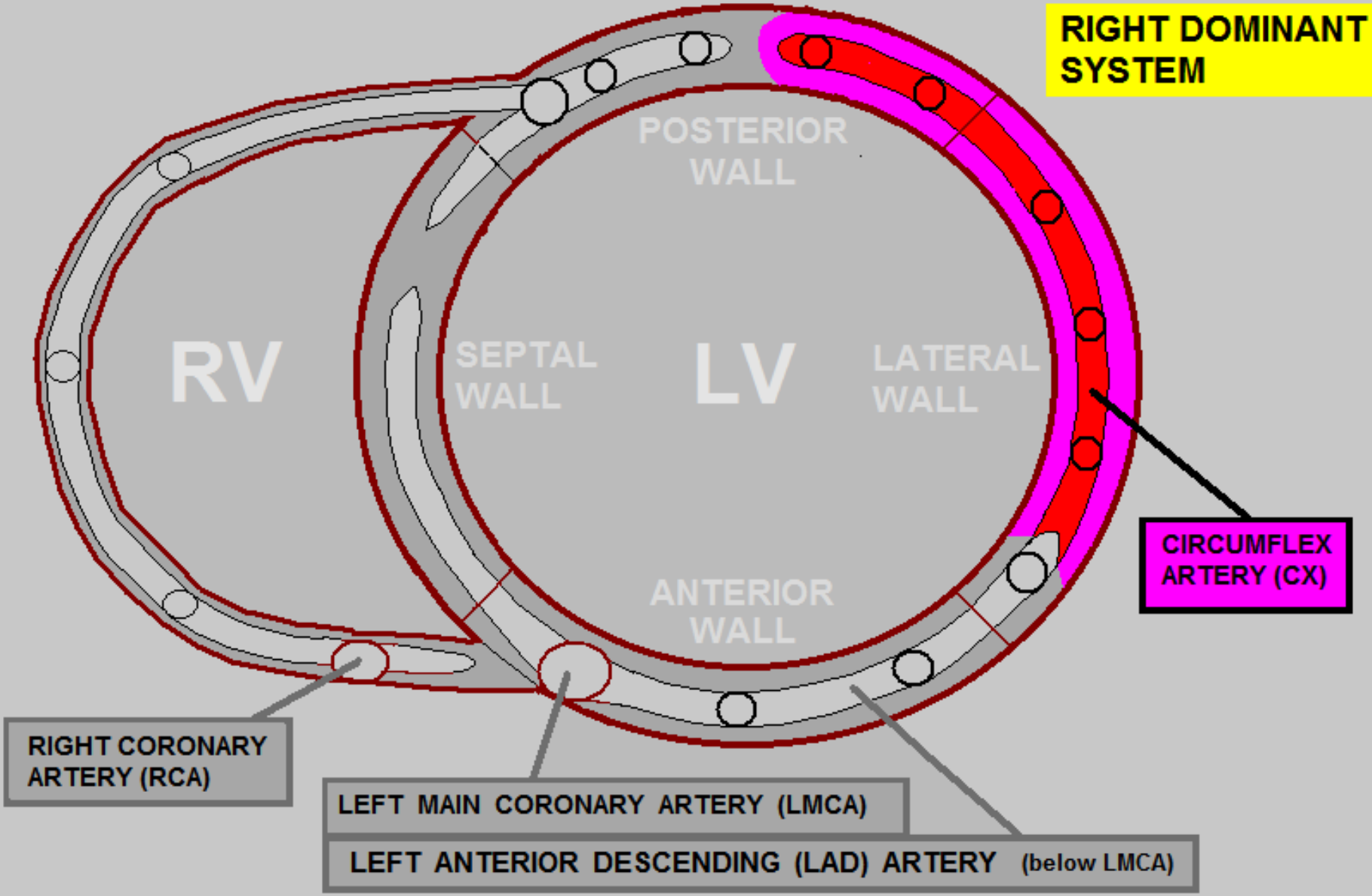
CIRCUMFLEX ARTERY



cutaway view of the

CIRCUMFLEX ARTERY (CX) DISTRIBUTION

SUPPLIES 20 - 30 % of the LV MUSCLE MASS



Circumflex (Cx) Artery

In patients with a Right Dominant coronary artery system, the Circumflex supplies blood to:

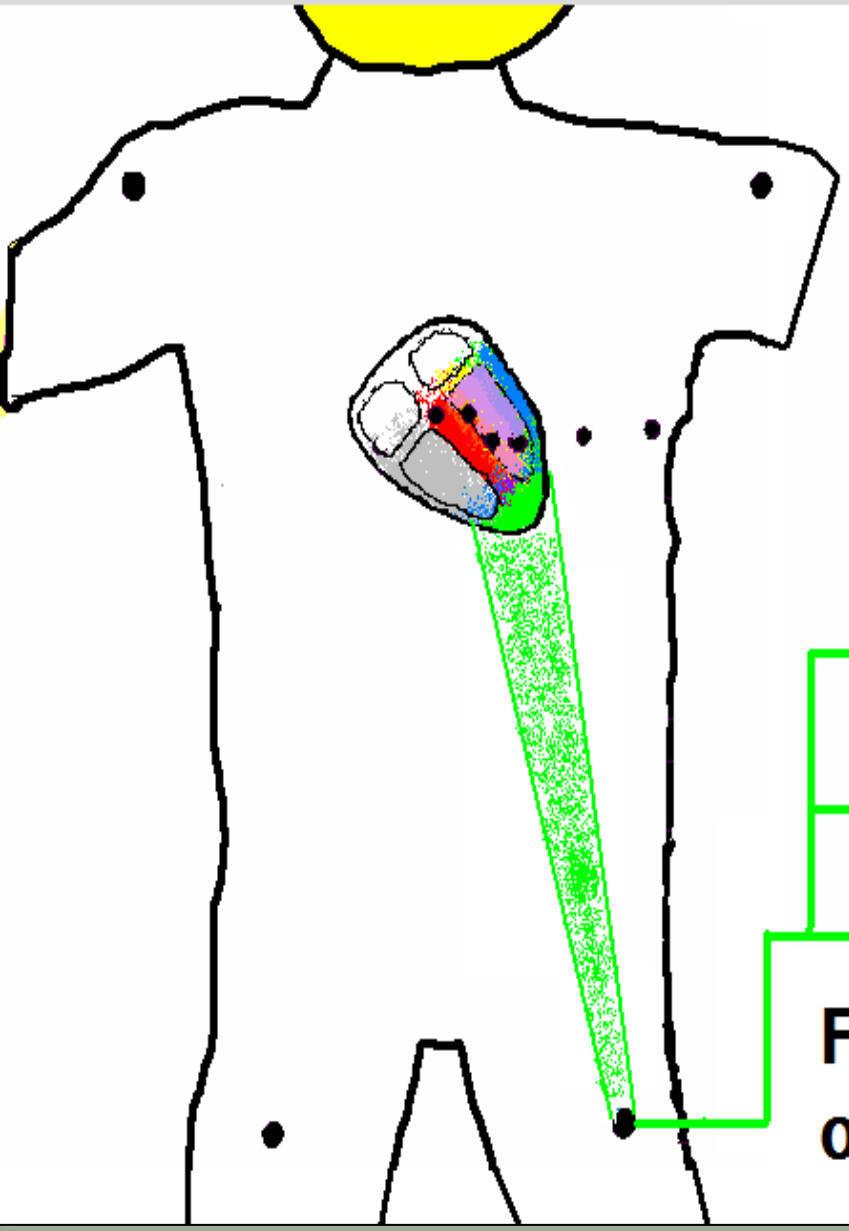
- **Approximately 20-30% of the Left Ventricle, which includes:**
  - **Lateral Wall of Left Ventricle**
  - **Approx ½ of Posterior Wall**
- **On rare occasion, the SINUS NODE**

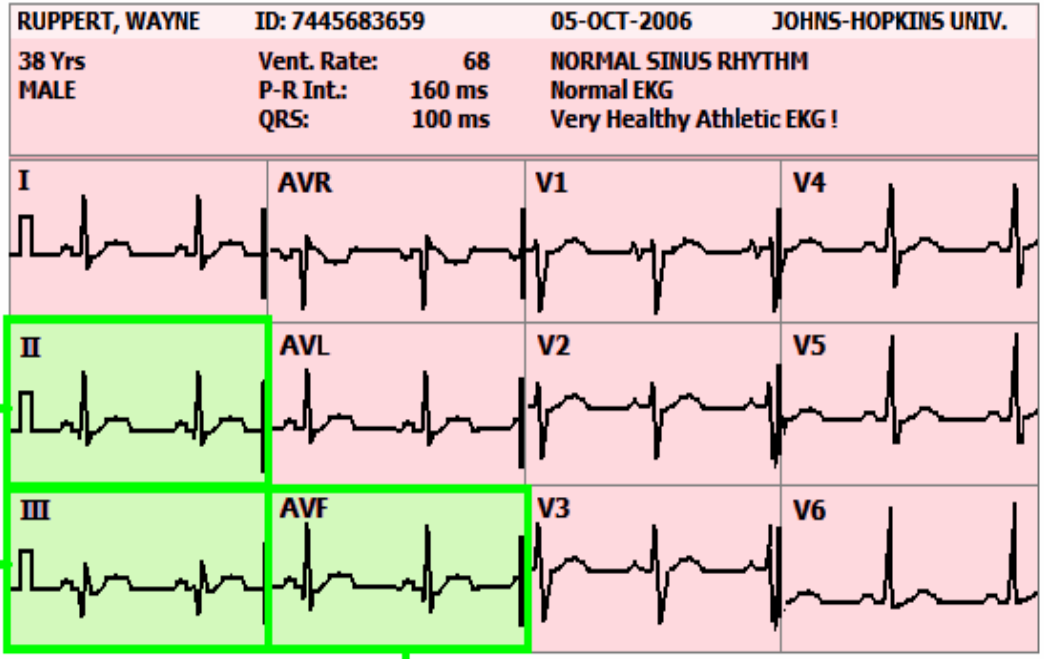
Circumflex (Cx) Artery

In patients with a Right Dominant coronary artery system, the Circumflex supplies blood to:

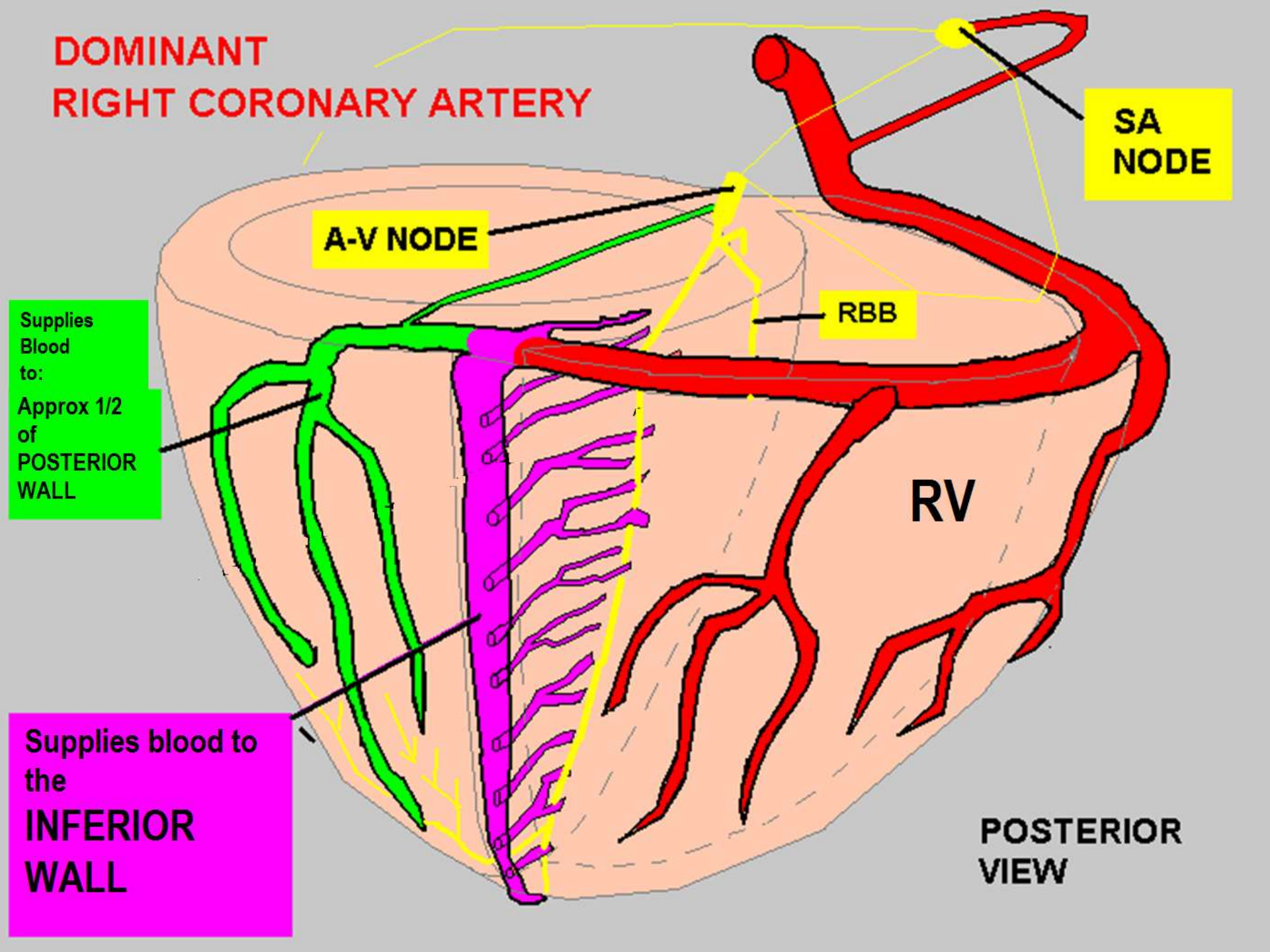
- **Approximately 20-30% of the Left Ventricle, which includes:**
  - **_____of Left Ventricle**
  - **_____**
- **On rare occasion, the _____**

LEADS II, III, and aVF VIEW
INFERIOR WALL of the LEFT VENTRICLE





FED by the RCA (75 - 80 % pop)
or the CIRCUMFLEX (10 - 15 %)


DOMINANT
RIGHT CORONARY ARTERY
SA NODE
A-V NODE
RBB
Supplies Blood to:
Approx 1/2 of POSTERIOR WALL
RV
Supplies blood to the INFERIOR WALL
POSTERIOR VIEW

Right Coronary Artery (RCA)

In patients with a RIGHT DOMINANT system, the RCA supplies blood to the following cardiac structures:

- **Sinus Node**
- **Right Ventricle**
- **AV Node**
- **Approximately 15-25% of the Left Ventricle**
  - **INFERIOR Wall**
  - **½ POSTERIOR WALL**

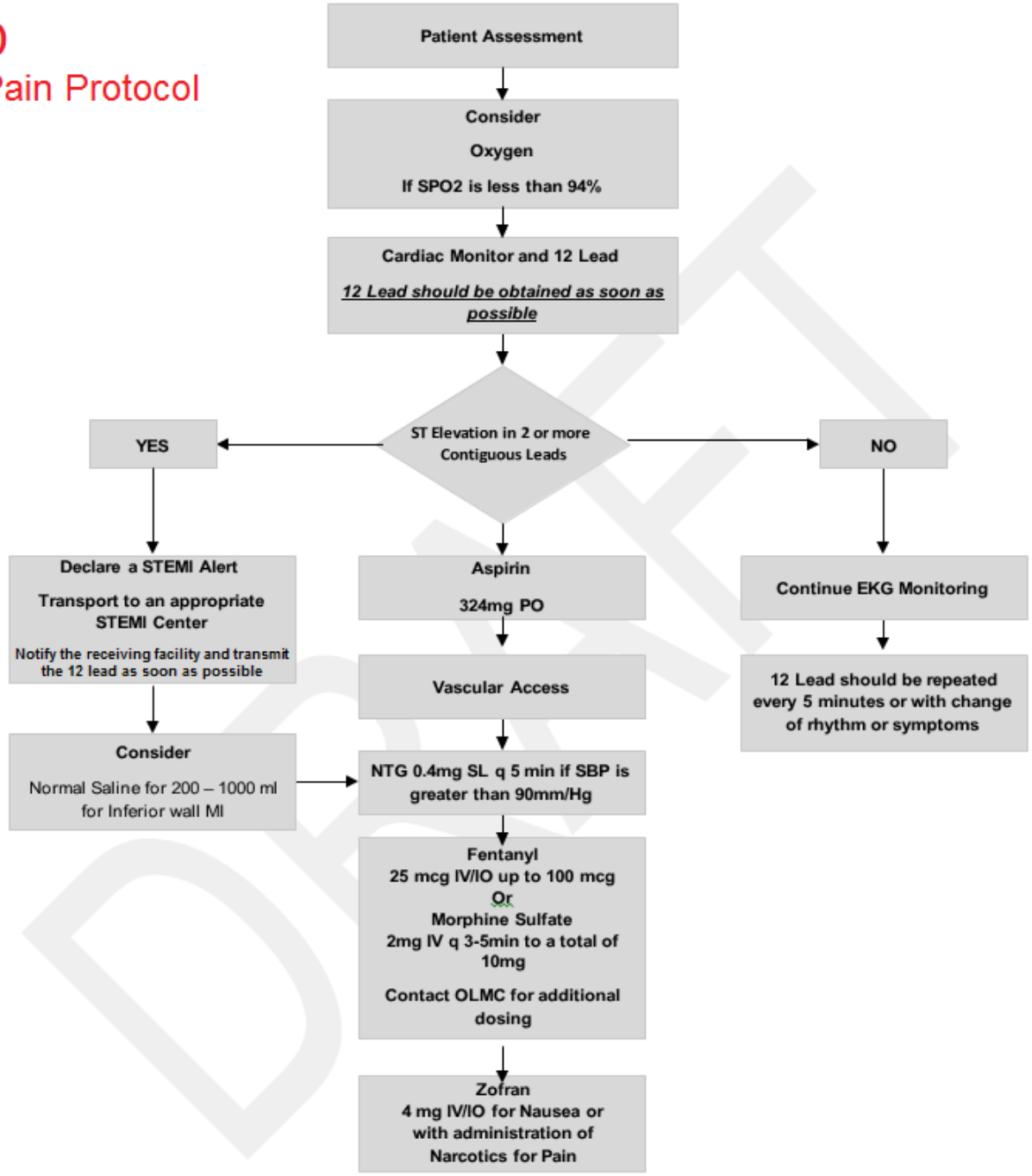
Right Coronary Artery (RCA)

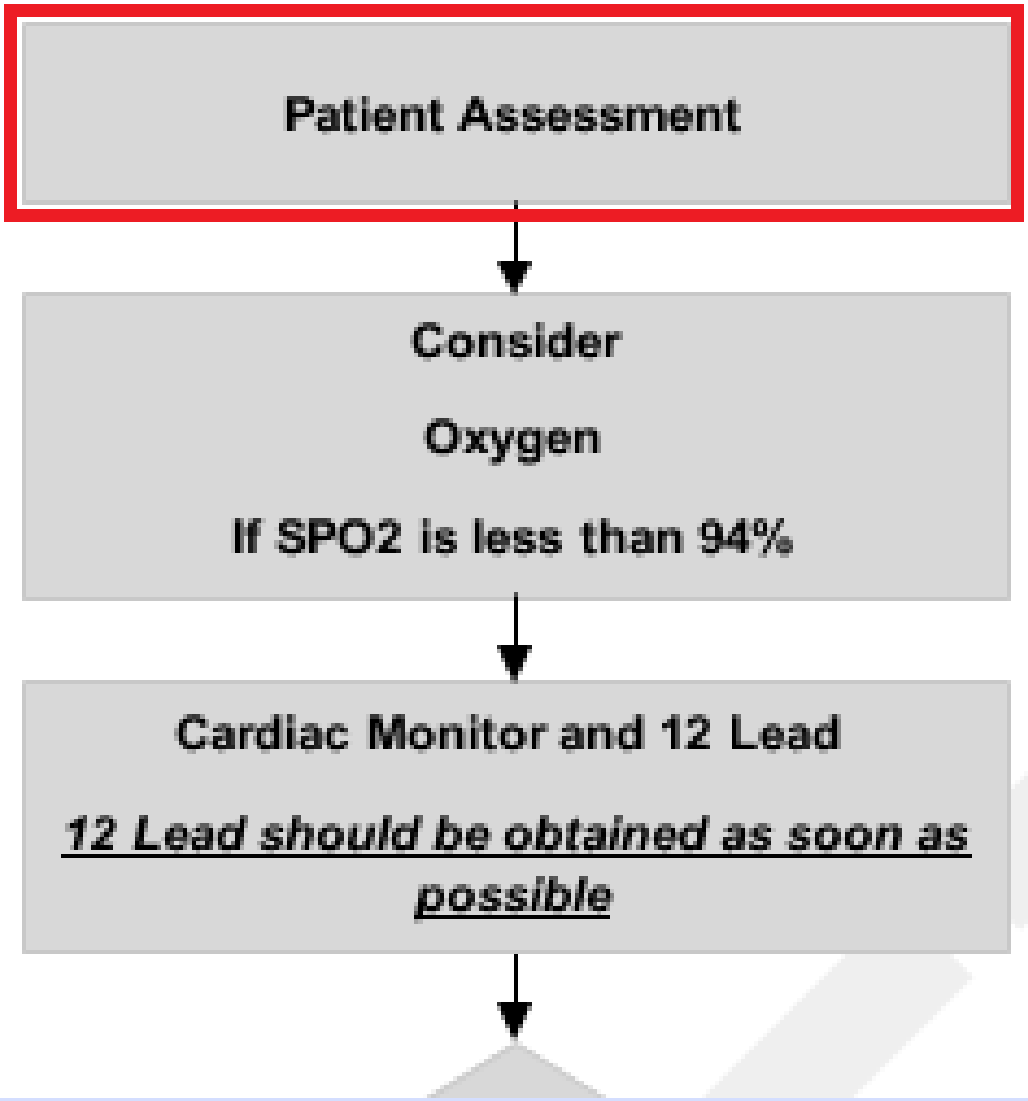
In patients with a RIGHT DOMINANT system, the RCA supplies blood to the following cardiac structures:

- _____
- _____
- _____
- **Approximately _____%of the Left Ventricle**
  - **INFERIOR Wall**
  - **½ POSTERIOR WALL**

CCFD
Chest Pain Protocol

(p. 24)




Patient Assessment
Consider
Oxygen
If SPO2 is less than 94%
Cardiac Monitor and 12 Lead
12 Lead should be obtained as soon as possible

Initial Assessment:

