

# **Basic ECG Interpretation**

**Presented by:**

**Wayne W Ruppert, CVT, CCC, NREMT-P**

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**CLINICIAN EDUCATION:** We've been registered as a Nursing Continuing Education Provider in the State of Florida for Practical Nurses. We report all CE hours to the State of Florida Board of Nursing via CE Broker within 24 hours of completion. We offer continuing education for Catheterization and / or Electrophysiology (EP) Labs. By combining the latest academic content with real-world Cath for physicians, mid-level providers, respiratory therapists and paramedics - and we frequently see some of each in our

**PATIENT MANAGEMENT TOOLS:** This website provides resources to assist physicians, case managers and nurses in Cardiovascular Disease as well as Resuscitation (Therapeutic Hypothermia) and Sudden Arrhythmia Death Syndromes

**PATIENTS:** This website provides resource to help patients and their families to better understand and cope with their in the near future. We only provide materials supported by the latest evidence-based research, as well as providing

- The American College of Cardiology
- American Heart Association
- Heart Failure Society of America
- Heart Rhythms Society \*
- Sudden Arrhythmia Death Syndromes (SADS) Foundation \*

\* denotes future addition

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[Download STAT 12 Lead ECG Part 1 - Basic Fundamentals](#)



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## Standards for Inpatient Electrocardiographic Monitoring

Oct 04, 2017 | [Richard L. Weinberg, MD, PhD, FACC](#)

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### Authors:

Sandau KE, Funk M, Auerbach A, et al., on behalf of the American Heart Association Council on Cardiovascular and Stroke Nursing; Council on Clinical Cardiology; and Council on Cardiovascular Disease in the Young.

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### Citation:

[Update to Practice Standards for Electrocardiographic Monitoring in Hospital Settings: A Scientific Statement From the American Heart Association. \*Circulation\* 2017;Oct 3:\[Epub ahead of print\].](#) 

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# Circulation

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REVIEW ARTICLE

Originally Published 3 October 2017 |

Check for updates

## Update to Practice Standards for Electrocardiographic Monitoring in Hospital Settings: A Scientific Statement From the American Heart Association

Kristin E. Sandau, PhD, RN, FAHA, Chair, Marjorie Funk, PhD, RN, FAHA, Co-Chair, Andrew Auerbach, MD, MPH, Gregory W. Barsness, MD, FAHA, Kay Blum, PhD, CRNP, Maria Cvach, DNP, RN, Rachel Lampert, MD, ... [SHOW ALL](#) ... On behalf of the American Heart Association Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Cardiovascular Disease in the Young | [AUTHOR INFO & AFFILIATIONS](#)

The comprehensive document is grouped into 5 sections:

- (1) Overview of Arrhythmia, Ischemia, and QTc Monitoring;
- (2) Recommendations for Indication and Duration of Electrocardiographic Monitoring presented by patient population;
- (3) Organizational Aspects: Alarm Management, Education of Staff, and Documentation;
- (4) Implementation of Practice Standards; and
- (5) Call for Research.

185,086

[PDF/EPUB](#)

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The goals of electrocardiographic monitoring have expanded from simple heart rate and basic rhythm determination to the diagnosis of complex arrhythmias, the detection of acute and often silent myocardial ischemia, and the identification of drug-induced prolonged QT interval. The first American Heart Association (AHA) scientific statement on practice standards for electrocardiographic monitoring in hospital settings was published in 2004<sup>1</sup> and provided an interprofessional, comprehensive review of evidence and recommendations for continuous electrocardiographic monitoring of hospitalized patients.