- ABCs (rule out – or treat – cardiac arrest)
- SHOCK Assessment

SHOCK ASSESSMENT

SHOCK =

INADEQUTE TISSUE PERFUSION

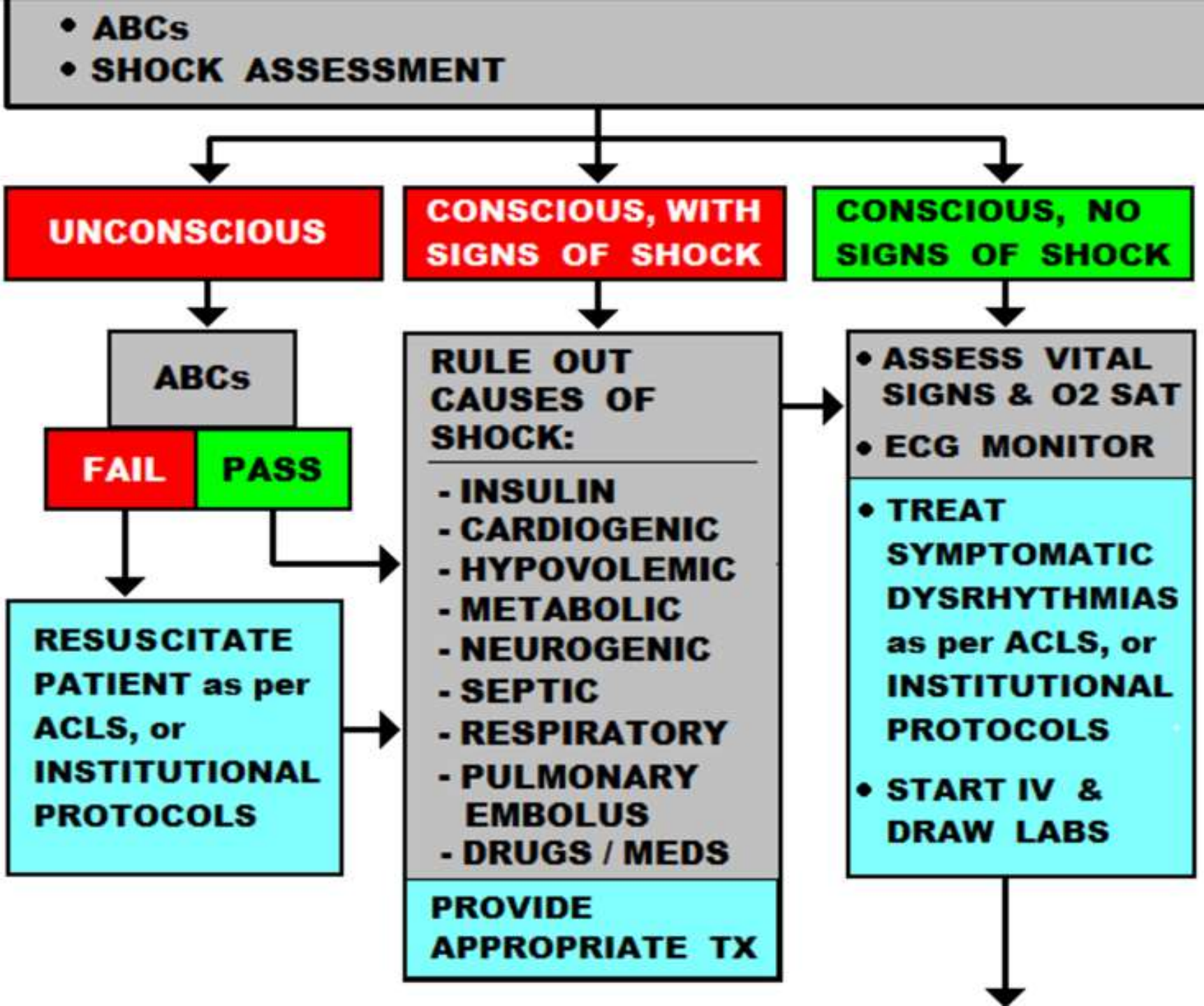
- STARTS THE INSTANT YOU SEE PATIENT
- ENDS WHEN YOU REACH THE PATIENT'S SIDE

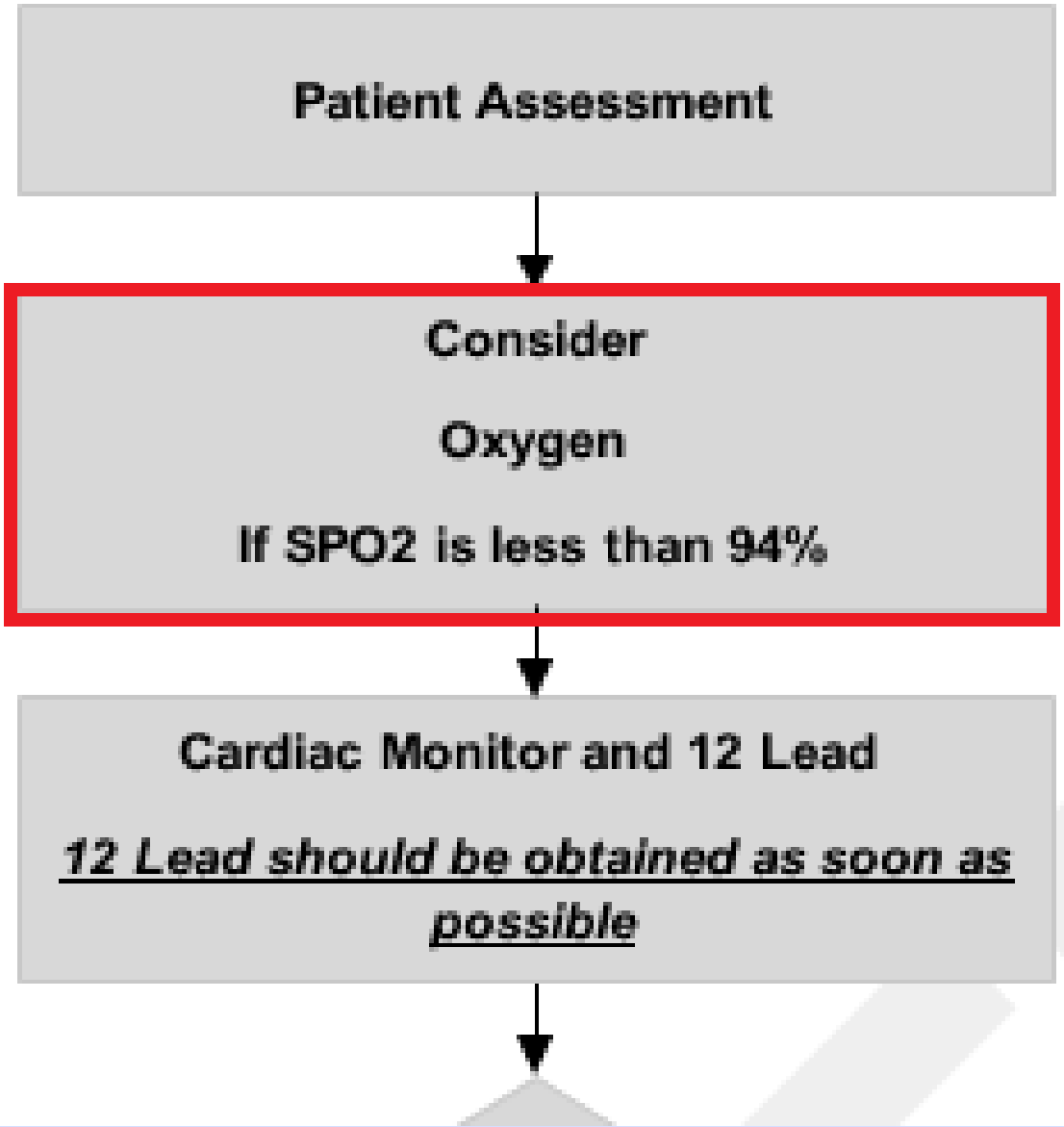
SHOCK ASSESSMENT

LOC:	ANXIOUS RESTLESS LETHARGIC UNCONSCIOUS	AWAKE ALERT & ORIENTED
SKIN:	PALE / ASHEN CYANOTIC COOL DIAPHORETIC	NORMAL HUE WARM DRY
BREATHING:	TACHYPNEA	NORMAL
PULSE:	WEAK / THREADY TOO FAST or SLOW	STRONG
STATUS:	SHOCK	NORMAL

FAIL the SHOCK SURVEY ?

- **RAPIDLY FIND *AND TREAT***
  THE ROOT CAUSE . . .


• ABCs
• SHOCK ASSESSMENT
UNCONSCIOUS
CONSCIOUS, WITH SIGNS OF SHOCK
CONSCIOUS, NO SIGNS OF SHOCK
ABCs
FAIL
PASS
RESUSCITATE PATIENT as per ACLS, or INSTITUTIONAL PROTOCOLS
RULE OUT CAUSES OF SHOCK:
- INSULIN
- CARDIOGENIC
- HYPOVOLEMIC
- METABOLIC
- NEUROGENIC
- SEPTIC
- RESPIRATORY
- PULMONARY EMBOLUS
- DRUGS / MEDS
PROVIDE APPROPRIATE TX
• ASSESS VITAL SIGNS & O2 SAT
• ECG MONITOR
• TREAT SYMPTOMATIC DYSRHYTHMIAS as per ACLS, or INSTITUTIONAL PROTOCOLS
• START IV & DRAW LABS


Patient Assessment
Consider
Oxygen
If SPO2 is less than 94%
Cardiac Monitor and 12 Lead
12 Lead should be obtained as soon as possible

ACLS criteria for Oxygen:

- SAO2 less than 90 …. And/ or …..
- Signs of Hypoxia (shock) are present.

Some agency protocols are more aggressive about when O2 is given

CHIEF COMPLAINT

KEY WORDS:

“CHEST: PAIN / HEAVINESS / PRESSURE/ FUNNY FEELING IN,” etc.

SHORTNESS BREATH

DIZZINESS / LIGHTHEADEDNESS

ETC. ETC. ETC.

“Classic” cardiac chest pain:

- Location: Substernal
- Dull or Pressure-like in nature
- Does not change with deep inspiration

“Classic” cardiac chest pain:

- Location: _____
- ___ or _____ in nature
- Does not change with _____

INFARCTION

- - - "Classic Symptoms" - - -

QUICK ASSESSMENT "SHORT FORM"

- ☑ **SUBSTERNAL CHEST PAIN**
  (HAVE PATIENT POINT TO WORST PAIN)
- ☑ **DESCRIBED AS "DULL PAIN," "PRESSURE," or "HEAVINESS"**
- ☑ **DOES NOT CHANGE WITH DEEP BREATH**

TYPICAL SYPTOMS of ACUTE CORNARY SYNDROME:

- ✓ **CHEST PAIN** - *DESCRIBED AS . . .*
  - "HEAVINESS, PRESSURE, DULL PAIN, TIGHTNESS"
  - CENTERED IN CHEST, SUBSTERNAL
  - MAY RADIATE TO SHOULDERS, JAW, NECK, LEFT or RIGHT ARM
  - NOT EFFECTED by:
    - MOVEMENT
    - POSITION
    - DEEP INSPIRATION
- ✓ **SHORTNESS OF BREATH**
  - MAY or MAY NOT BE PRESENT
- ✓ **NAUSEA / VOMITING**
  - MAY or MAY NOT BE PRESENT

ATYPICAL SYMPTOMS of ACS

? ? ?

Acute MI patients who present without chest pain* are SHREWD:

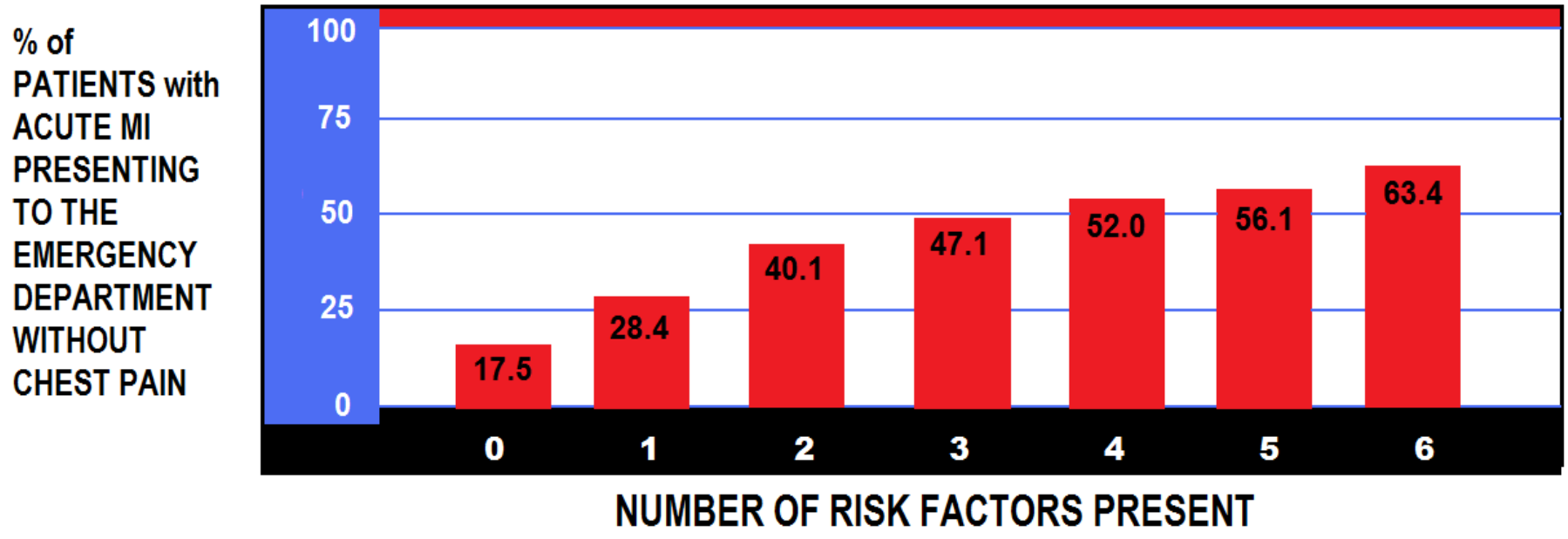
Stroke (previous history of)
Heart failure (previous history of)
Race (non-white)
Elderly (age 75+)
Women
Diabetes mellitus

* The information listed in the table to the immediate left resulted from a study conducted by John G. Canto, MD, MSPH, et. al., of the University of Alabama. The study consisted of 434,877 patients diagnosed with AMI between 1994 and 1998 in 1,674 US hospitals. Study results were published in the Journal of the American Medical Association (JAMA) on June 28, 2000, Vol. 283, No. 24, pages 3223-3229

Common atypical complaints associated with AMI without chest pain include:

Malaise (weakness)
Indigestion
Nausea
Dizziness
Syncope
Fatigue
Abdominal pain
Cold sweats
Elevated heart rate
Dsypnea

Effect of Having Multiple Risk Factors for AMI Without Chest Pain



RISK FACTORS INCLUDE: **S**troke (previous), **H**eart failure (previous), **R**ace (non-white), **E**lderly (age 75+), **W**omen, **D**iabtetes

DATA SOURCE: J. CANTO, MD, MSPH, et al, JAMA 2000 ; 283 : 3223 - 3229

WOMEN'S MAJOR SYMPTOMS *PRIOR* TO THEIR HEART ATTACK:

- UNUSUAL FATIGUE 71 %
- SLEEP DISTURBANCE 48 %
- SOB 42 %
- INDIGESTION 39 %
- ANXIETY 36 %

APPROXIMATELY 78 % OF WOMEN REPORTED EXPERIENCING AT LEAST ONE OF THESE SYMPTOMS FOR MORE THAN ONE MONTH EITHER DAILY OR SEVERAL TIMES PER WEEK PRIOR TO THEIR MI.

WOMEN'S MAJOR SYMPTOMS DURING THEIR HEART ATTACK:

SHORTNESS OF BREATH	58 %
WEAKNESS	55 %
UNUSUAL FATIGUE	43 %
COLD SWEAT	39 %
DIZZINESS	39 %

43 % HAD NO CHEST PAIN AT ANY TIME DURING THEIR MI !

Circulation, 2003:108;2619-2623

Physical Exam – Clues of MI:

- Skin may be PALE, CLAMMY
- SWEATING ! (Diaphoresis)
- Clutching /Rubbing chest
- BP can be high, normal or low
- Anxiety / “look of impending doom.”

All patients with ACS symptoms . . .

STAT 12 Lead ECG; obtain and have read within 10 minutes !!!

ACC/AHA Guideline!

All patients with ACS symptoms . . .

STAT 12 Lead ECG; obtain and have read within _____ !!!

ACC/AHA Guideline!

The 12 Lead ECG to Rule out ACS:

- **Acute Coronary Syndrome (ACS) is made up of the following cardiac conditions:**
  - **Unstable Angina**
  - **Non-ST Segment Elevation Myocardial Infarction (NSTEMI)**
  - **ST Segment Elevation Myocardial Infarction (STEMI)**
- **Low Risk Chest Pain**

Unstable Angina - ECG:

The 12 Lead ECG may show:

The 12 Lead ECG may show:

- ST Depression
- Other ST Segment changes
- Inverted T waves
- **THE ECG MAY BE COMPLETELY NORMAL**.

CASE STUDY 17 - UNSTABLE ANGINA

CHIEF COMPLAINT and SIGNIFICANT HISTORY:

45 y/o MALE c/o EXERTIONAL CHEST PRESSURE x past 2 months, getting worse. In last week, CHEST PRESSURE has come on at rest. DYSPNEA sometimes present. Pain is relieved when patient rests, however now takes longer than 20 minutes to subside.

RISK FACTOR PROFILE:

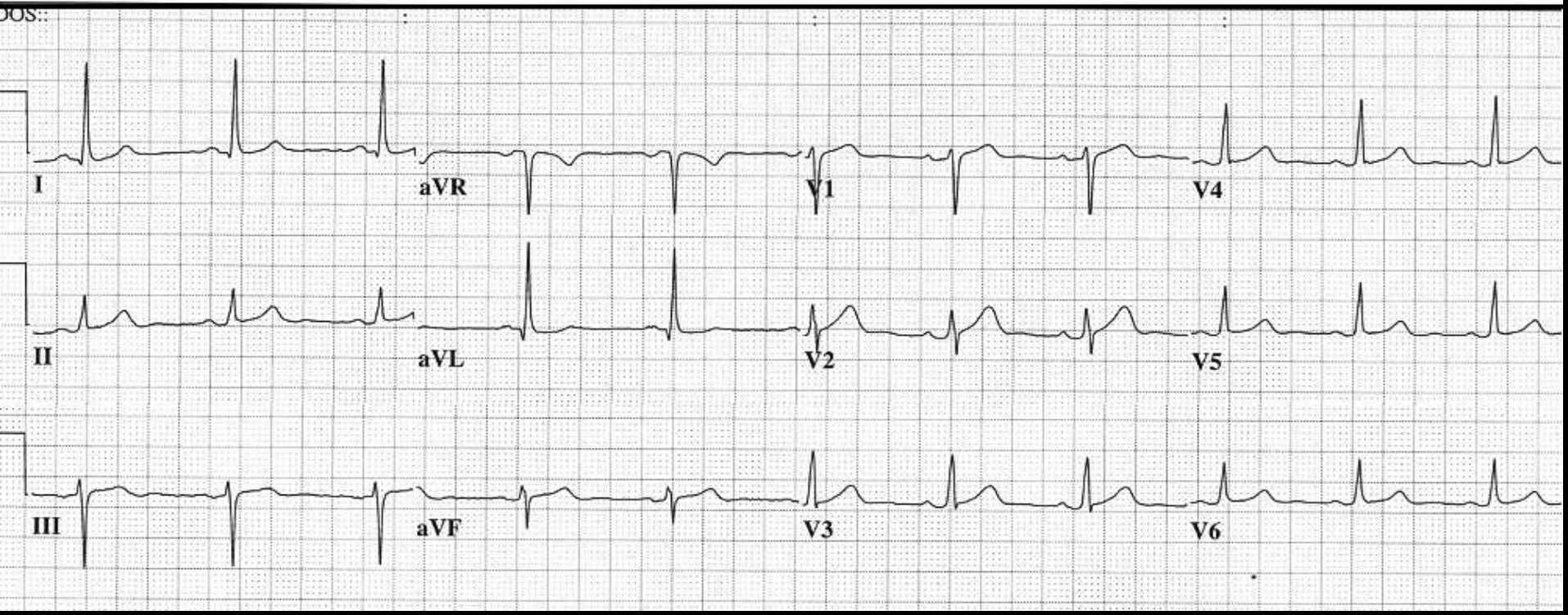
- FAMILY HISTORY: father died of AMI age 50, brother had CABG age 44
- CIGARETTE SMOKER x 20 YEARS
- HYPERTENSION
- ELEVATED LDL, TRIGLYCERIDES, LOW HDL CHOLESTEROL

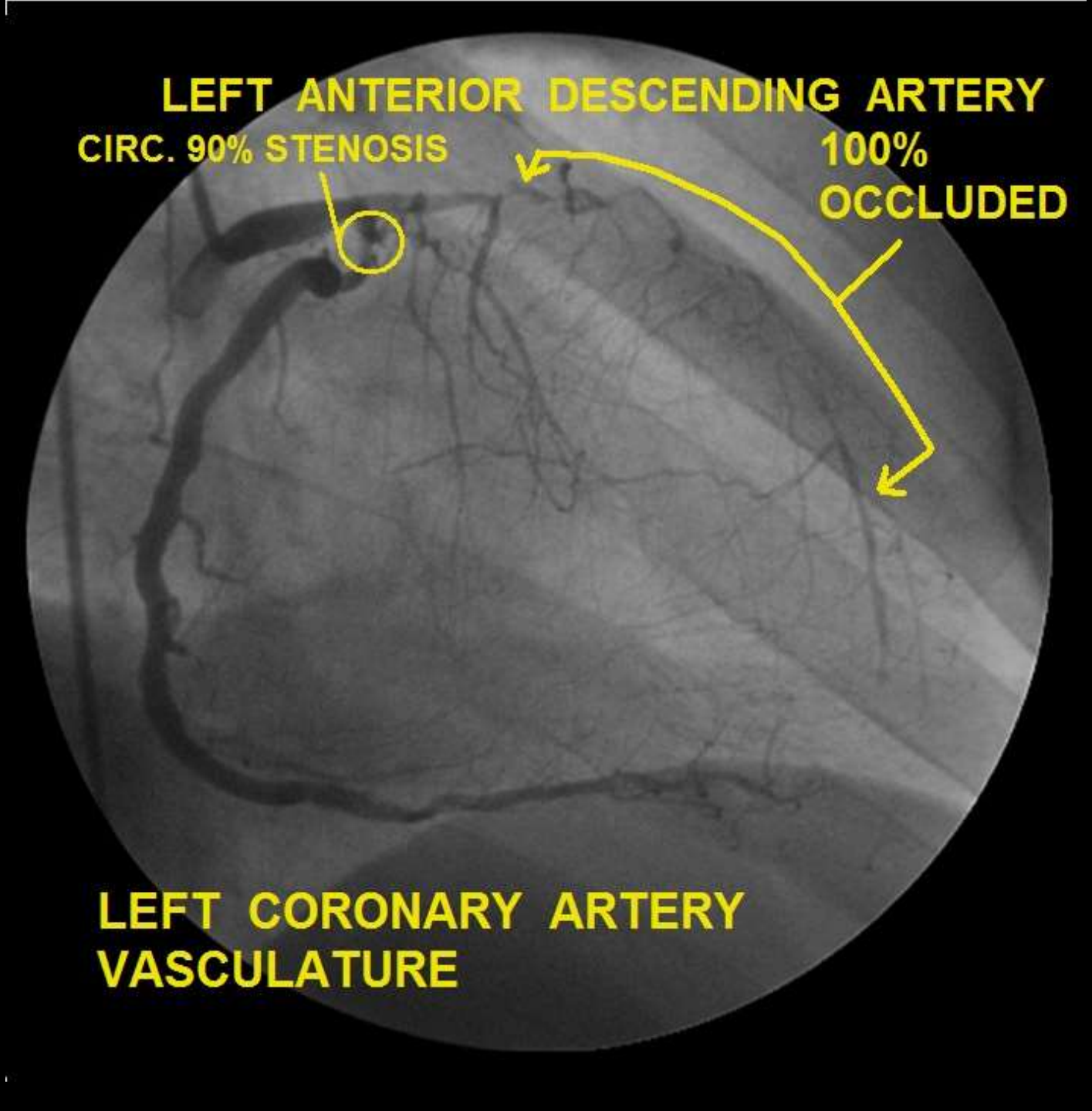
PHYSICAL EXAM: Pt. asymptomatic at time of exam, skin warm, dry, color normal, pupils PERLA, no JVD, lungs = clear, heart sounds normal S1, S2. Abd. soft, non-tender, No ankle edema

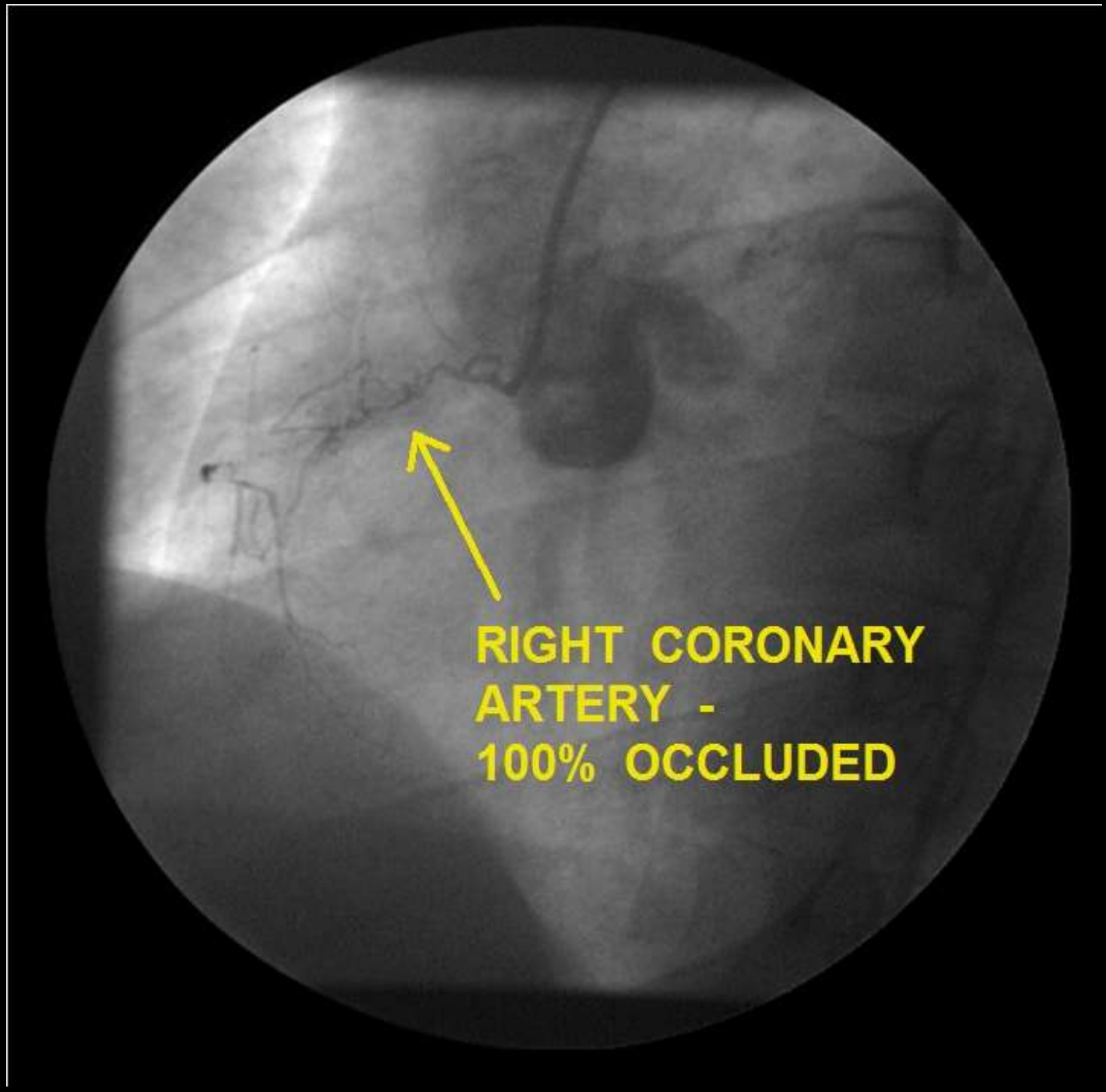
VITAL SIGNS: BP: 177/96 P: 64 R: 16 SAO2: 99 % on room air

LABS: TROPONIN: < .04

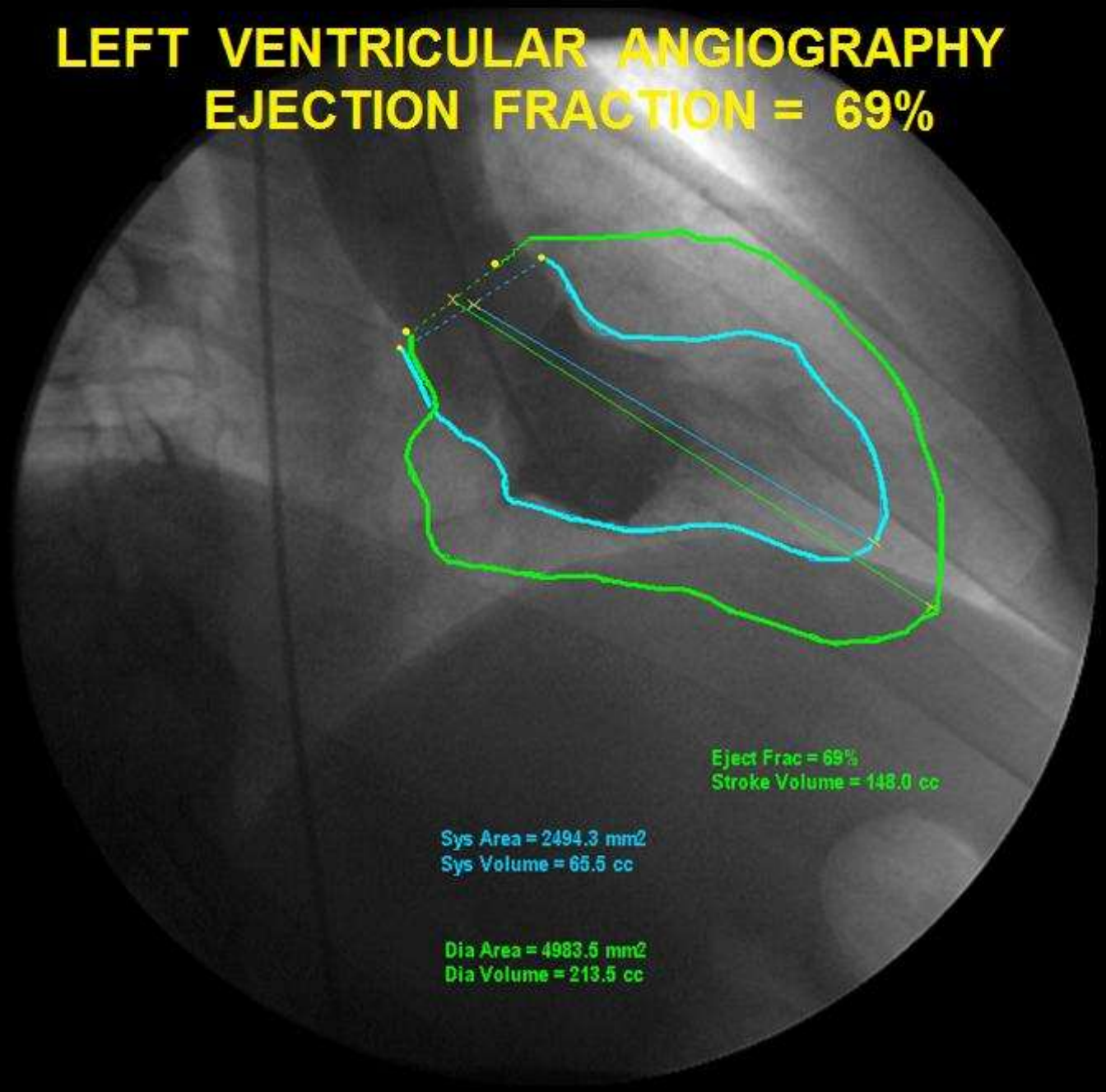
45 yr		Vent. rate	65	BPM
Male	Caucasian	PR interval	160	ms
		QRS duration	86	ms
		QT/QTc	384/399	ms
Loc:7	Option:35	P–R–T axes	11 –8	55




LEFT ANTERIOR DESCENDING ARTERY
CIRC. 90% STENOSIS
100%
OCCLUDED
LEFT CORONARY ARTERY
VASCULATURE


RIGHT CORONARY
ARTERY -
100% OCCLUDED

LEFT VENTRICULAR ANGIOGRAPHY
EJECTION FRACTION = 69%



CASE STUDY 15 - UNSTABLE ANGINA

CHIEF COMPLAINT and SIGNIFICANT HISTORY:

42 y/o FEMALE c/o INTERMITTENT CHEST PRESSURE which has been WORSENING during the past week. Also c/o mild DIB. Symptoms previously provoked by exertion, now comes on at rest.

RISK FACTOR PROFILE:

- HYPERTENSION
- CIGARETTE SMOKER x 15 YEARS
- FAMILY HISTORY - FATHER Dx WITH CAD, HAD CABG AT 52

PHYSICAL EXAM: Pt. ASYMPTOMATIC at time of exam. SKIN WARM, DRY, COLOR NORMAL, PERLA, LUNGS= CLEAR, HS NORMAL S1, S2, NO ANKLE EDEMA.

VITAL SIGNS: BP: 148/92 P: 64 R: 20 SAO2: 97 % on 2 LPM O2

LABS: TROPONIN: < .04

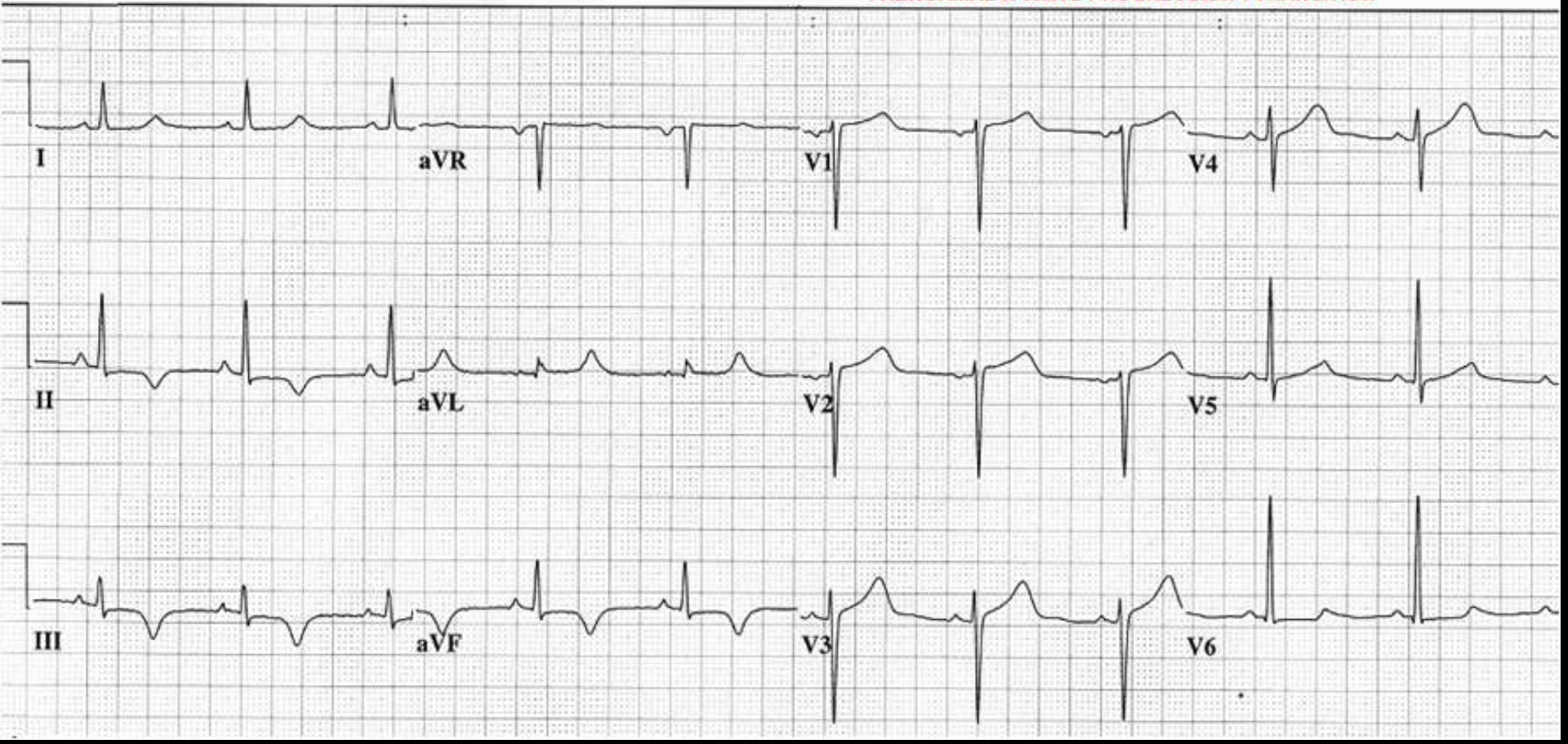
42 yr
Female Caucasian

Room:S5
Loc:3 Option:23

Vent. rate	63	BPM
PR interval	142	ms
QRS duration	74	ms
QT/QTc	462/472	ms
P–R–T axes	65 42	–72

☞ EVALUATE THE EKG FOR:

- ST SEGMENT ELEVATION / DEPRESSION
- HYPERACUTE T WAVES
- FLAT / CONVEX J-T APEX SEGMENTS
- OTHER ST-T WAVE ABNORMALITIES
- ABNORMAL R WAVE PROGRESSION / TRANSITION



42 yr
Female Caucasian

Room:S5
Loc:3 Option:23

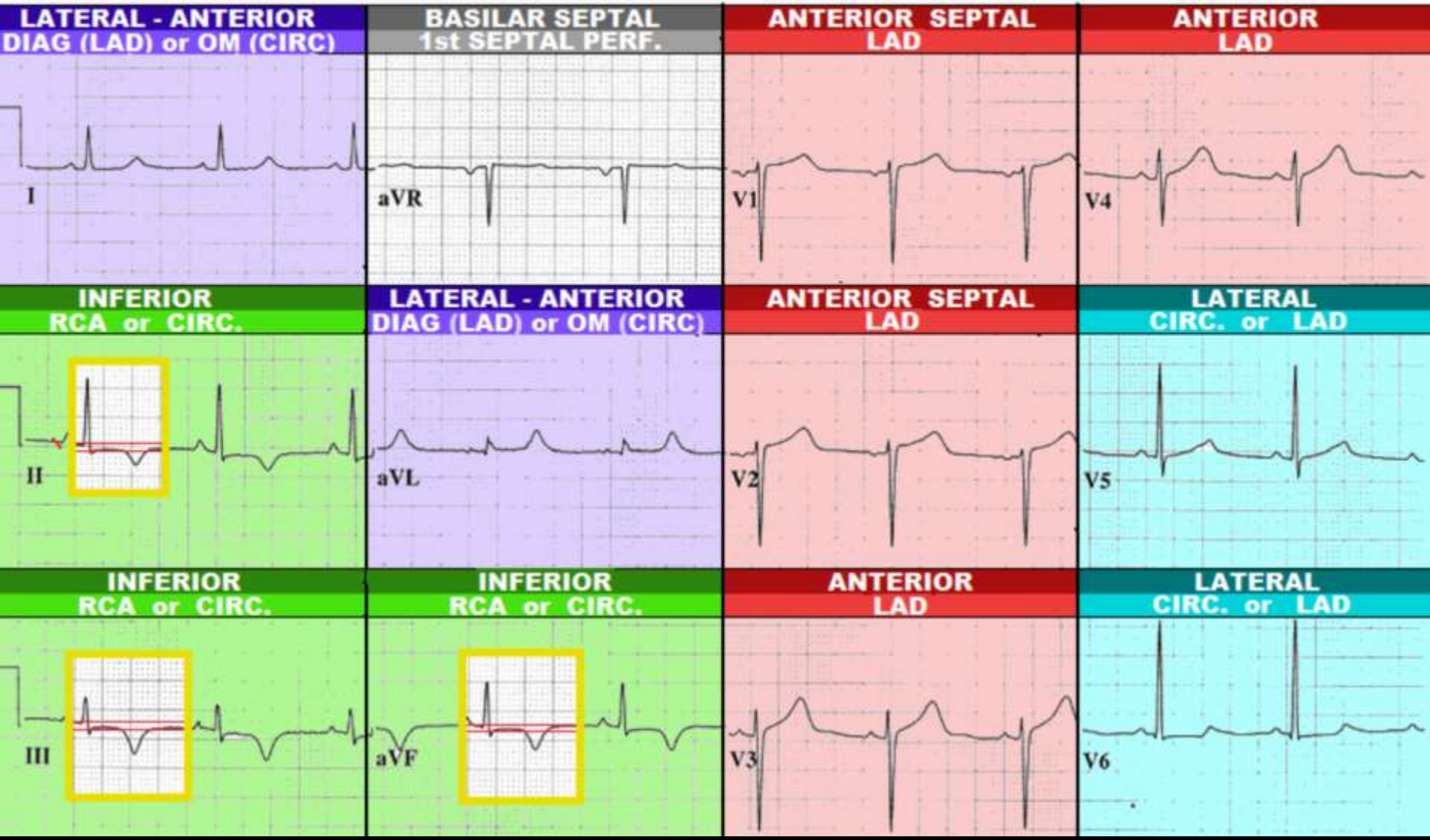
Vent. rate	63	BPM
PR interval	142	ms
QRS duration	74	ms
QT/QTc	462/472	ms
P-R-T axes	65 42	-72

Normal sinus rhythm

ST & T wave abnormality, consider inferior ischemia

Abnormal ECG

ST SEGMENT DEPRESSION



Unstable Angina Findings:

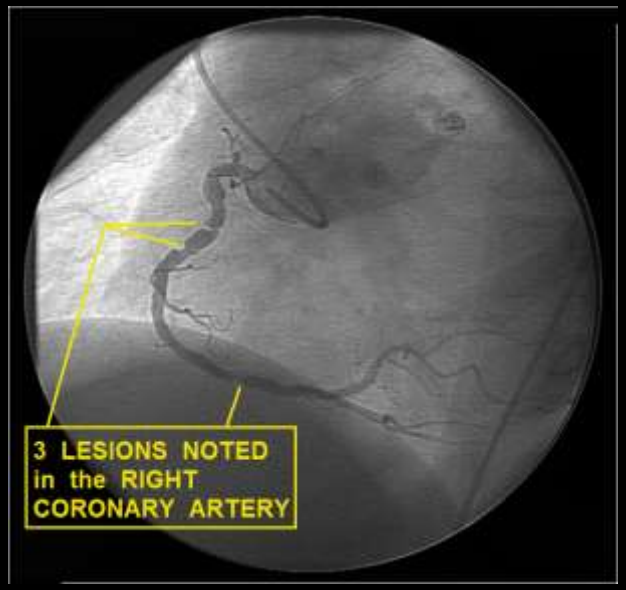
The 12 Lead ECG may exhibit:

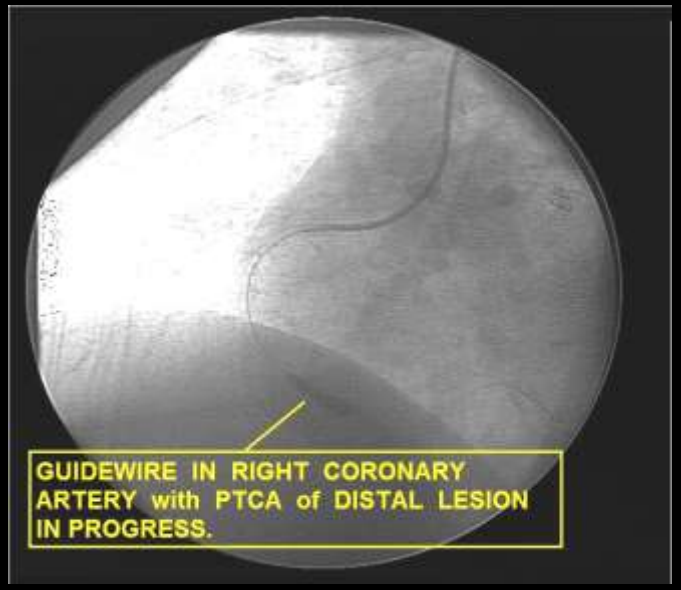
- **ST-T Wave changes in leads that view the ischemic region**
  - **ST Depression**
  - **T Wave Inversion**
  - **Other "non-specific" ST-T changes**
- **The ECG may be TOTALLY NORMAL.**
- **Troponin is NEGATIVE.**

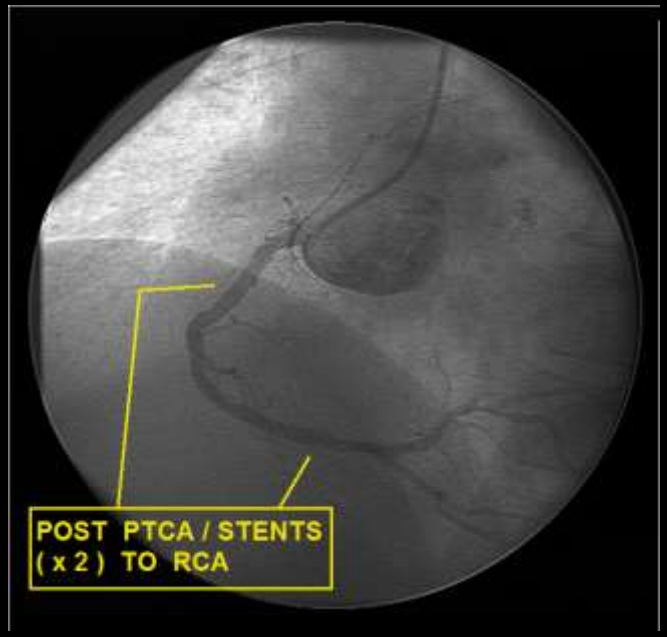
Unstable Angina Findings:

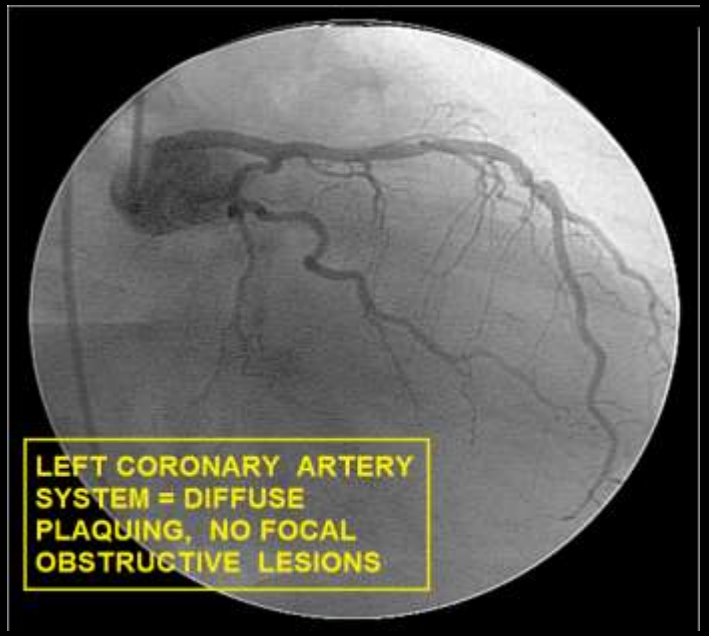
The 12 Lead ECG may exhibit:

- **_____in leads that view the ischemic region**
  - **ST Depression**
  - **T Wave Inversion**
  - **Other "non-specific" ST-T changes**
- **The ECG may be _____.**
- **Troponin is _____.**


3 LESIONS NOTED
in the RIGHT
CORONARY ARTERY


GUIDEWIRE IN RIGHT CORONARY
ARTERY with PTCA of DISTAL LESION
IN PROGRESS.

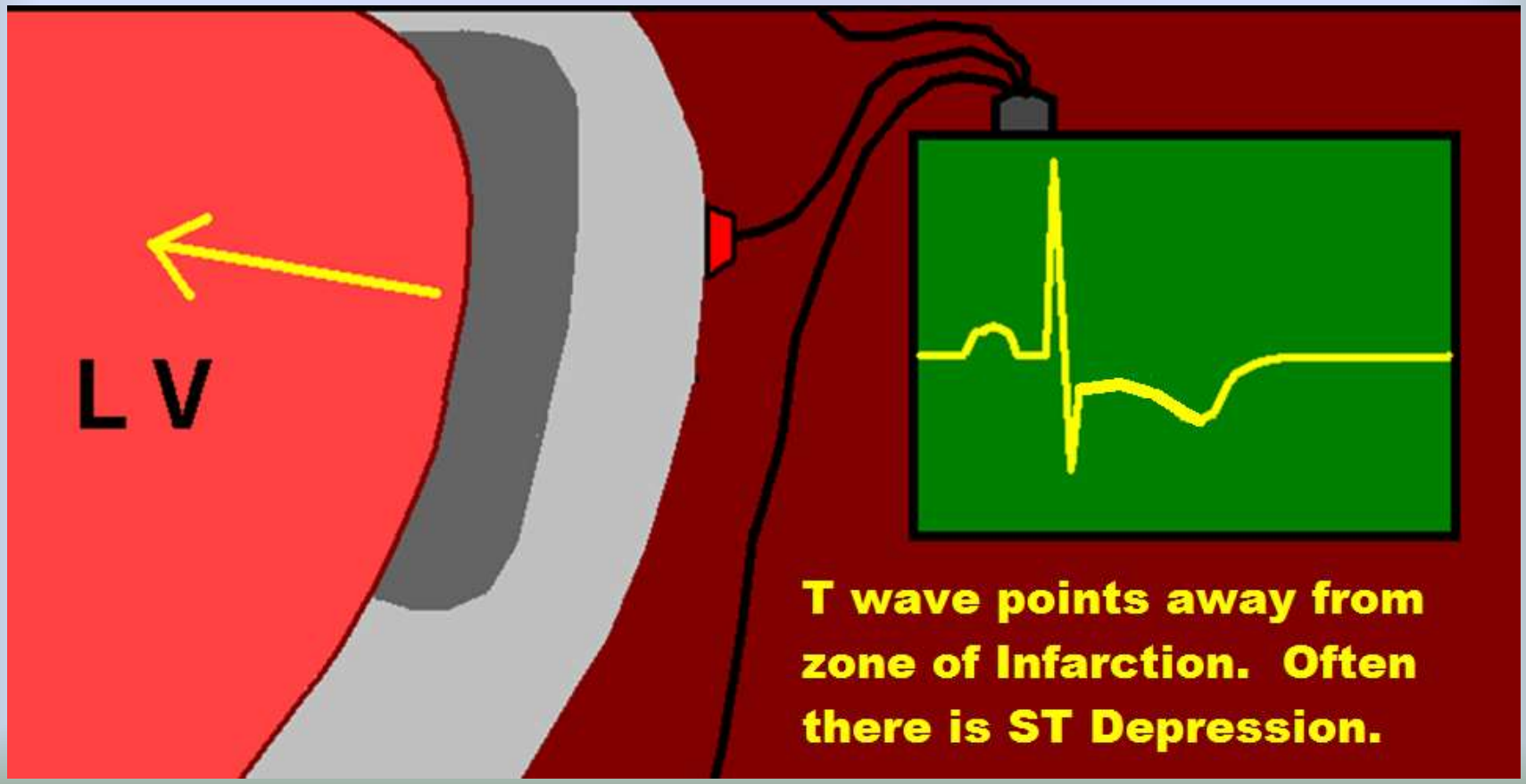

POST PTCA / STENTS
(x 2) TO RCA


LEFT CORONARY ARTERY
SYSTEM = DIFFUSE
PLAQUING, NO FOCAL
OBSTRUCTIVE LESIONS

Non-STEMI (NSTEMI)

Non-ST Segment Elevation Myocardial Infarction.

"sub-endocardial MI" . . . "partial wall thickness"



NSTEMI Findings:

The 12 Lead ECG may exhibit:

- **ST-T Wave changes in leads that view the ischemic region**
  - **ST Depression**
  - **T Wave Inversion**
  - **Other "non-specific" ST-T changes**
- **The ECG may be COMPLETELY NORMAL.**
- **Troponin is POSITIVE.**

NSTEMI Findings:

The 12 Lead ECG may exhibit:

- **_____in leads that view the ischemic region**
  - **ST Depression**
  - **T Wave Inversion**
  - **Other "non-specific" ST-T changes**
- **The ECG may be _____.**
- **Troponin is _____.**

CASE STUDY 11 - NSTEMI *ATYPICAL EKG*

CHIEF COMPLAINT and SIGNIFICANT HISTORY:

42 y/o MALE in ED c/o INTERMITTENT SUBSTERNAL CHEST PAIN x 9 HOURS, "8" on 1-10 scale, pain does not radiate, not effected by position/deep inspiration. Denies DIB.
Pt. given NTG 0.4mg SL without releif of CHEST PAIN.

RISK FACTOR PROFILE:

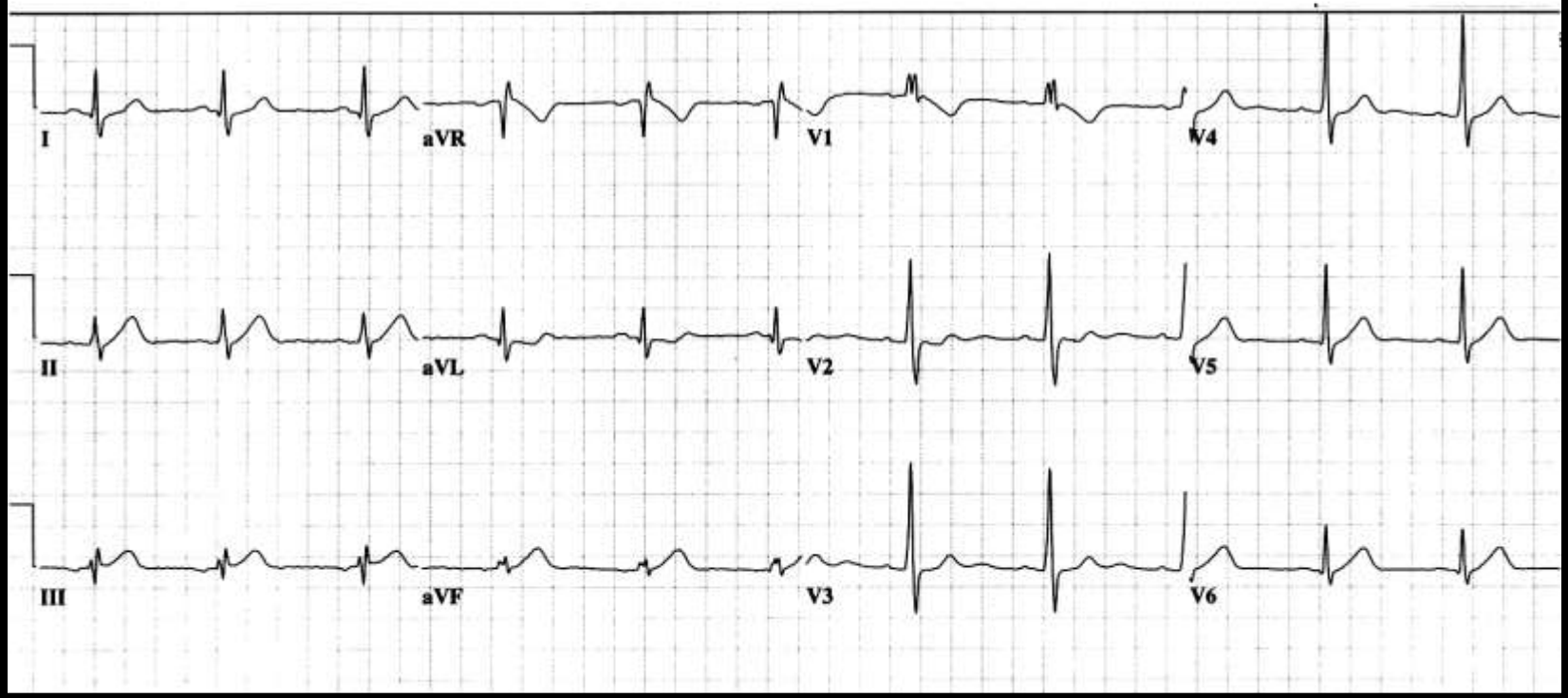
- ELEVATED LDL CHOLESTEROL, LOW HDL CHOLESTEROL
- ✔ PATIENT DENIES SMOKING, FAMILY HISTORY, HYPERTENSION

PHYSICAL EXAM: CAOx4, SKIN WARM, DRY, COLOR NORMAL, NON-ANXIOUS, LUNGS CLEAR, HEART SOUNDS NORMAL S1, S2, NO JVD, NO ANKLE EDEMA

VITAL SIGNS: BP: 122/76 P: 86 R: 16 SAO2: 98% on 2 LPM O2

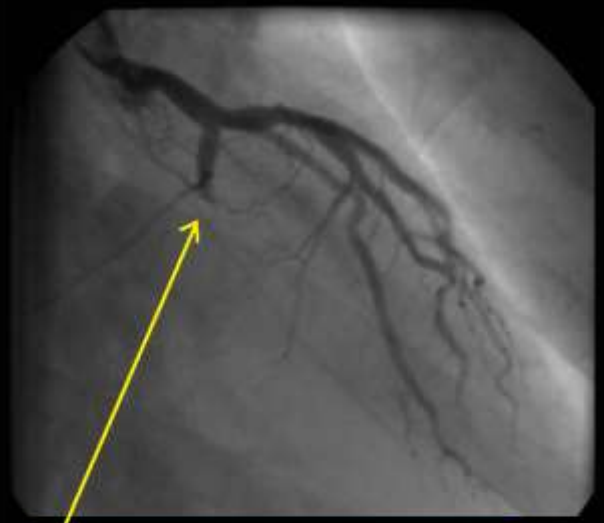
LABS: TROPONIN: >500 CK: 4,410 CK MB: 224.1 CK INDEX: 5.1

42 yr		Vent. rate	67	BPM	"**unedited copy: report is computer generated only, without physician interpretation".
Male	Hispanic	PR interval	148	ms	Normal sinus rhythm
		QRS duration	94	ms	Nonspecific ST abnormality
Room:ED		QT/QTc	400/422	ms	Abnormal ECG
Loc:3	Option:23	P-R-T axes	-5 34	59	No previous ECGs available



CASE STUDY QUESTIONS:

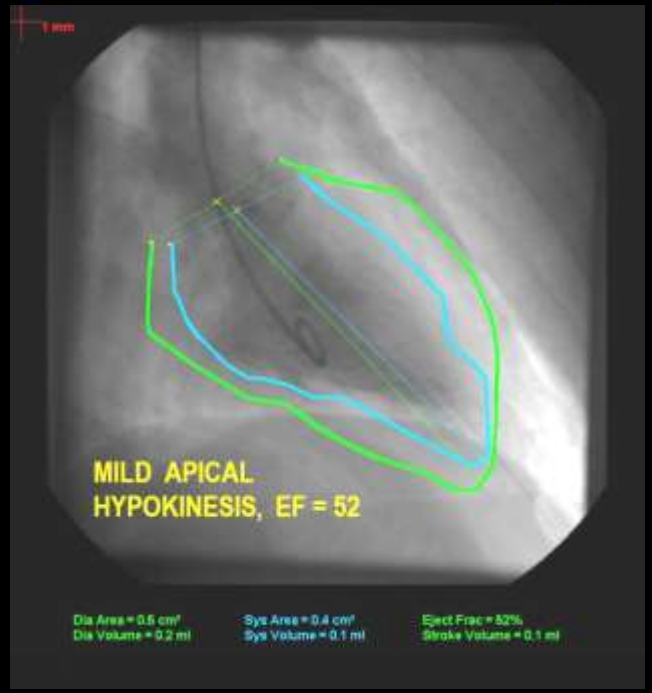
NOTE LEADS WITH ST ELEVATION:	**NOTE LEADS WITH ST DEPRESSION:**
WHAT IS THE SUSPECTED DIAGNOSIS ?	
WHAT IS THE "CULPRIT ARTERY" -- if applicable ?	
LIST ANY CRITICAL STRUCTURES COMPROMISED:	**LIST ANY POTENTIAL COMPLICATIONS:**



TOTAL OBSTRUCTION - PROXIMAL CIRCUMFLEX ARTERY

DOMINANT RIGHT CORONARY ARTERY OPEN

POST PTCA / STENT TO CIRCUMFLEX ARTERY



Non-STEMI (NSTEMI)

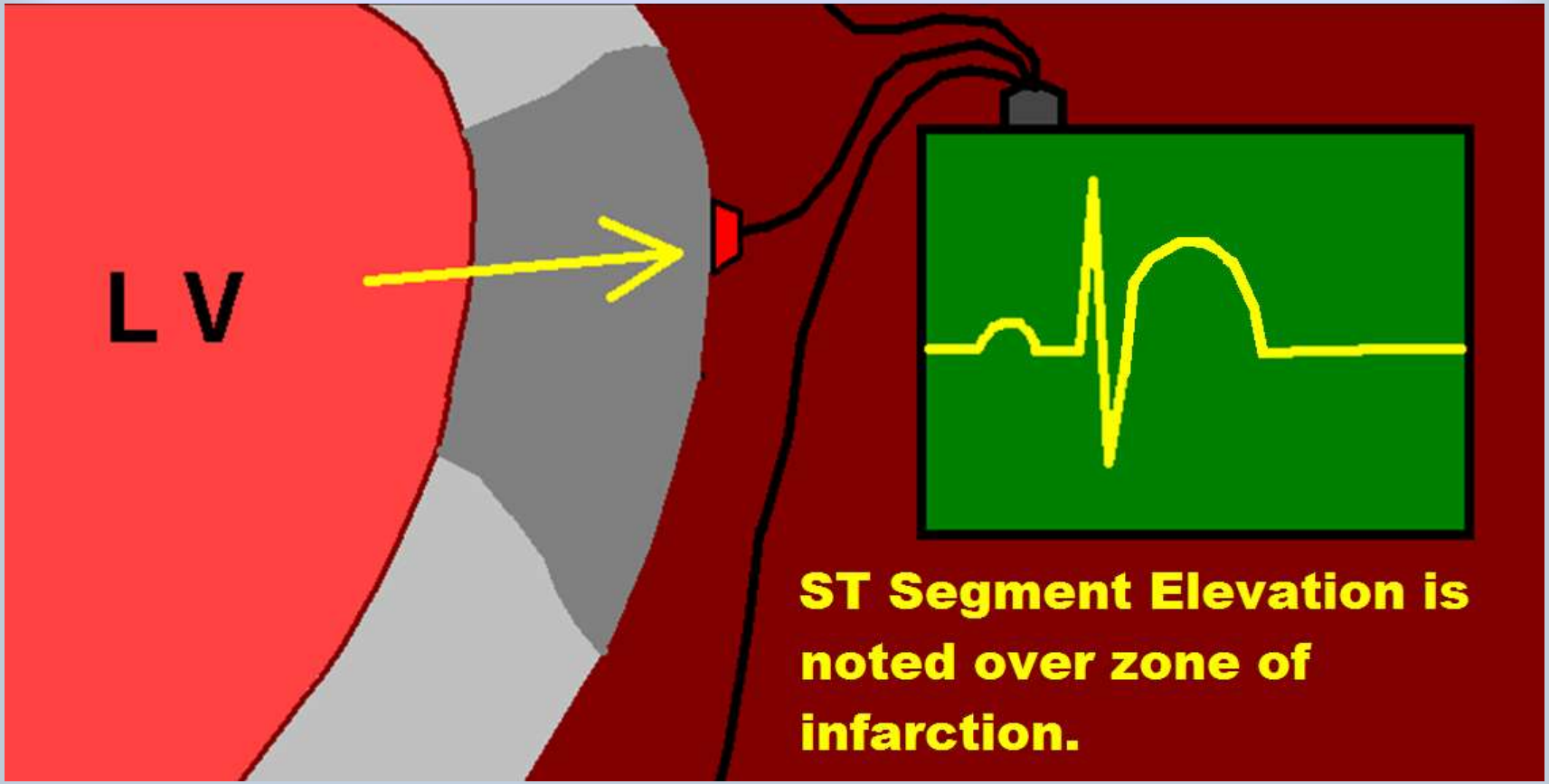
Non-ST Segment Elevation Myocardial Infarction.

"sub-endocardial MI" . . . "partial wall thickness"

This is a "Partial Wall Thickness" MI, heart cells are dying, and the Troponin becomes detectable in the patient's bloodstream. Usually "less severe" than a STEMI, patient needs blood thinners and to get to the cath lab in 24-48 hours.

STEMI

- ST Segment Elevation Myocardial Infarction.



STEMI

ST Segment Elevation Myocardial Infarction.

("full-wall thickness," Transmural event)

This is a life-threatening emergency. Part of the patient's heart is dying. Blood flow must be restored within 90 minutes or less in order to preserve heart muscle. Based on the region of the heart affected, critical and often lethal complications rapidly develop.

Ischemia and Infarction = Acute Coronary Syndrome

The conditions associated with Acute Coronary Syndrome (ACS) include:

- Unstable Angina (ischemia)
- Non-ST Segment Elevation Myocardial Infarction (NSTEMI) (infarction)
- ST Segment Elevation Myocardial Infarction (STEMI) (Infarction)

Q: To evaluate the patient for ischemia or infarction, what part of the ECG do we look at?

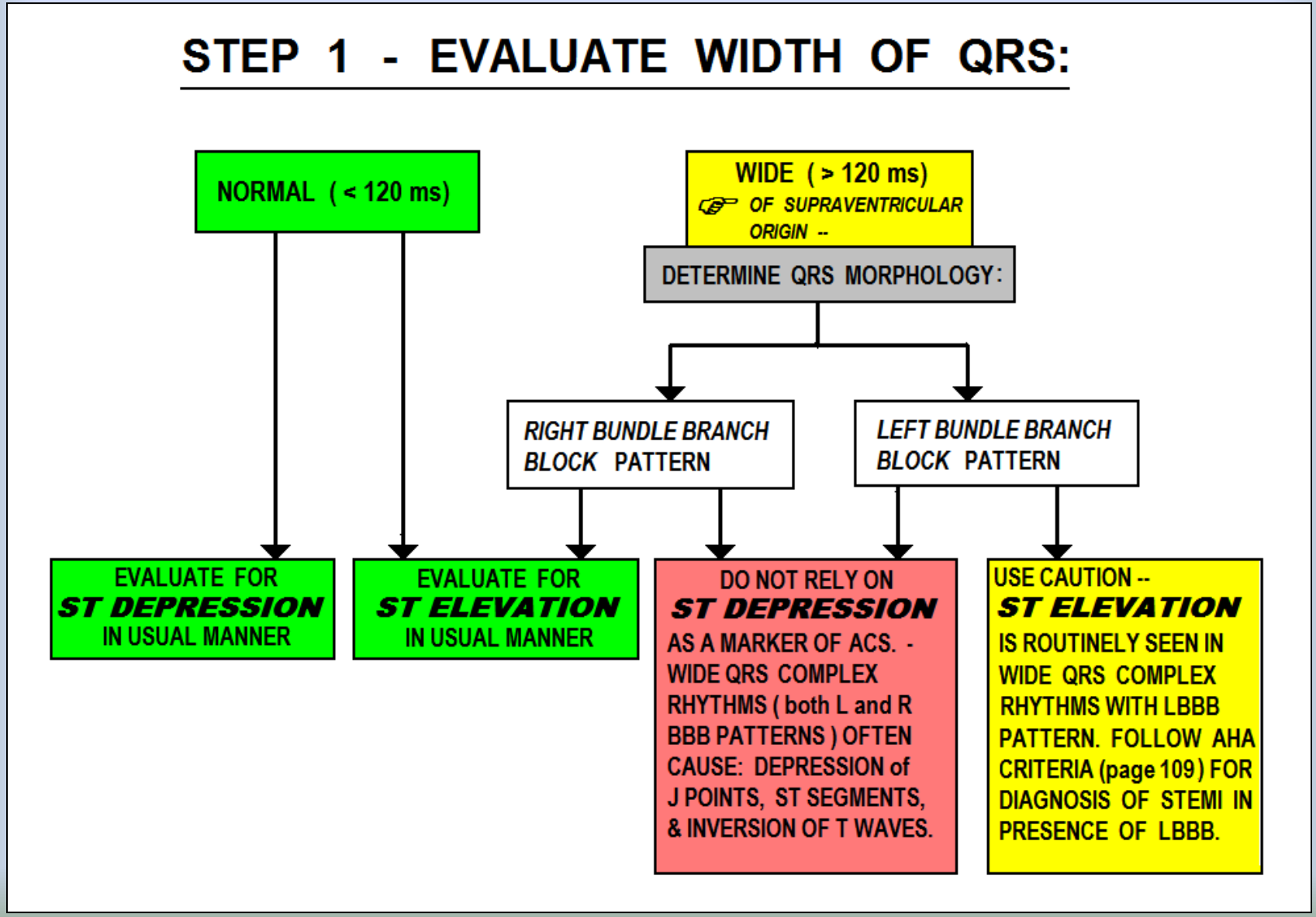
Q: To evaluate the patient for ischemia or infarction, what part of the ECG do we look at?

A: We evaluate the

- **J Points**
- **ST Segments &**
- **T Waves**

…… in each lead !

Evaluating the ECG for ACS:



Evaluating the ECG for ACS:

Patients with Normal Width QRS (QRSd < 120ms)

STEP 2 - EVALUATE the EKG for ACS

THE EKG MARKERS USED FOR DETERMINING THE PRESENCE OF ACUTE CORONARY SYNDROME INCLUDE:

- J POINTS
- ST SEGMENTS
- T WAVES

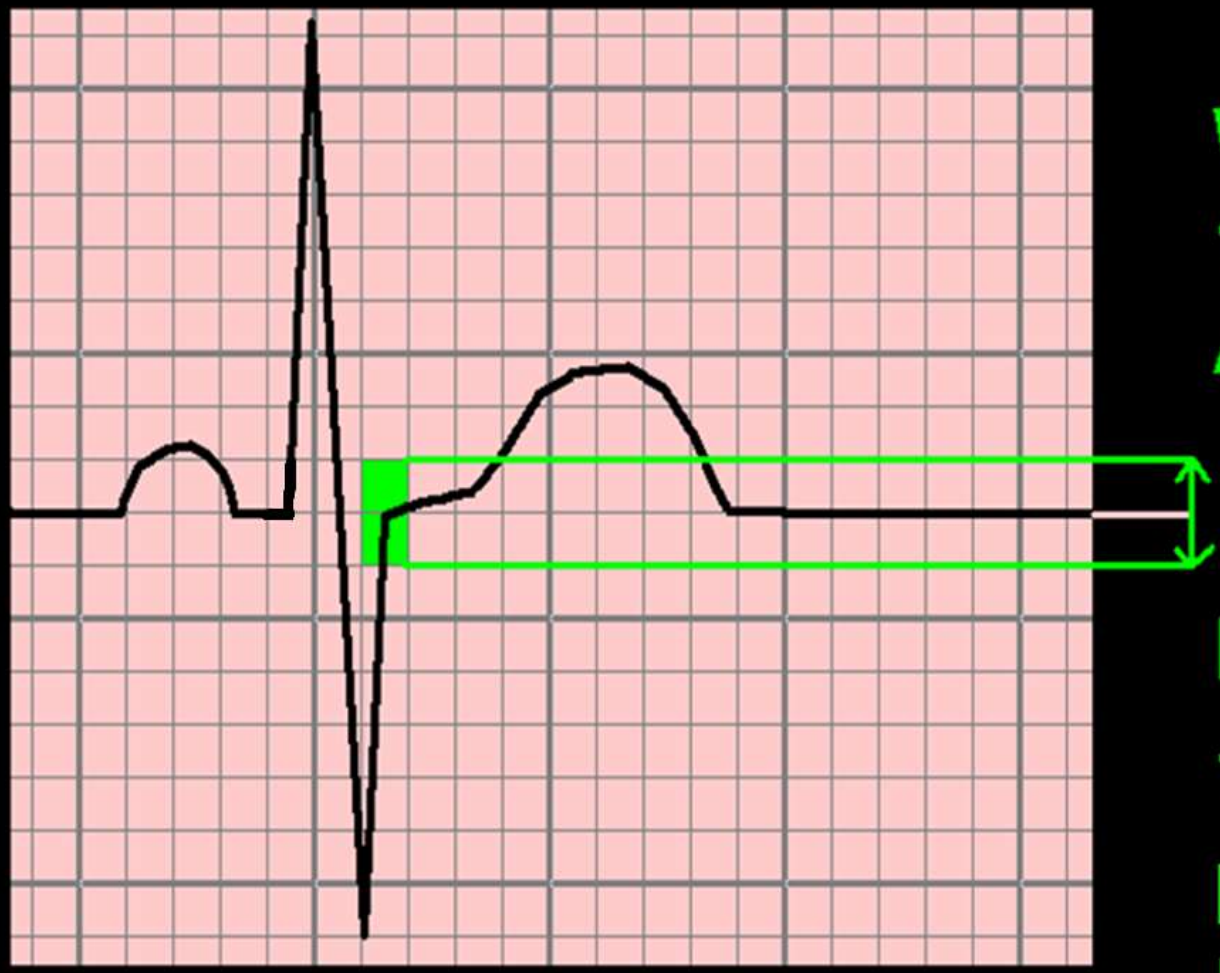
CAREFULLY SCRUTINIZE THESE MARKERS IN EVERY LEAD OF THE 12 LEAD EKG, TO DETERMINE IF THEY ARE *NORMAL* or *ABNORMAL*.

Q: Why is QRS width an issue when we look at J Points, ST Segments and T Waves??

Q: Why is QRS width an issue when we look at J Points, ST Segments and T Waves??

A: When the QRS is abnormally wide (> 120ms), it ALTERS the J Points, ST Segments and T Waves.

THE J POINT SHOULD BE . .

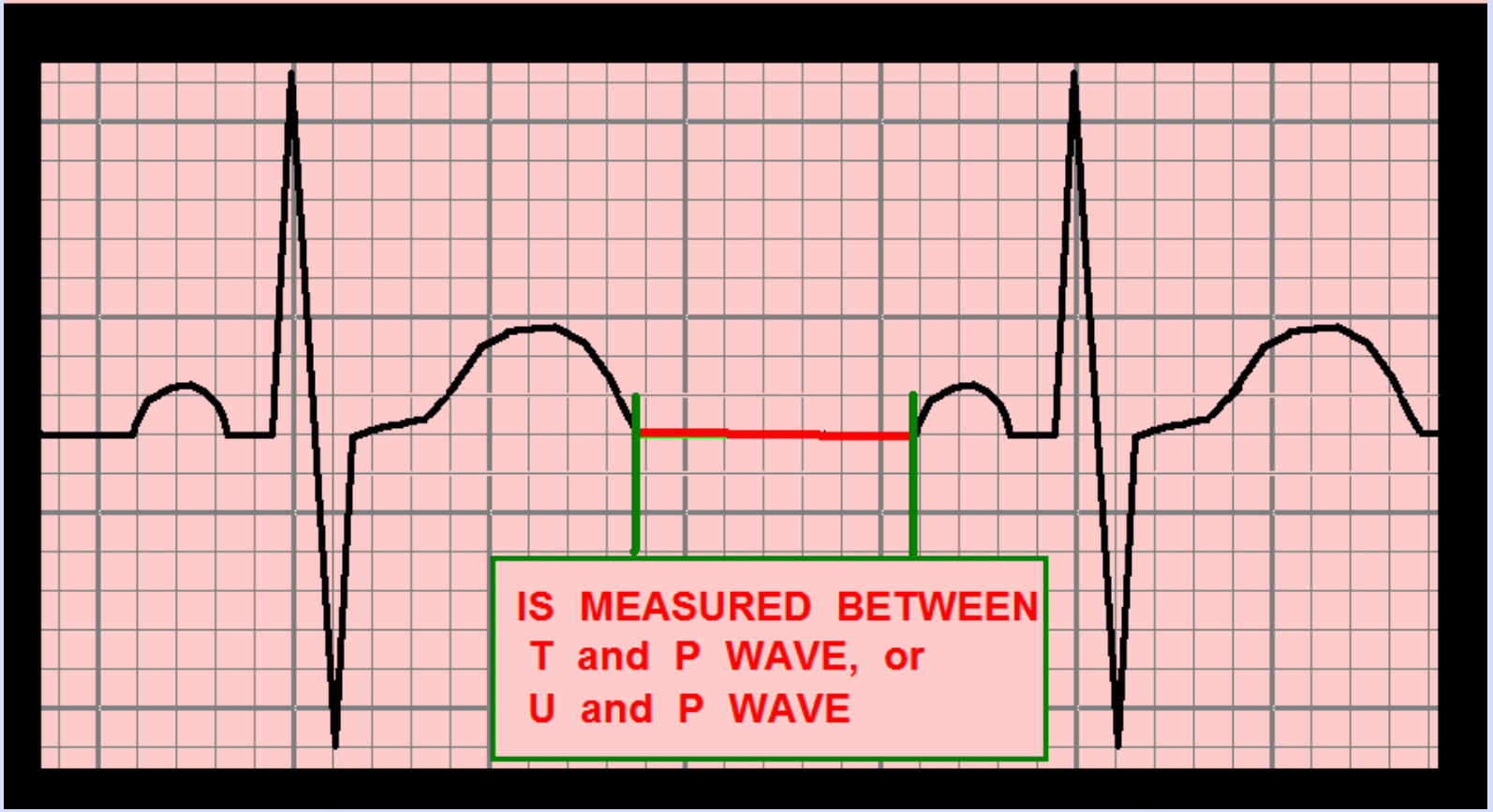


WITHIN
1 mm
ABOVE

OR

BELOW
the
ISOELECTRIC
LINE

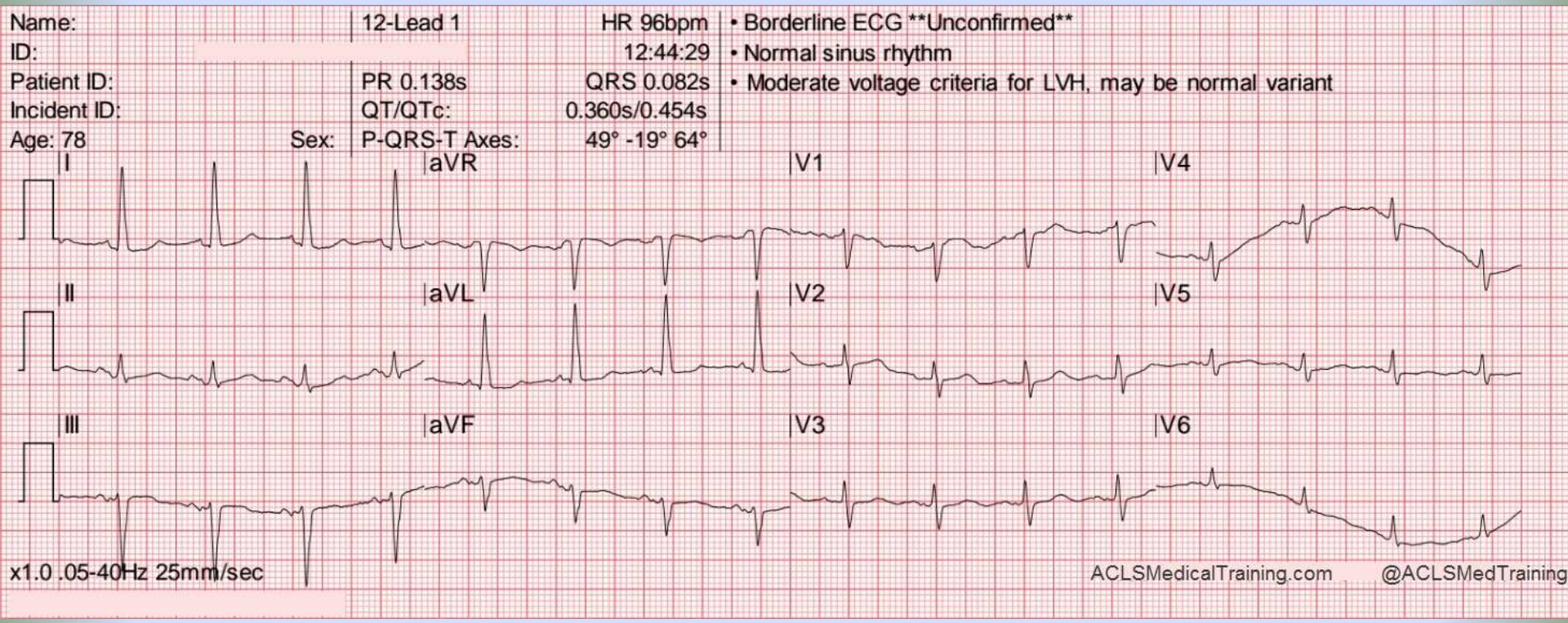
THE ISOELECTRIC LINE



. . .the “flat line” between ECG complexes, when there is no detectable electrical activity . . .

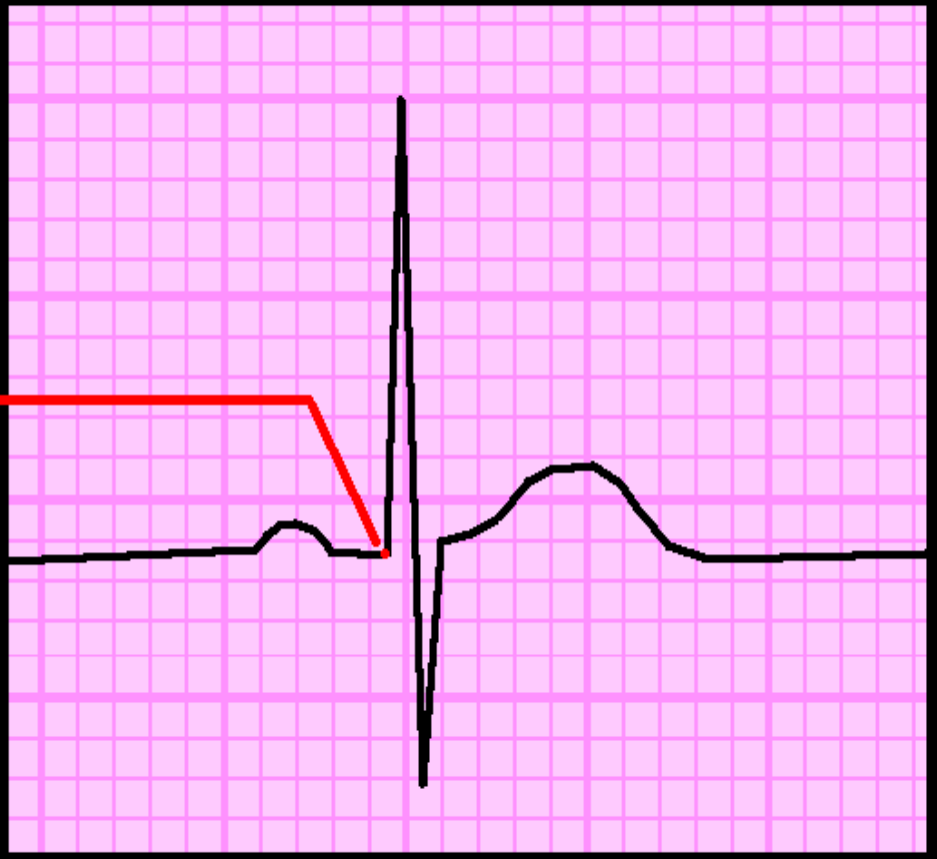
The Isoelectric Line -

it's not always isoelectric !



THE P-Q JUNCTION

. . . is the POINT where the P-R SEGMENT ends and the QRS COMPLEX BEGINS.



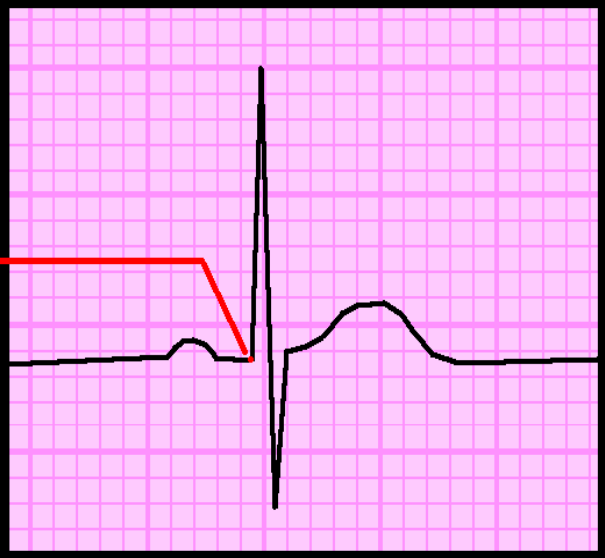
Used for POINT OF REFERENCE for measurement of the J-POINT and the S-T SEGMENT –

— as per the A.H.A., A.C.C., and WANG, ASINGER, and MARRIOTT, N.E.J.M. vol. 349:2128-2135 Nov. 27, 2003

Use the P-Q junction as a reference point for measuring the J Point and ST-Segment when “iso-electric line is not iso-electric !”

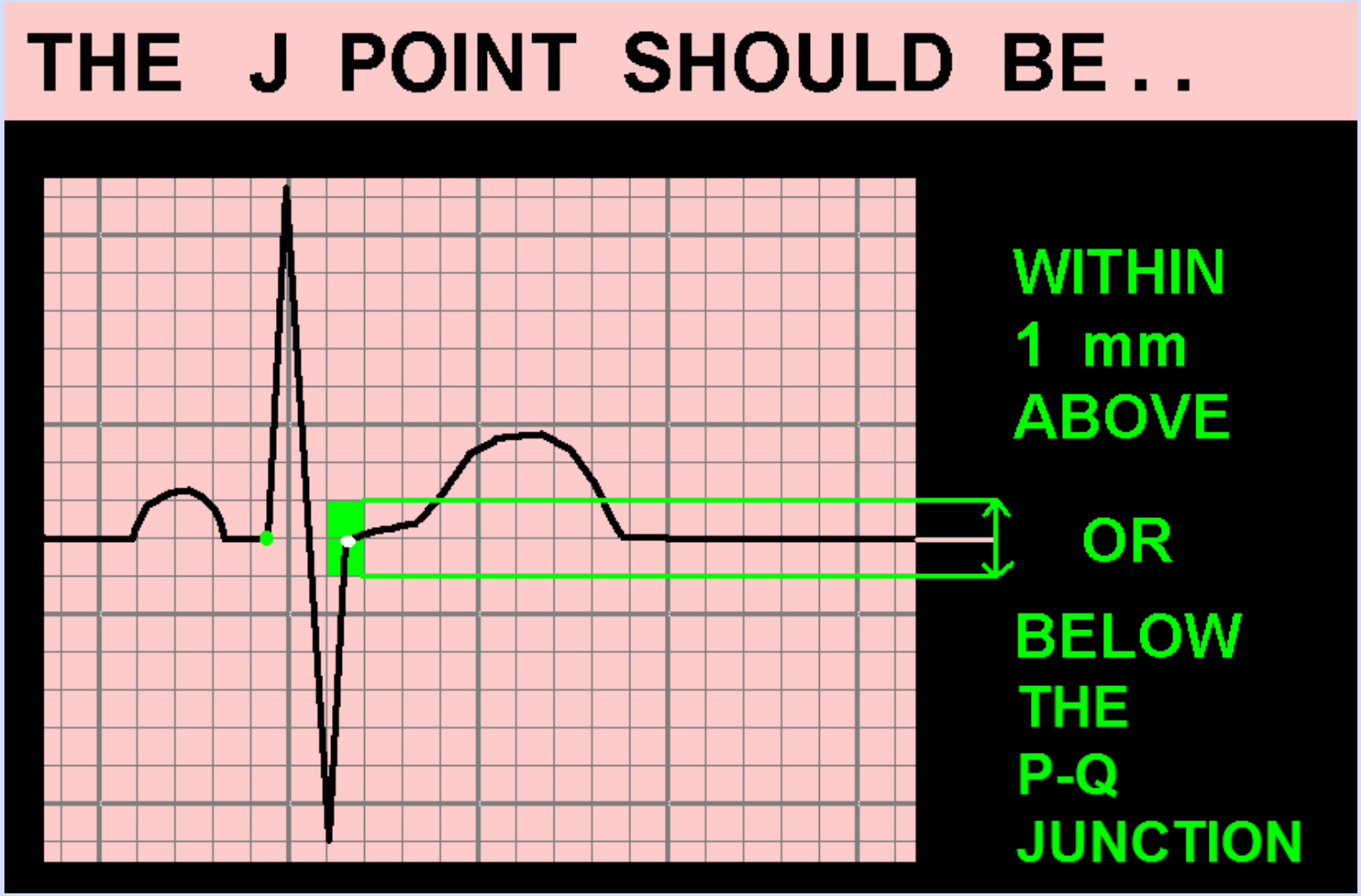
THE P-Q JUNCTION

. . . is the POINT where the P-R SEGMENT ends and the QRS COMPLEX BEGINS. Used for POINT OF REFERENCE for measurement of the J-POINT and the S-T SEGMENT –



— as per the A.H.A., A.C.C., and WANG, ASINGER, and MARRIOTT, N.E.J.M. vol. 349:2128-2135 Nov. 27, 2003

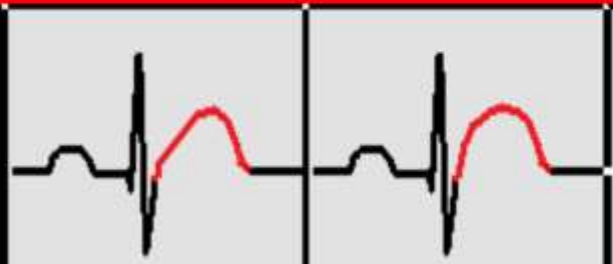
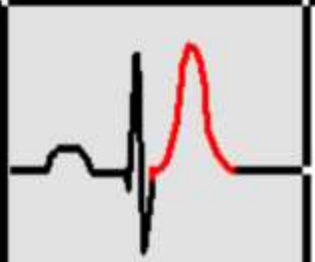
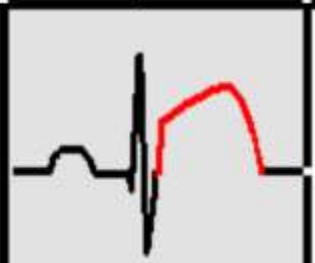
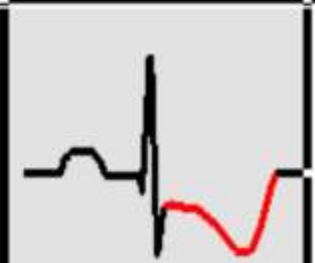
Defining NORMAL:

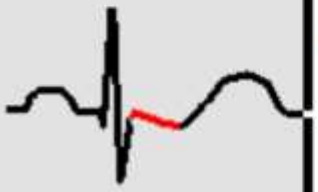


ECG Indicators of ABNORMAL PERFUSION (possible ischemia / infarction) in Patients with *Normal Width* QRS Complexes (QRS duration < 120 ms)

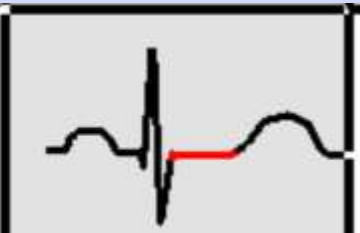
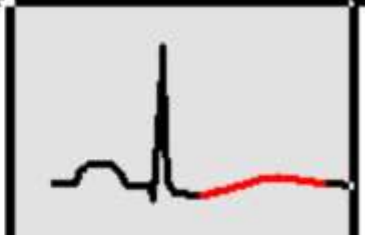
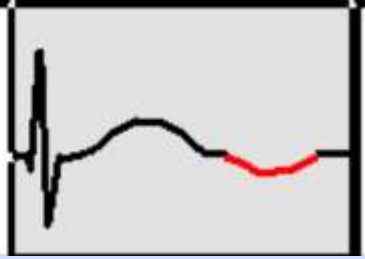
PATTERNS of ACS & ISCHEMIA

-- J POINT, ST SEGMENT, and T WAVE ABNORMALITIES --

!	FLAT or CONVEX J-T APEX SEGMENT		**ACUTE MI** *EARLY PHASE*
!	HYPER-ACUTE T WAVE		**ACUTE MI** *EARLY PHASE*
!	S-T SEGMENT ELEVATION at J POINT		**ACUTE MI**
!	DEPRESSED J pt. DOWNSLOPING ST and INVERTED T		- **ACUTE (NON-Q WAVE) MI** - **ACUTE MI** - (RECIPROCAL CHANGES) - **ISCHEMIA**

INVERTED T WAVE		- MYOCARDITIS - ELECTROLYTE IMBAL. - ISCHEMIA
SHARP S-T T ANGLE		- ACUTE MI (NOT COMMON) - ISCHEMIA
BI-PHASIC T WAVE (WELLEN'S)		- SUB-TOTAL LAD LESION - VASOSPASM - HYPERTROPHY
DEPRESSED J POINT with UPSLOPING ST		- ISCHEMIA
DOWNSLOPING S-T SEGMENT		- ISCHEMIA

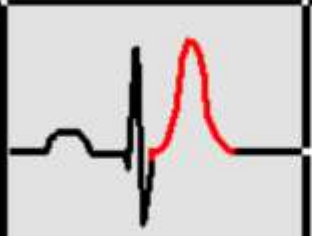
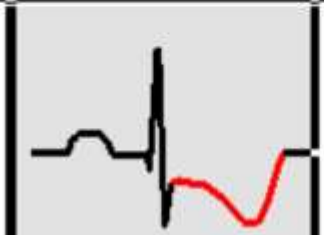
Some less common, less reliable possible indicators of ACS:

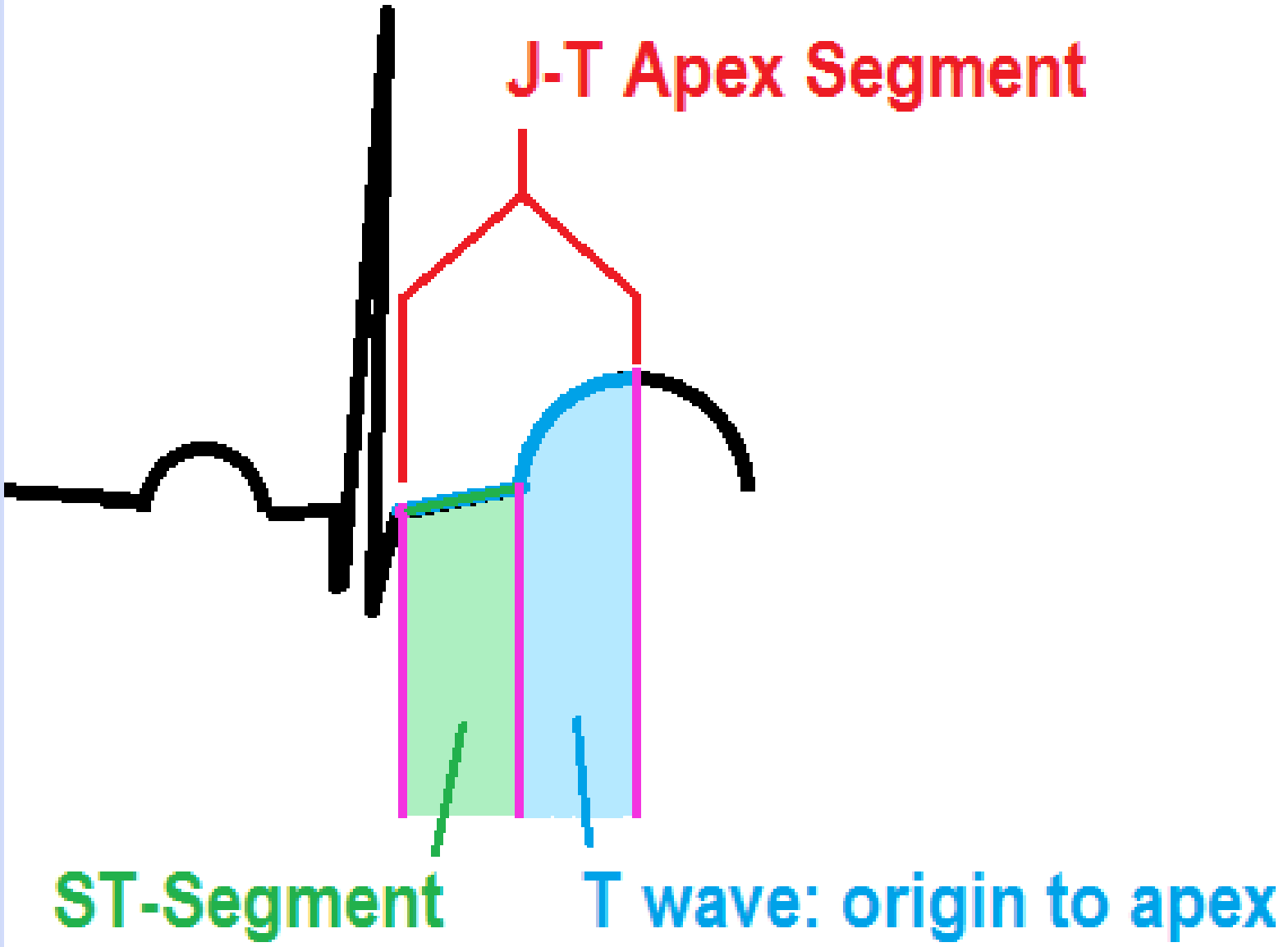
?	FLAT S-T SEGMENT > 120 ms		- ISCHEMIA
?	LOW VOLTAGE T WAVE WITH NORMAL QRS		- ISCHEMIA
?	U WAVE POLARITY OPPOSITE THAT OF T WAVE		- ISCHEMIA

LET'S START HERE . . . .

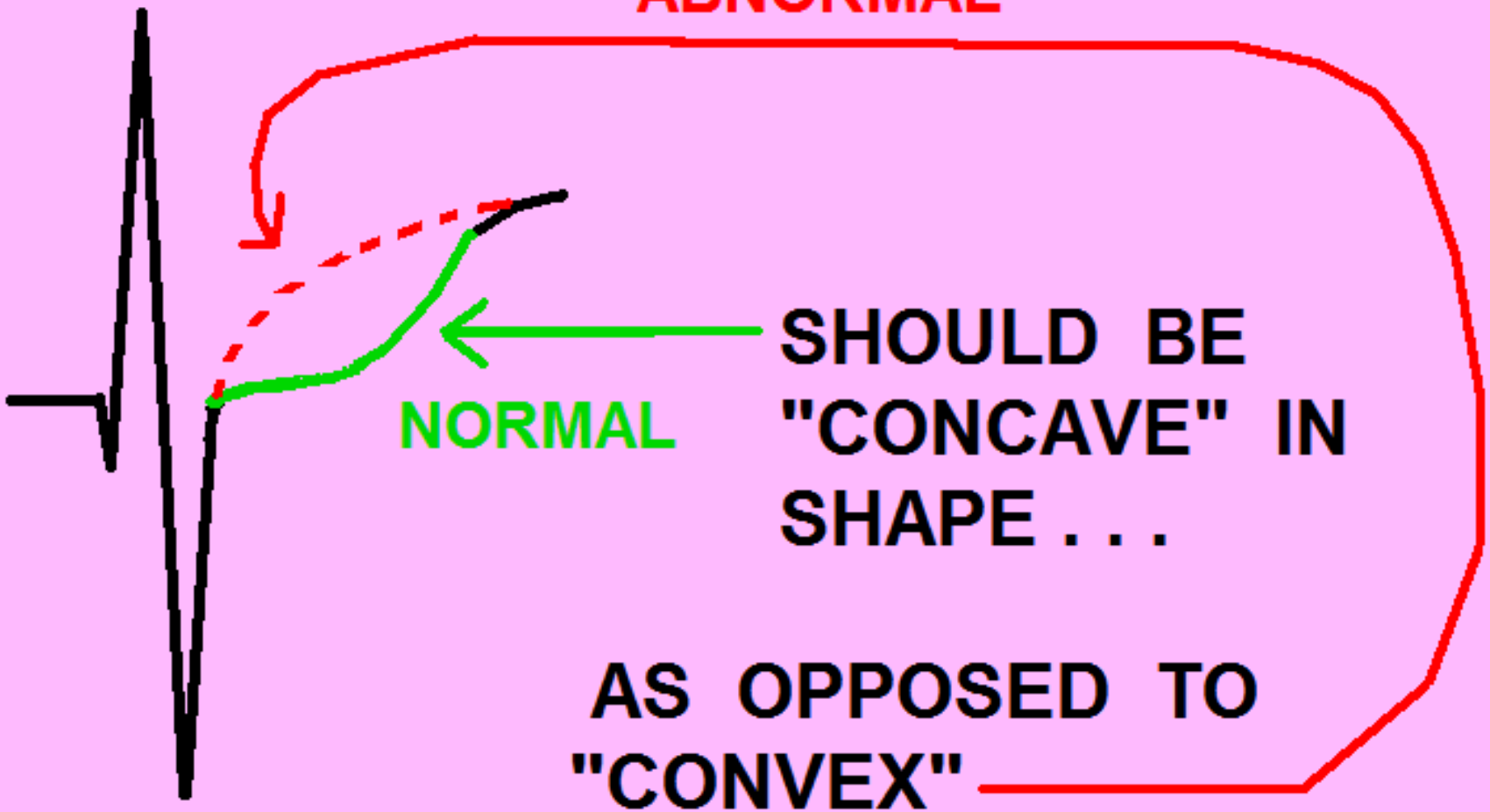
PATTERNS of ACS & ISCHEMIA

-- J POINT, ST SEGMENT, and T WAVE ABNORMALITIES --

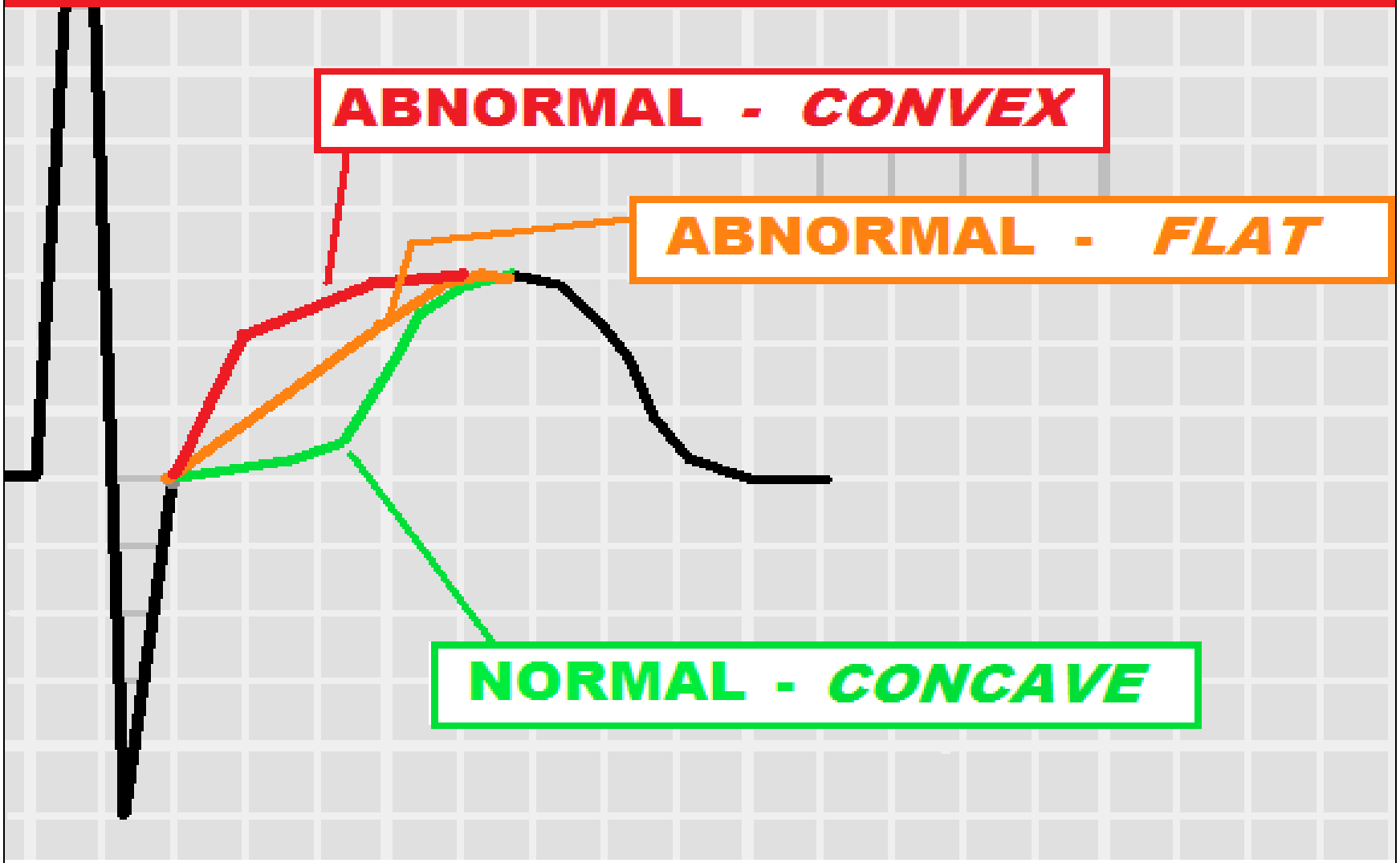
!	FLAT or CONVEX J-T APEX SEGMENT		**ACUTE MI** EARLY PHASE
!	HYPER-ACUTE T WAVE		**ACUTE MI** EARLY PHASE
!	S-T SEGMENT ELEVATION at J POINT		**ACUTE MI**
!	DEPRESSED J pt. DOWNSLOPING ST and INVERTED T		- **ACUTE (NON-Q WAVE) MI** - **ACUTE MI** - (RECIPROCAL CHANGES) - **ISCHEMIA**


J-T Apex Segment
ST-Segment
T wave: origin to apex

THE S-T SEGMENT



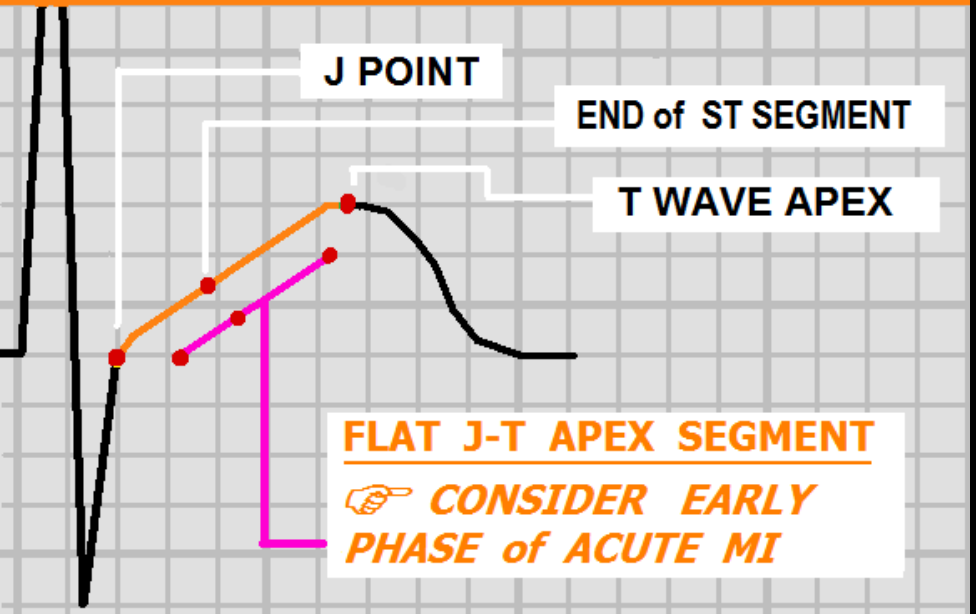
J - T APEX SEGMENT VARIATIONS



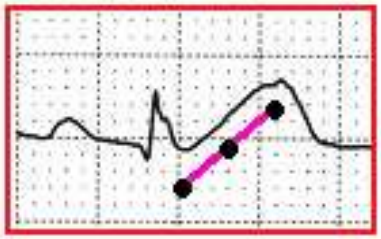
PATTERNS of EARLY INFARCTION

-- FLAT and CONVEX J-T APEX SEGMENTS

ABNORMAL J-T APEX SEGMENT



LEAD II



1839 hrs

41 y/o FEMALE

In ER C/O CHEST PAIN x 30 minutes.

- *FLAT J-T APEX SEGMENT*
- *NO ST ELEVATION at J POINT !*

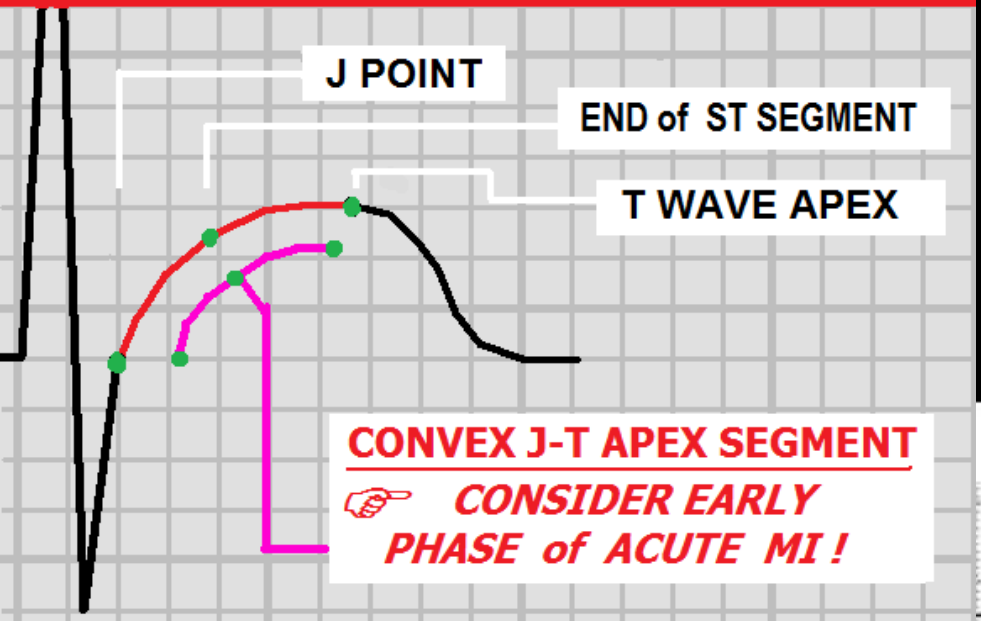
1850 hrs

STEMI - INFERIOR WALL

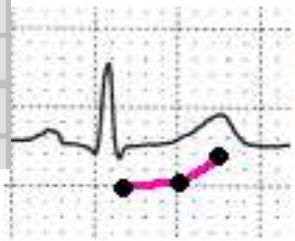
11 MINUTES LATER, S-T ELEVATION at the J POINT IS NOTED.

- CATH LAB FINDINGS: TOTAL OCCLUSION of the RIGHT CORONARY ARTERY

ABNORMAL J-T APEX SEGMENT

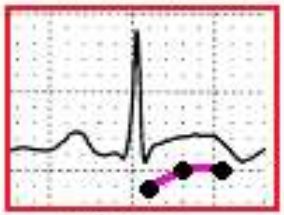


LEAD I



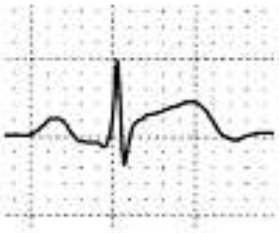
53 y/o MALE

1 yr. PRIOR TO MI
NORMAL EKG
CONCAVE J - T APEX SEGMENT



0732 hrs

STEMI LATERAL WALL
- *CONVEX J-T APEX SEGMENT*
- MINIMAL ST ELEVATION at J POINT



0747 hrs

15 MINUTES LATER, S-T ELEVATION at the J POINT IS NOTED.
- CATH LAB FINDINGS: TOTAL OCCLUSION OF CIRCUMFLEX ARTERY

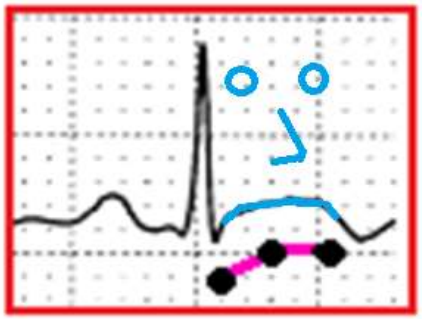
LEAD I

53 y/o MALE

1 yr. PRIOR TO MI

NORMAL EKG

CONCAVE J - T APEX SEGMENT



0732 hrs

STEMI LATERAL WALL

- *CONVEX J-T APEX SEGMENT*
- **MINIMAL ST ELEVATION at J POINT**

0747 hrs

15 MINUTES LATER, S-T ELEVATION at the J POINT IS NOTED.

- **CATH LAB FINDINGS: TOTAL OCCLUSION OF CIRCUMFLEX ARTERY**

CASE STUDY: ABNORMAL J-T APEX SEGMENTS

CHIEF COMPLAINT and SIGNIFICANT HISTORY:

56 y/o MALE presents to ED with complaint of "INTERMITTENT SUBSTERNAL & SUB-EPIGASTRIC PRESSURE" x 3 HOURS. PMHx of ESOPHAGEAL REFLUX. NO other significant past medical history.

RISK FACTOR PROFILE:

- FAMILY HISTORY - father died of MI at age 62
- ☑ PREVIOUS CIGARETTE SMOKER - quit 15 years ago.
- ☑ CHOLESTEROL - DOES NOT KNOW; "never had it checked."
- ☑ OBESITY

PHYSICAL EXAM: Patient supine on exam table, mildly anxious, currently complaining of "mild indigestion," skin is warm, pale, dry; REST OF EXAM is UNREMARKABLE.

VITAL SIGNS: BP 142/94, P 80, R 20, SAO2 98%

LABS: JUST OBTAINED, RESULTS NOT AVAILABLE YET.

56 yr
Male Caucasian

Room:A9
Loc:3 Option:23

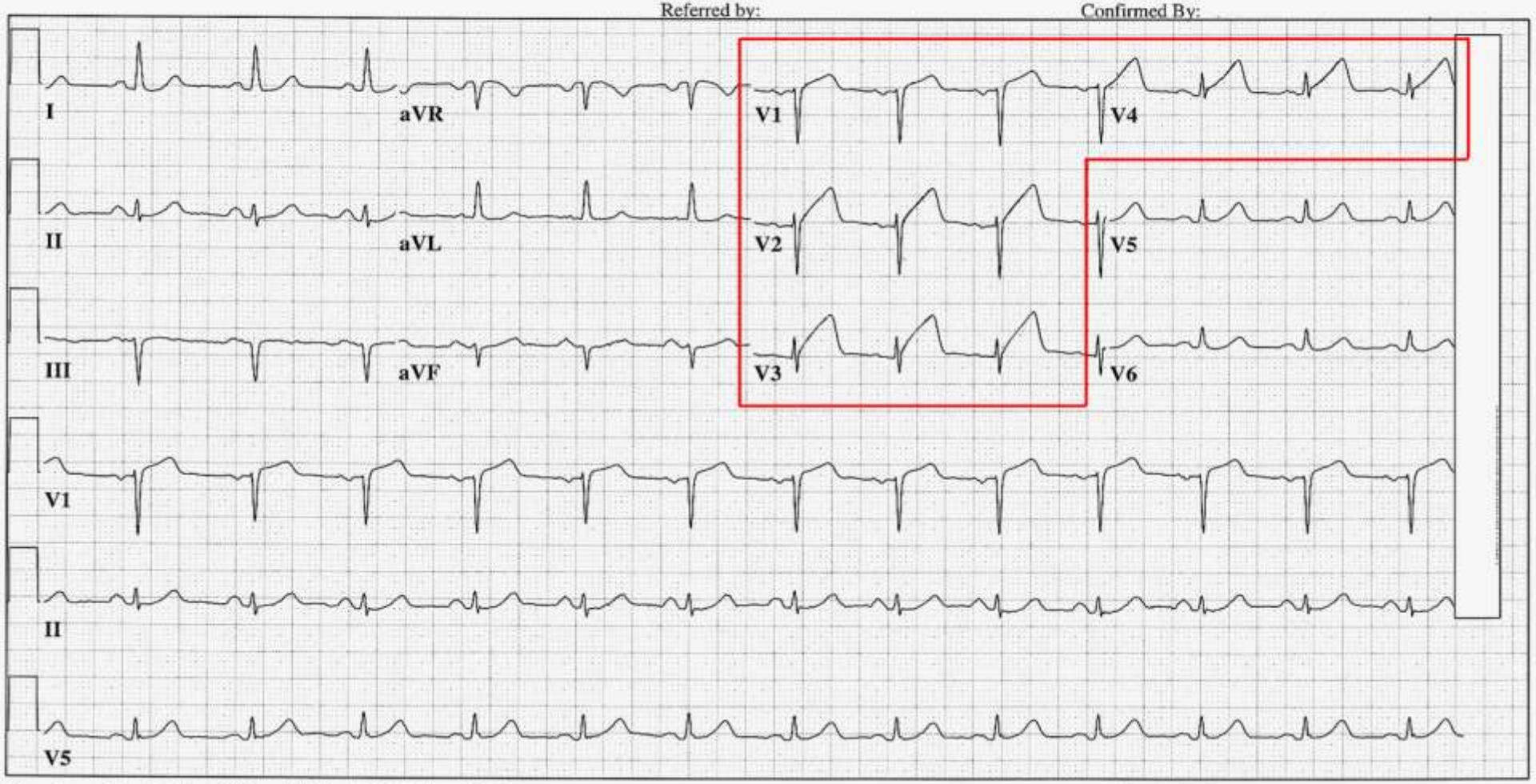
Vent. rate	80	BPM
PR interval	154	ms
QRS duration	78	ms
QT/QTc	380/438	ms
P–R–T axes	51 –24	38

**UNEDITED COPY – REPORT IS COMPUTER GENERATED ONLY, WITHOUT PHYSICIAN INTERPRETATION

Normal sinus rhythm
Normal ECG
No previous ECGs available

Technician: W Ruppert

Referred by: Confirmed By:

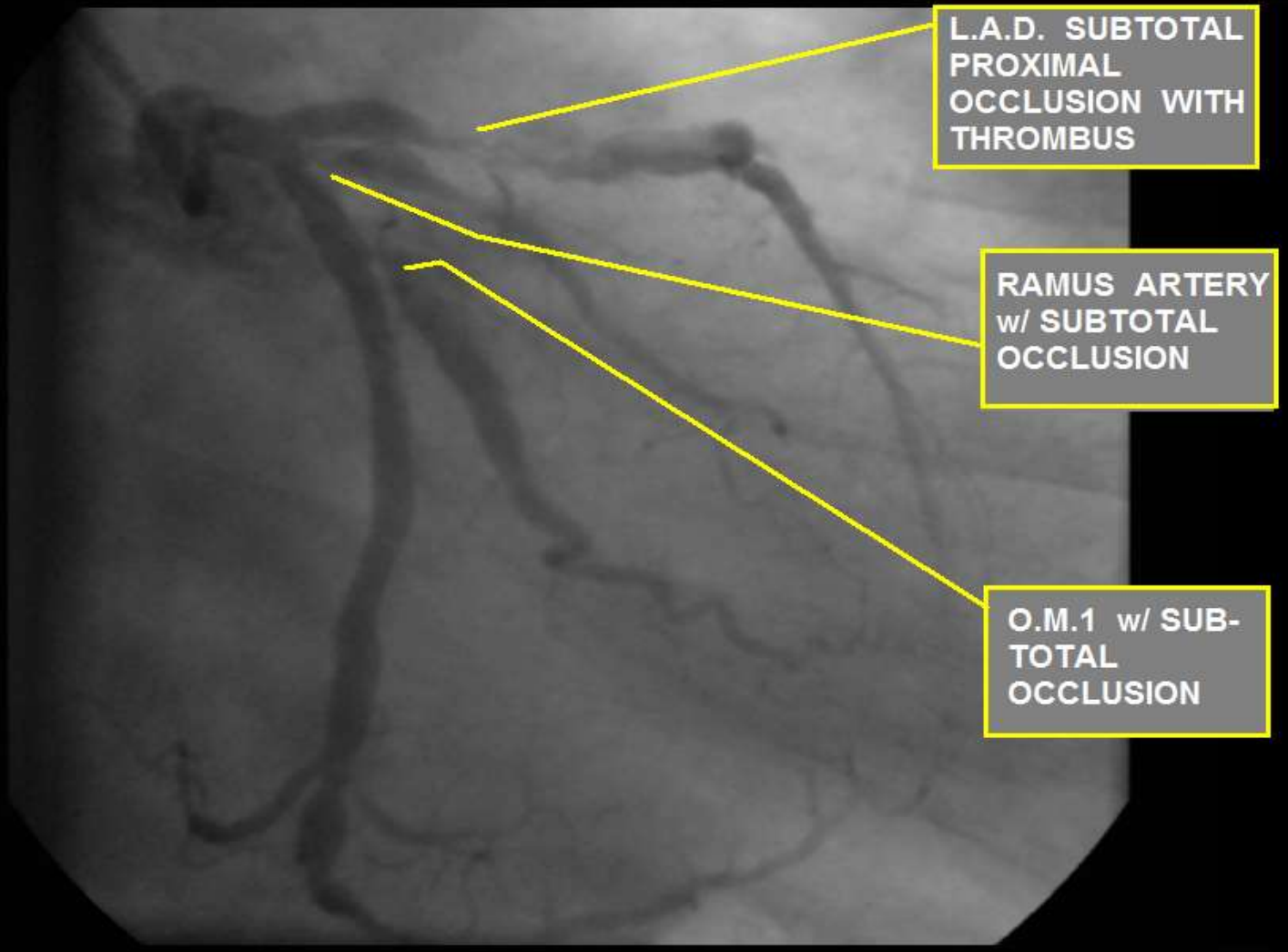


25mm/s 10mm/mV 40Hz 005C 12SL 235 CID: 3

EID:10 EDT:

ECG COMPUTER DOES NOT NOTICE THE CONVEX J-T APEX SEGMENTS !

CASE STUDY: 56 y/o male with INTERMITTENT "CHEST HEAVINESS" . . . .



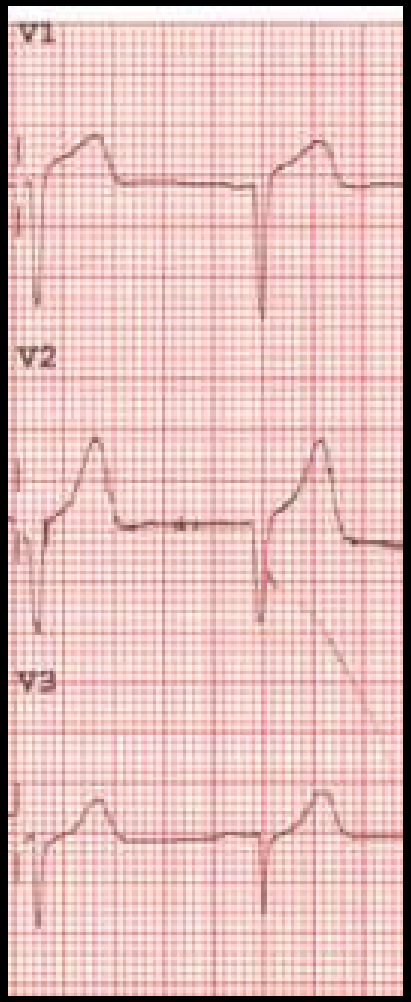
TREATMENT PLAN : EMERGENCY CORONARY ARTERY BYPASS SURGERY (4 VESSEL)

ECG Patterns associated with "EARLY PHASE MI:"

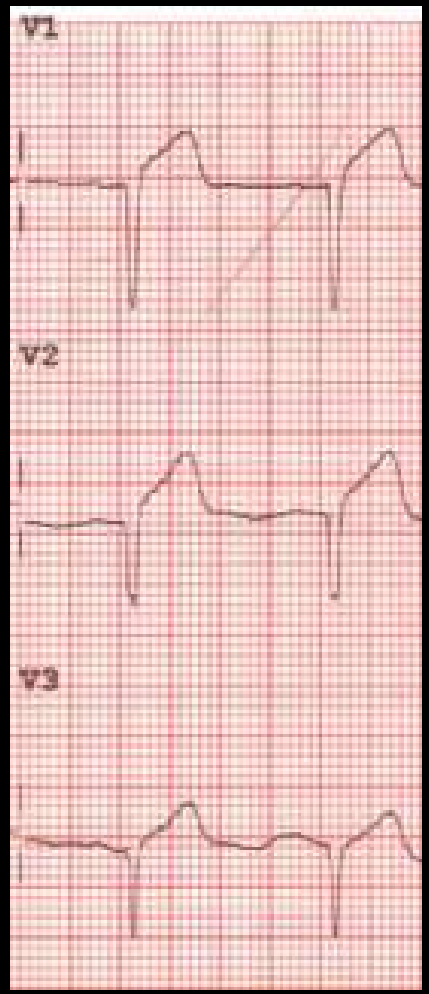
- *J-T Apex abnormalities*
- *Dynamic ST-T Wave Changes on Serial ECGs*

3. Dynmamic ST-T Wave Changes in Serial ECGs. Recorded at SRRMC

1st ECG

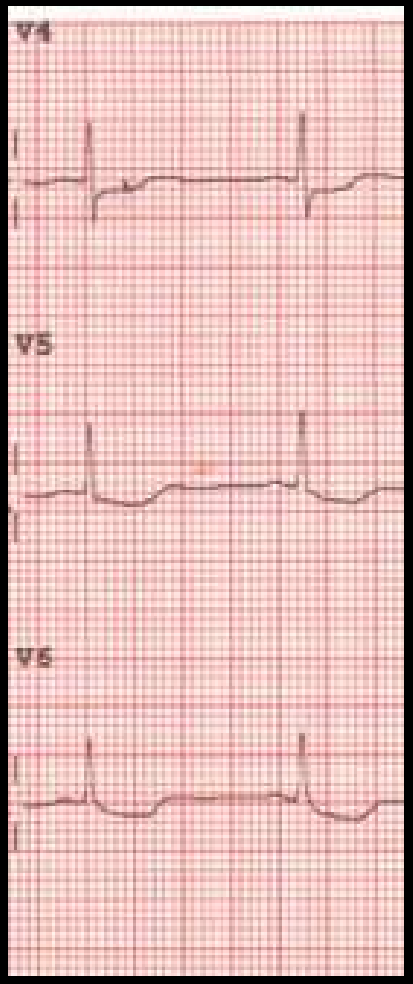


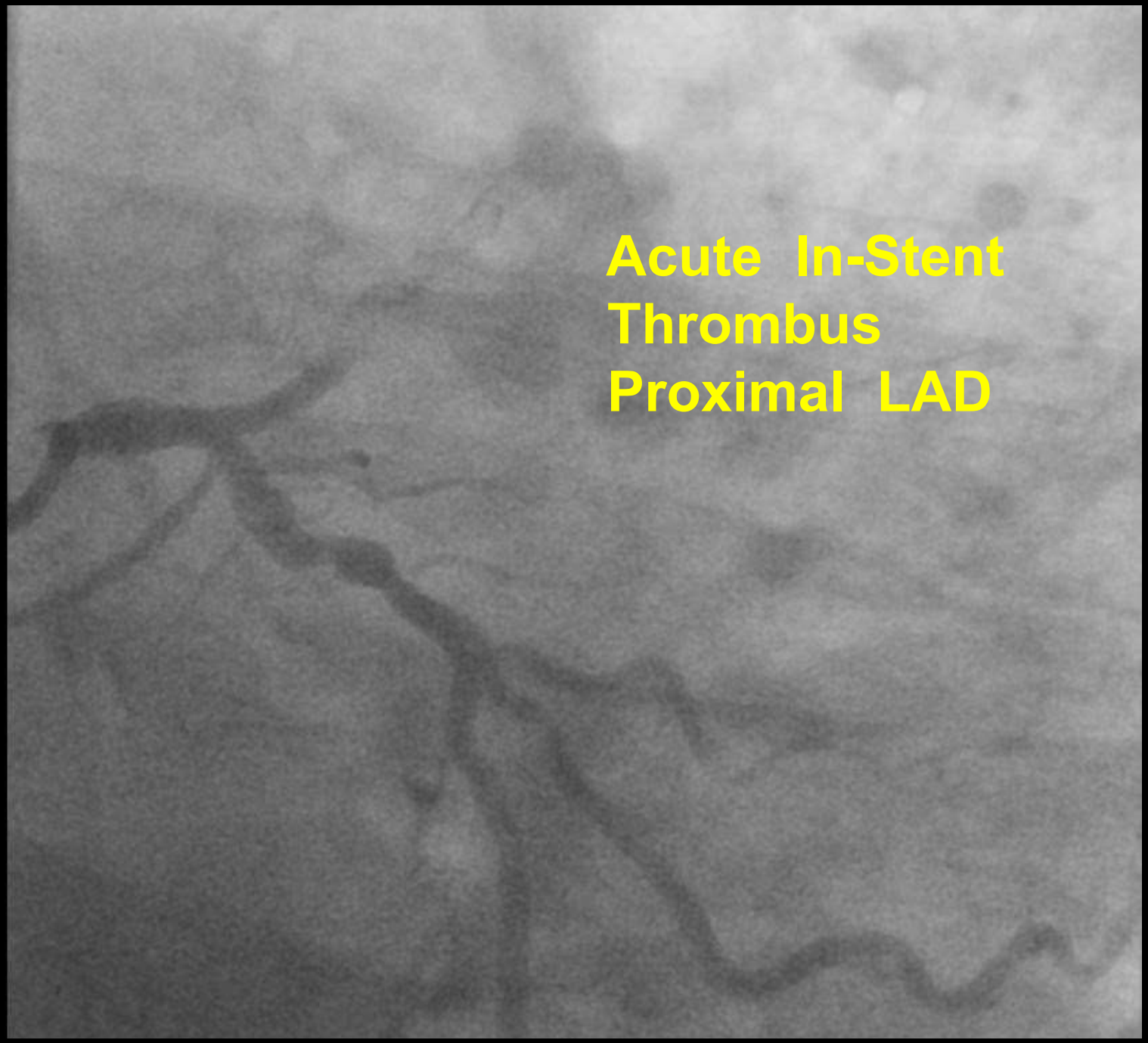
2nd ECG



1st ECG

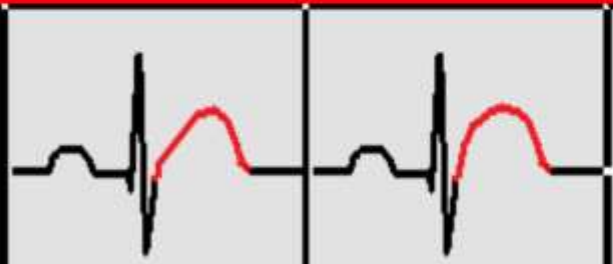
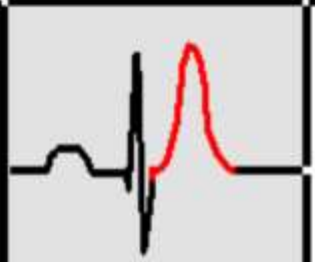
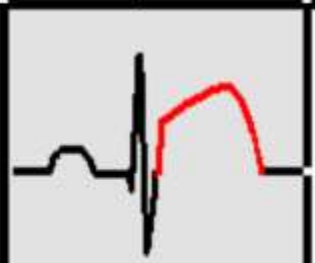
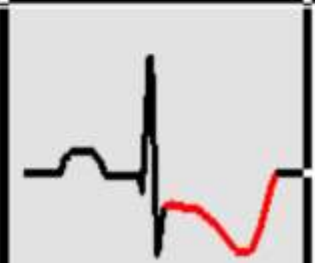
2nd ECG



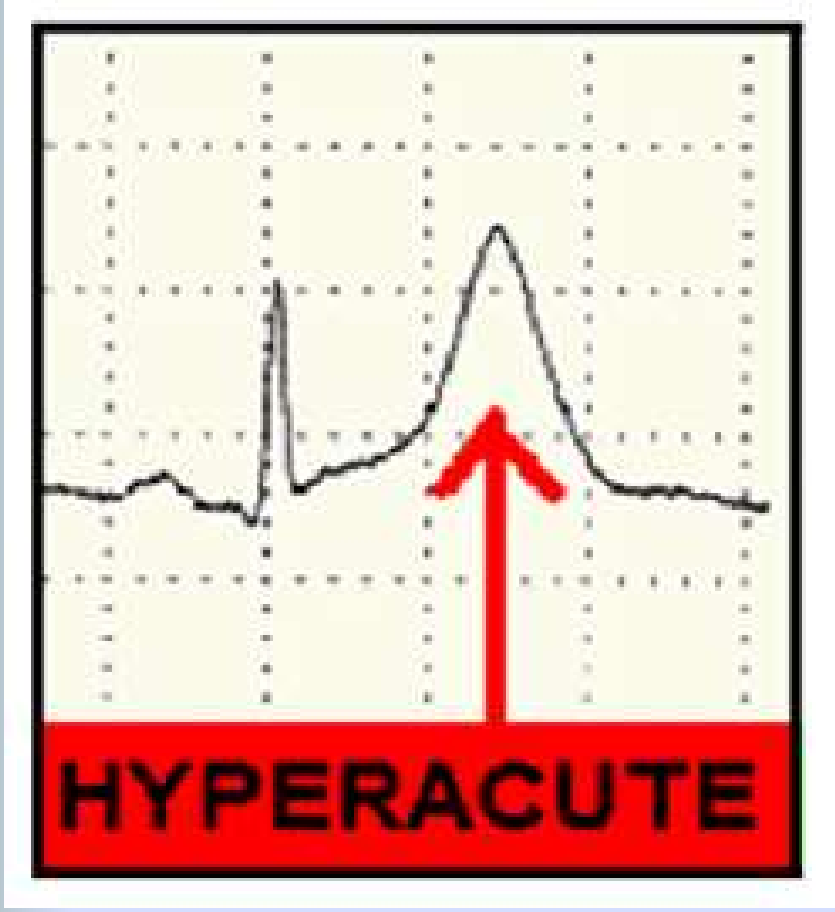

Acute In-Stent
Thrombus
Proximal LAD

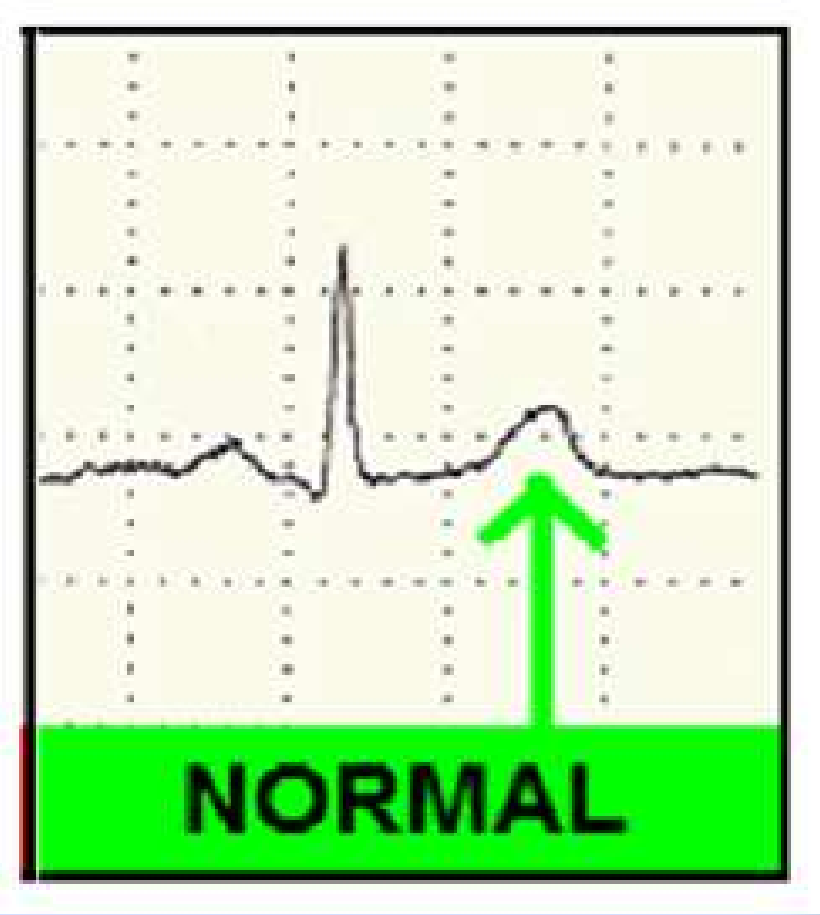
PATTERNS of ACS & ISCHEMIA

-- J POINT, ST SEGMENT, and T WAVE ABNORMALITIES --

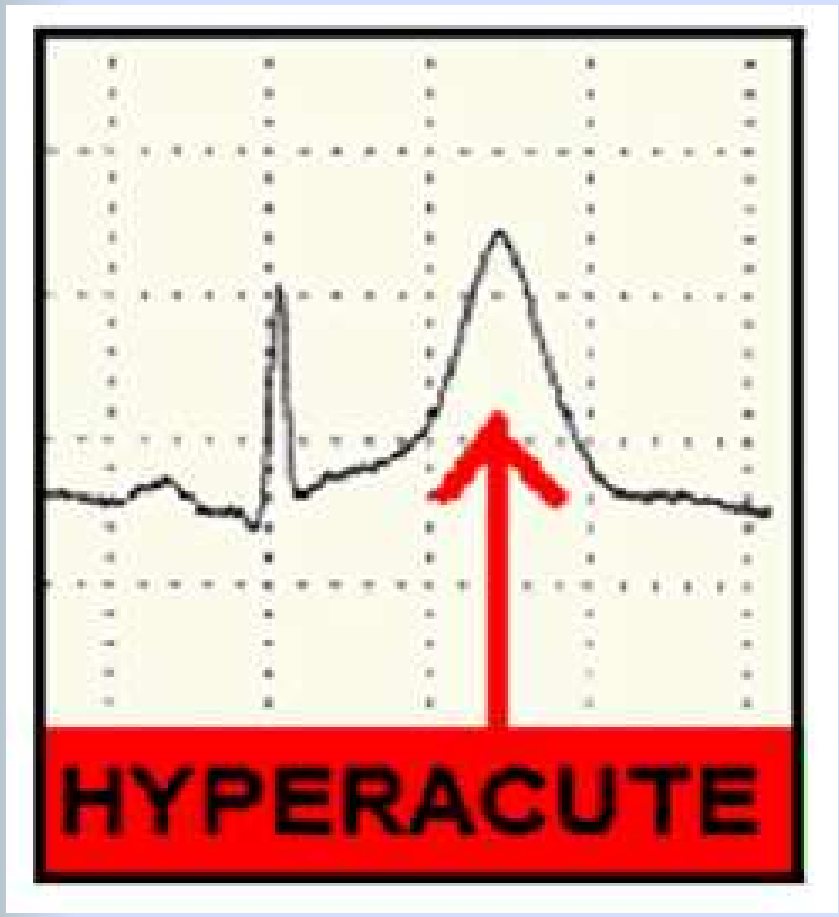
!	FLAT or CONVEX J-T APEX SEGMENT		**ACUTE MI** EARLY PHASE
!	HYPER-ACUTE T WAVE		**ACUTE MI** EARLY PHASE
!	S-T SEGMENT ELEVATION at J POINT		**ACUTE MI**
!	DEPRESSED J pt. DOWNSLOPING ST and INVERTED T		- **ACUTE (NON-Q WAVE) MI** - **ACUTE MI** - (RECIPROCAL CHANGES) - **ISCHEMIA**

T waves should not be HYPERACUTE



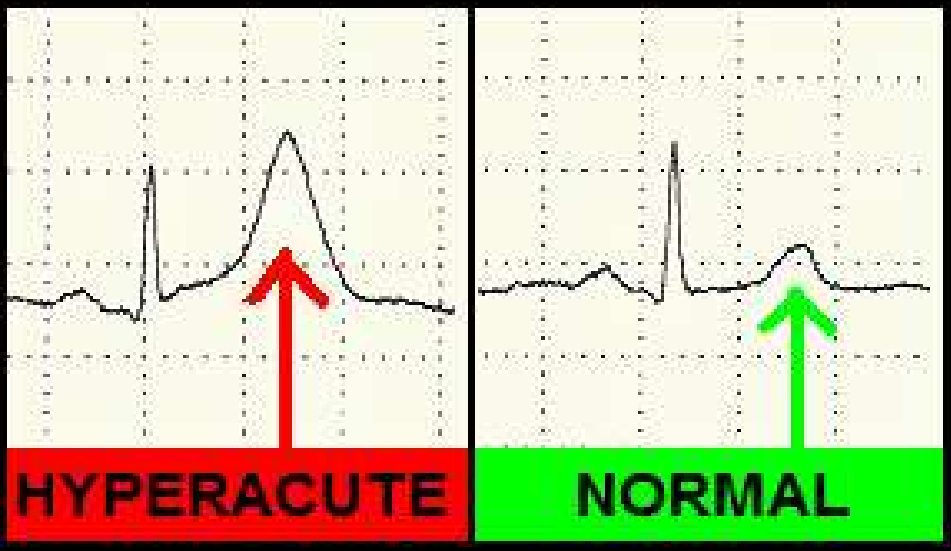


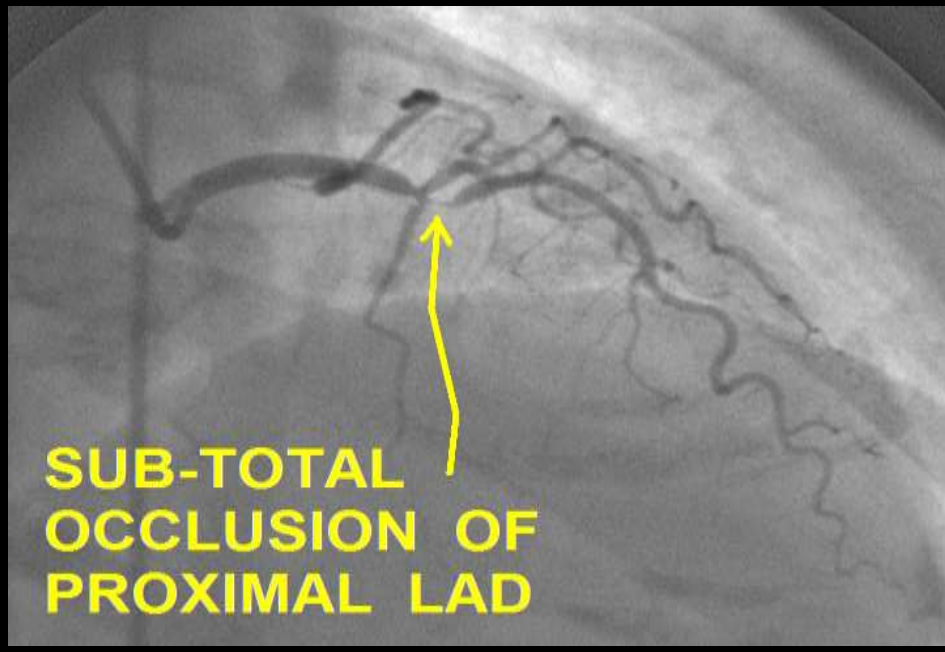
HYPERACUTE T Waves may indicate:



- **Early phase Acute MI**
- **Transmural ischemia** (usually seen in one region of the ECG)
- **Hyperkalemia** (seen globally across ECG)
- **Hypertrophy**

HYPERACUTE T WAVES





ECG waveforms obtained just before (hyperacute) and just after (normal) the critical blockage was stented in this patient's Proximal Left Anterior Descending (LAD) artery.

Helpful Clue: Hyper-Acute T Waves

- **GLOBAL Hyper-acute T Waves** (in leads viewing multiple myocardial regions / arterial distributions) **favors HYPERKALEMIA**

ID:

23-Nov-

REGIONAL MEDICAL CENTER

55years
Female Caucasian

Room:

Vent. rate	57 bpm
PR interval	150 ms
QRS duration	102 ms
QT/QTc	472/459 ms
P-R-T axes	76 70 58

Sinus bradyc a
Possible Left atrial enlargement
Borderline ECG

ER ATTENDING REVIEW
NO STEMI
TIME 1511

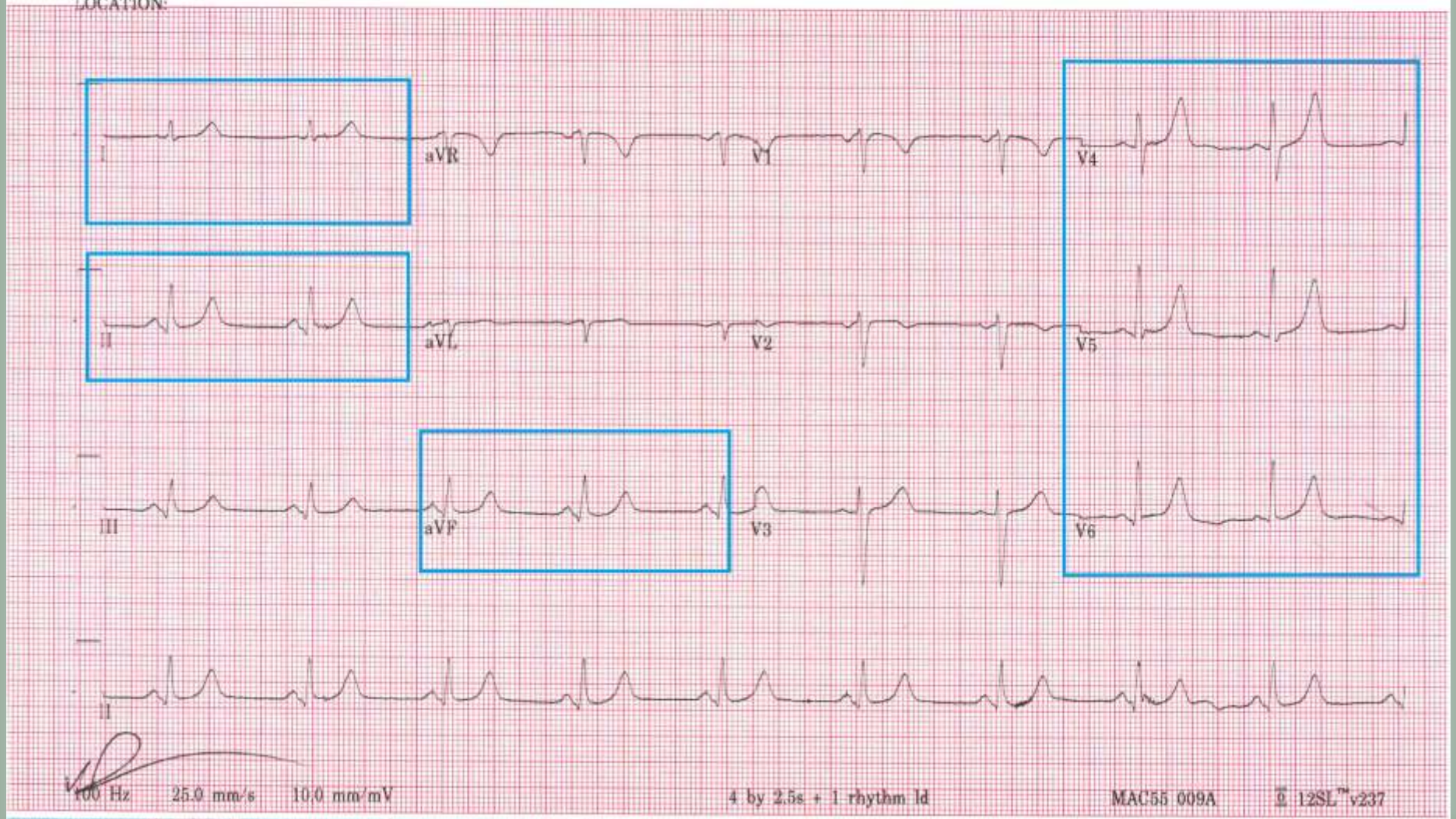
K+ = 6.7

Technician:
Test ind:

Referred by:

Unconfirmed

LOCATION:



Helpful Clue: Hyper-Acute T Waves

- **GLOBAL Hyper-acute T Waves** (in leads viewing multiple myocardial regions / arterial distributions) **favors HYPERKALEMIA**

- **Hyper-acute T Wave noted in ONE ARTERIAL DISTRIBUTION** (Anterior / Lateral / Inferior) favors TRANSMURAL ISCHEMIA / Early Phase Acute MI

CASE STUDY: HYPERACUTE T WAVES

CHIEF COMPLAINT and SIGNIFICANT HISTORY:

30 y/o male presents to ER via EMS, c/o sudden onset of dull chest pain x 40 min. Pain level varies, not effected by position, movement or deep inspiration. No associated symptoms.

RISK FACTOR PROFILE: NONE. CHOLESTEROL UNKNOWN.

PHYSICAL EXAM: Patient is supine on exam table, CAO x 4, anxious, restless, skin pale, cool, dry. Patient c/o chest pressure, "7" on 1 - 10 scale, uneffected by position, movement, deep inspiration. Lungs clear. HS: NL S1, S2, no rubs, murmurs, gallops

VITAL SIGNS: BP 136/88 P 90 R 20 SAO2 98%

DIAGNOSTIC TESTING: 1st TROPONIN I - ultra: <0.07

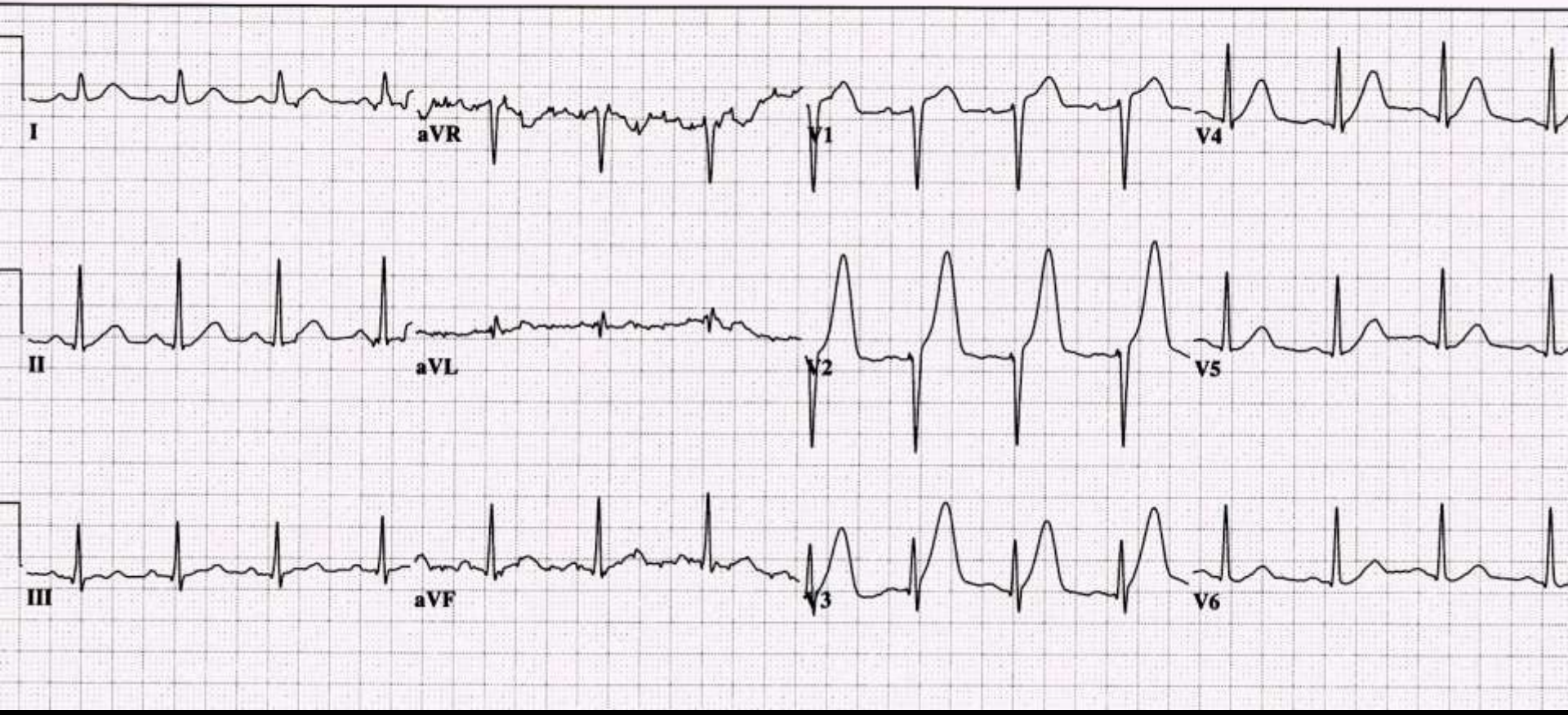
30 yr
Male Black

Room: ER
Loc: Option:

Vent. rate	88	BPM
PR interval	164	ms
QRS duration	90	ms
QT/QTc	370/447	ms
P-R-T axes	61 62	53

Normal sinus rhythm
Normal ECG
No previous ECGs available

← NOTE COMPUTER INTERPRETATION



30 yr
Male Black

Room: ER
Loc: Option:

Vent. rate	88	BPM
PR interval	164	ms
QRS duration	90	ms
QT/QTc	370/447	ms
P-R-T axes	61 62	53

Normal sinus rhythm
Normal ECG
No previous ECGs available

HIGHLIGHTED AREAS = HYPERACUTE T WAVES

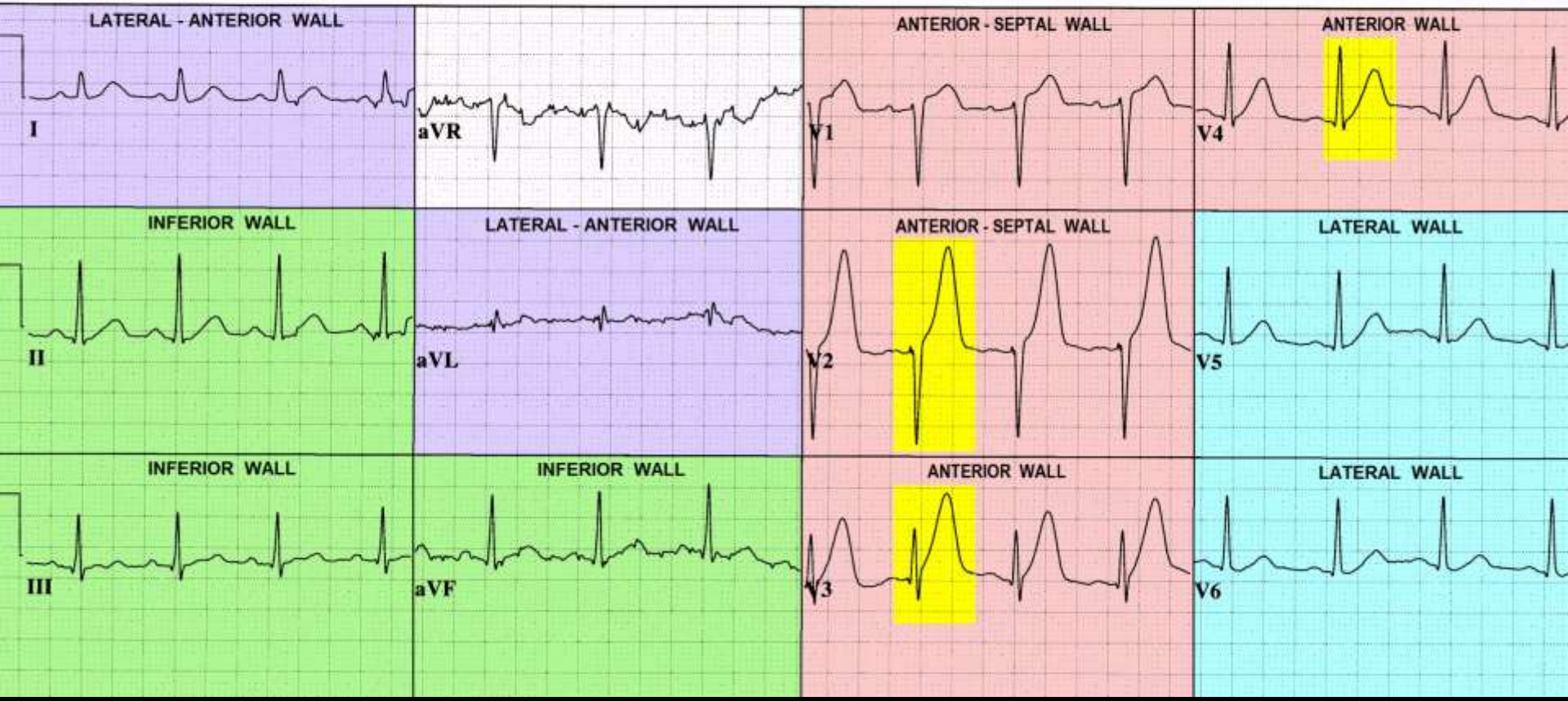
CORONARY ARTERIAL DISTRIBUTIONS:

V1 - V4 = LEFT ANTERIOR DESCENDING (LAD)

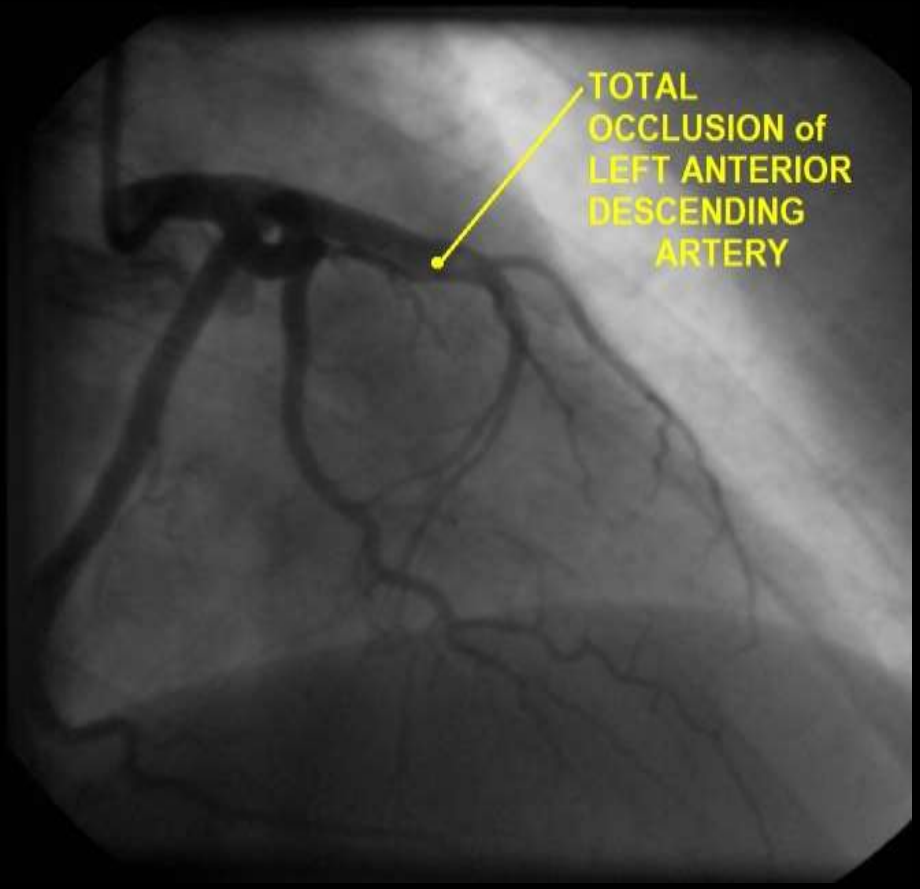
I, AVL = DIAGONAL (DIAG) off the LAD or OBTUSE MARGINAL (OM) off CIRCUMFLEX (CX)

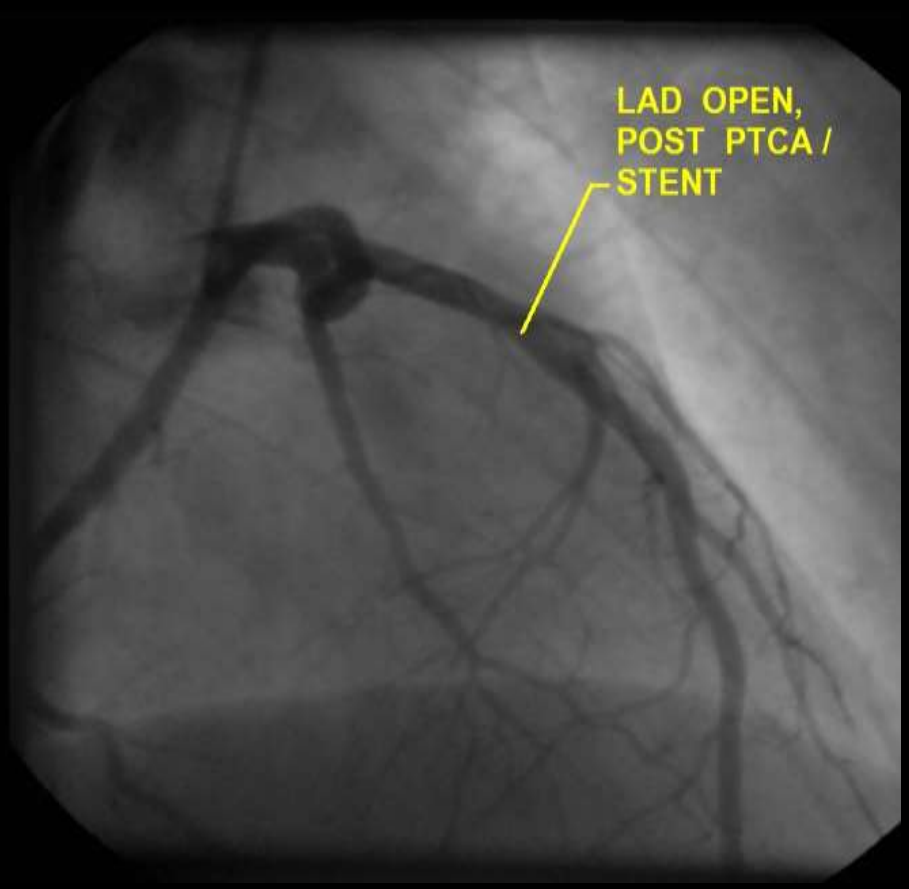
V5, V6 = CIRCUMFLEX

II, III, AVF = RIGHT CORONARY ARTERY or CX



Cath Lab findings:





Dynamic ST-T Wave Changes:

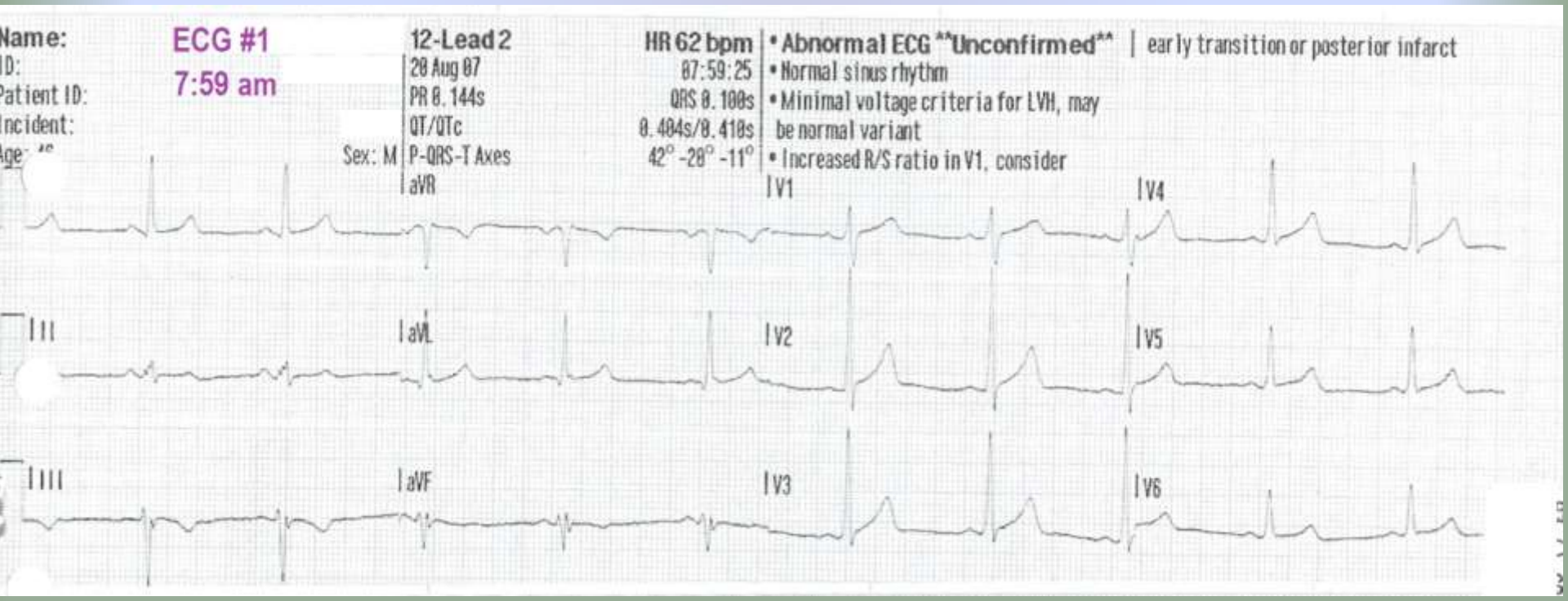
- Other than HEART RATE related variations (which affect intervals), ***J Points, ST-Segments and T Waves SHOULD NOT CHANGE.***

Dynamic ST-T Wave Changes:

- Other than HEART RATE related variations (which affect intervals), ***J Points, ST-Segments and T Waves SHOULD NOT CHANGE.***
- **When changes to J Points, ST-Segments and/or T waves are NOTED, consider EVOLVING MYOCARDIAL ISCHEMIA and/or EARLY PHASE MI, until proven otherwise.**

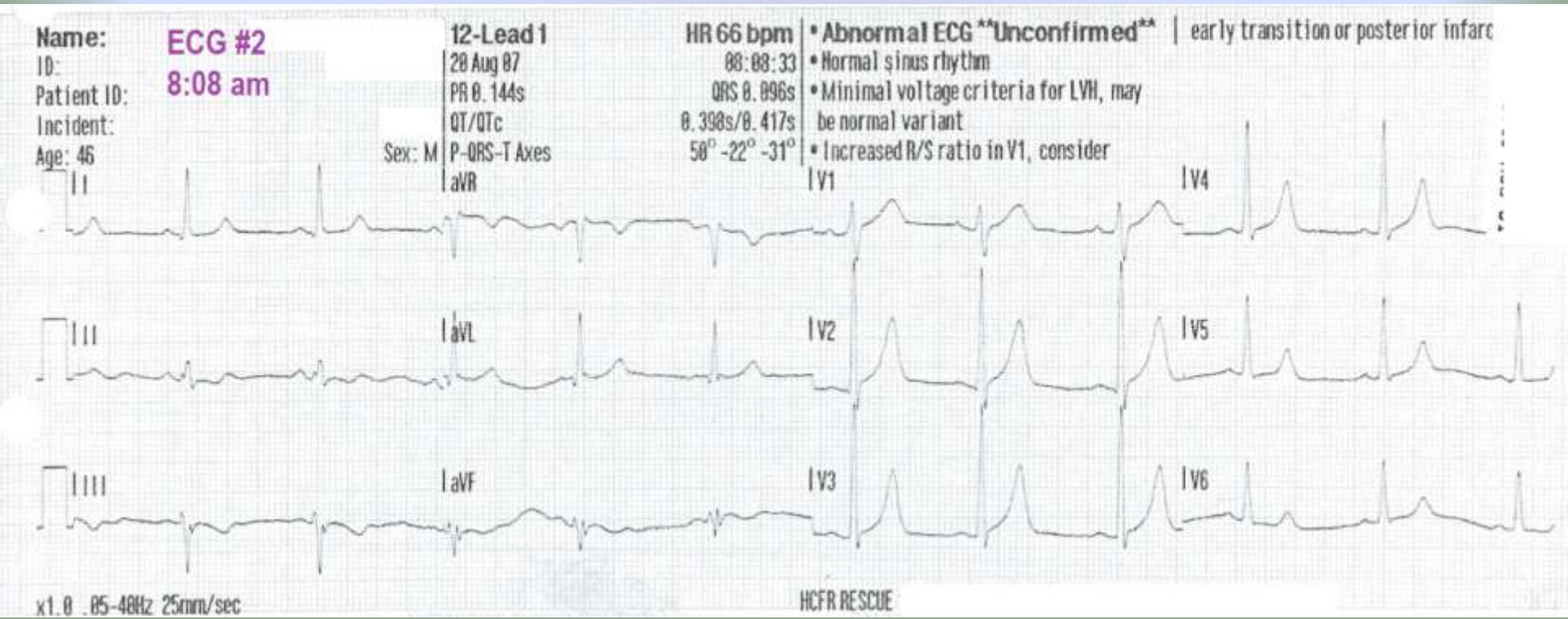
46 year old male

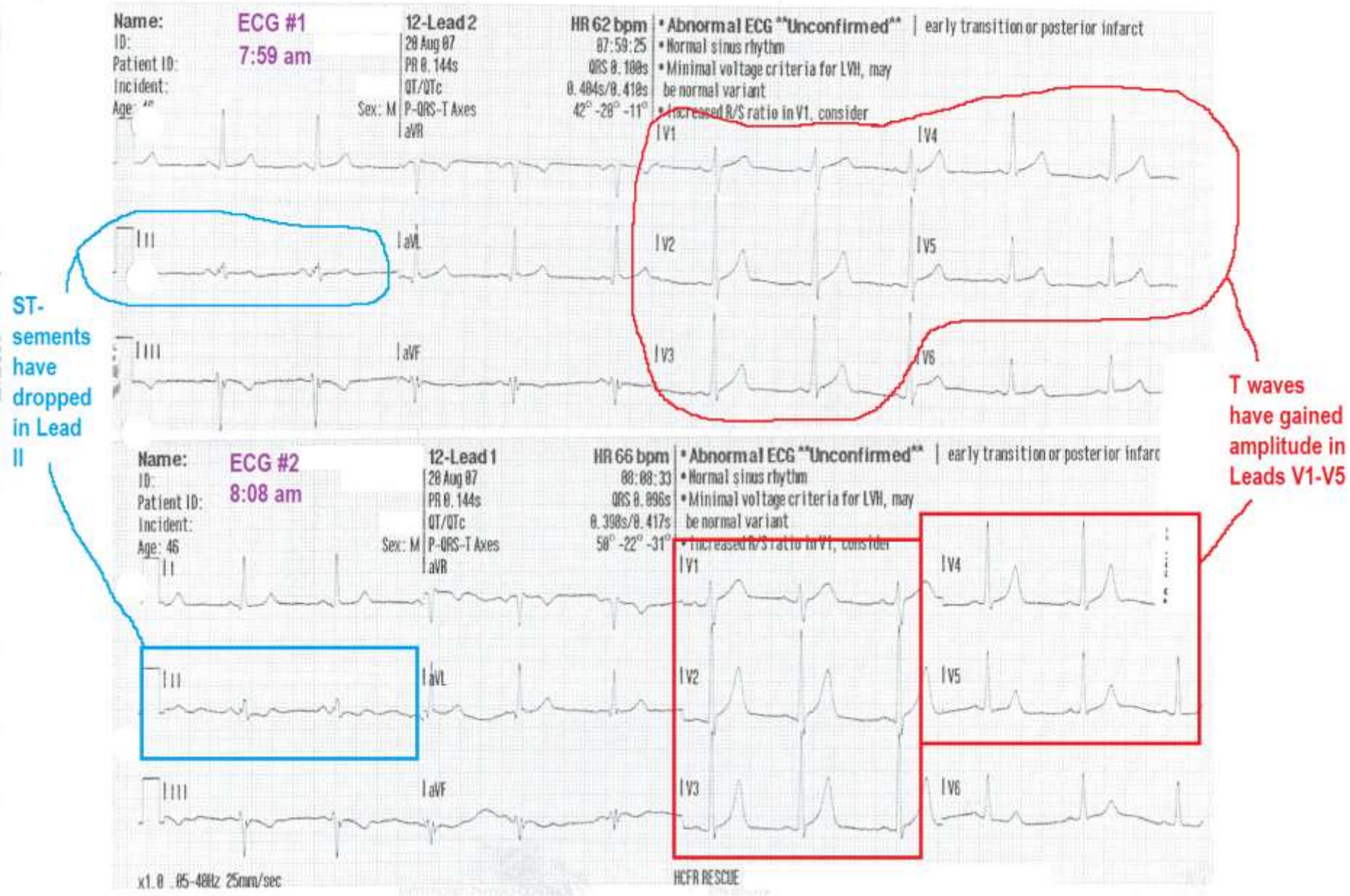
- Exertional dyspnea X “several weeks”
- Intermittent chest pressure X last 3 hours. Currently pain free.

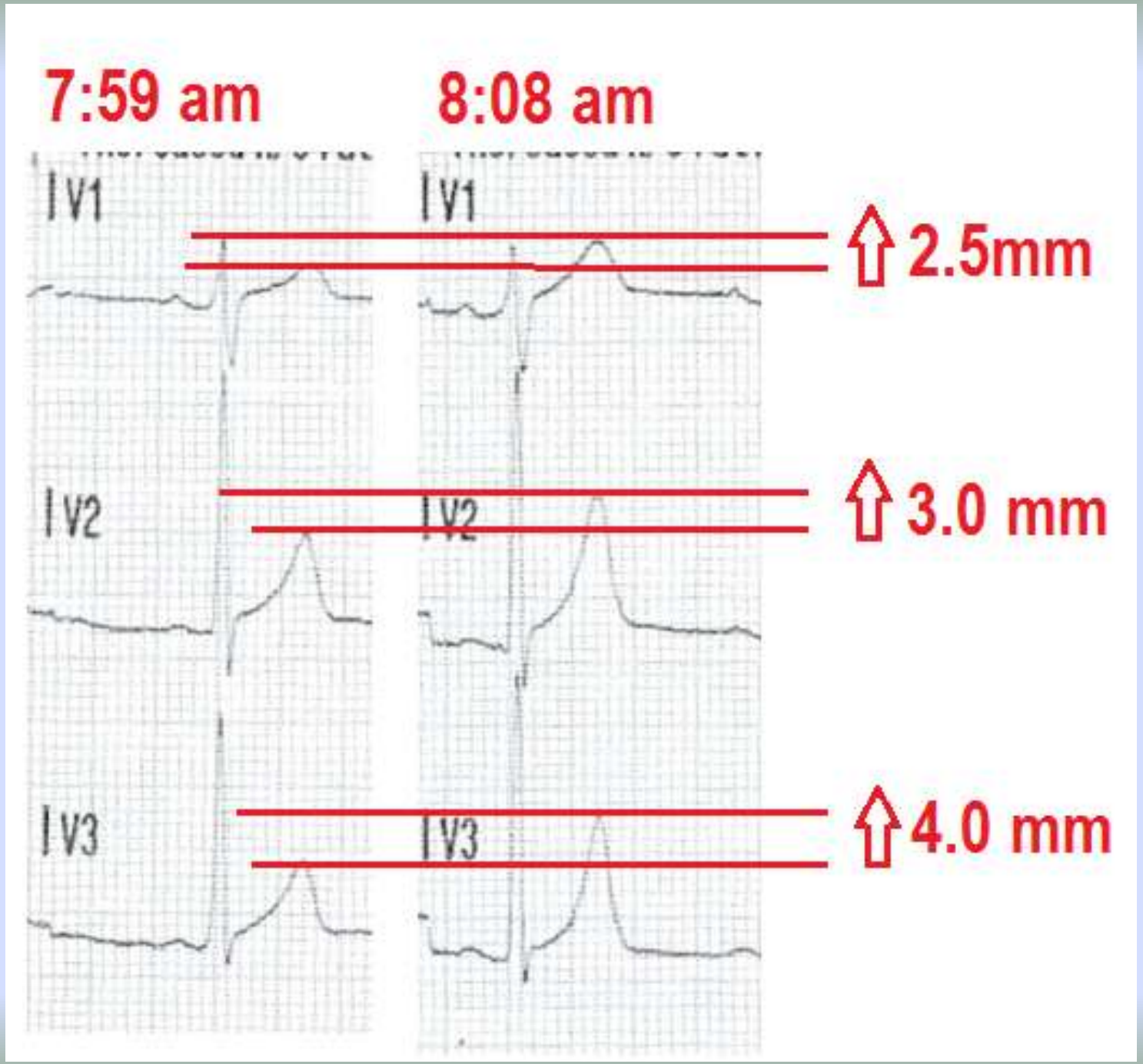


46 year old male: ECG 1

- Chest pressure has returned, "5" on 1-10 scale. 2nd ECG obtained due to "change in symptoms":

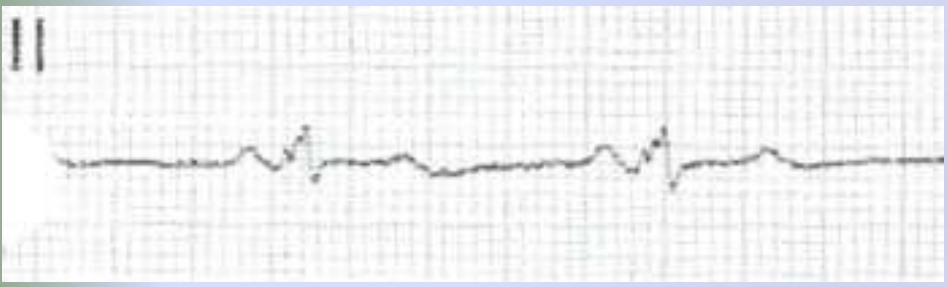



Name:
ID:
Patient ID:
Incident:
Age:
ECG #1
7:59 am
12-Lead 2
20 Aug 07
PR 0.144s
QT/QTc
Sex: M
P-QRS-T Axes
aVR
HR 62 bpm
07:59:25
QRS 0.100s
0.404s/0.410s
42° -28° -11°
• Abnormal ECG **Unconfirmed**
• Normal sinus rhythm
• Minimal voltage criteria for LVH, may be normal variant
• Increased R/S ratio in V1, consider
early transition or posterior infarct
I
II
III
aVL
aVF
V1
V2
V3
V4
V5
V6
ST-segments have dropped in Lead II
T waves have gained amplitude in Leads V1-V5
Name:
ID:
Patient ID:
Incident:
Age: 46
ECG #2
8:08 am
12-Lead 1
20 Aug 07
PR 0.144s
QT/QTc
Sex: M
P-QRS-T Axes
aVR
HR 66 bpm
08:08:33
QRS 0.096s
0.398s/0.417s
50° -22° -31°
• Abnormal ECG **Unconfirmed**
• Normal sinus rhythm
• Minimal voltage criteria for LVH, may be normal variant
early transition or posterior infarc
x1.0 .05-40Hz 25mm/sec
HCFR RESCUE

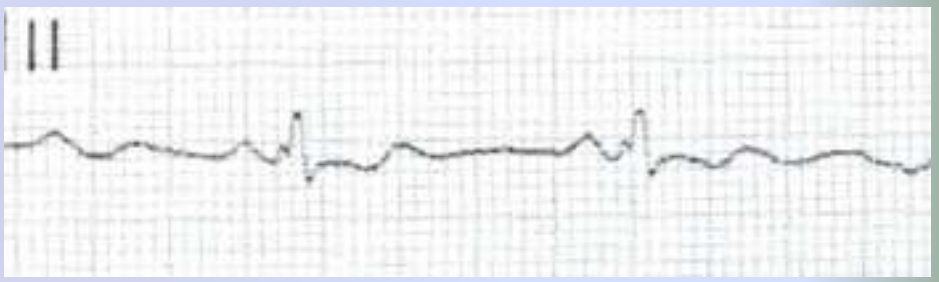

7:59 am
8:08 am
V1
V1
2.5mm
V2
V2
3.0 mm
V3
V3
4.0 mm

ST-Segment Depression

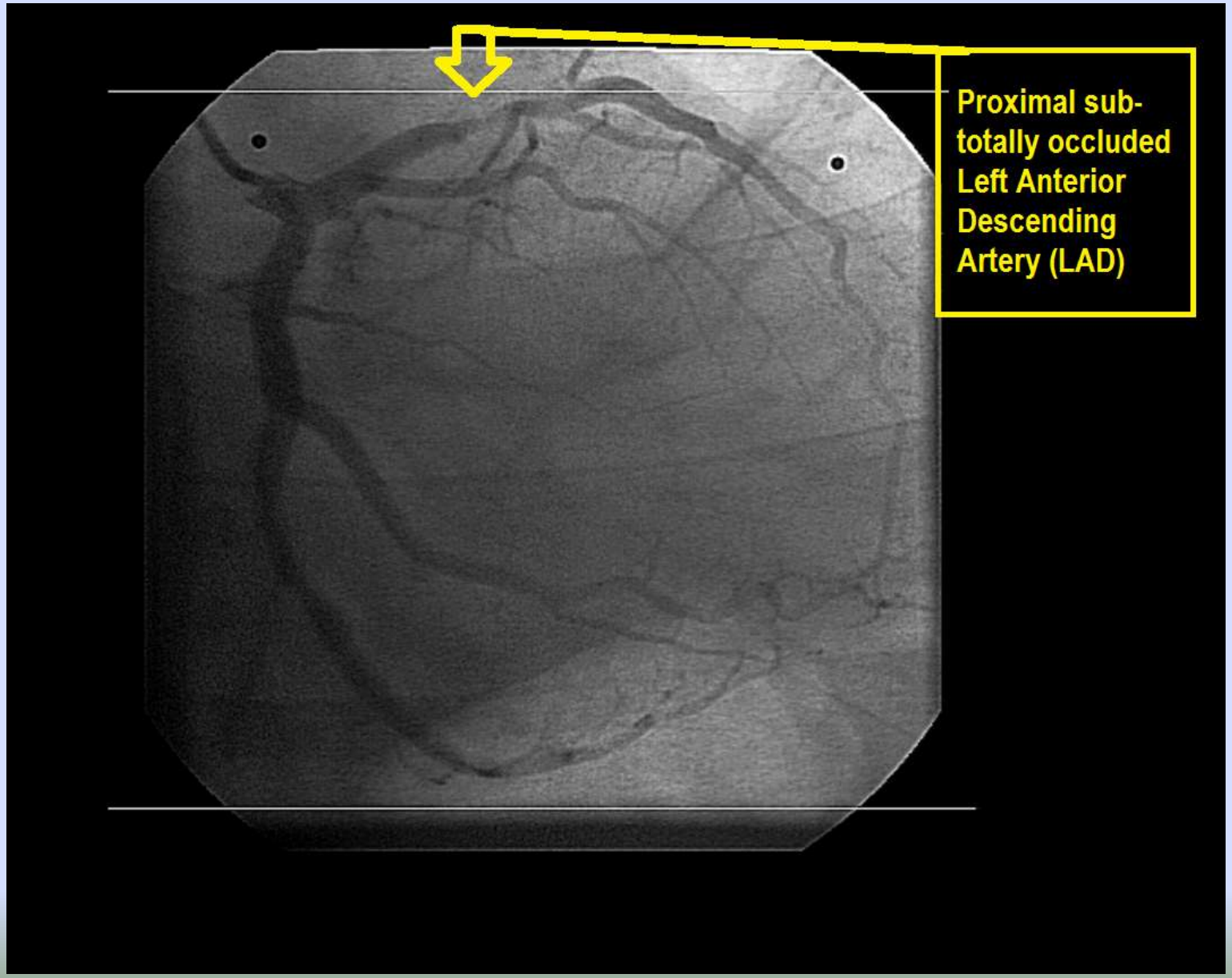
7:59 am



8:08 am



Cath Lab Angiography:



MOM and DAD at Lee's Diner, York, PA 2006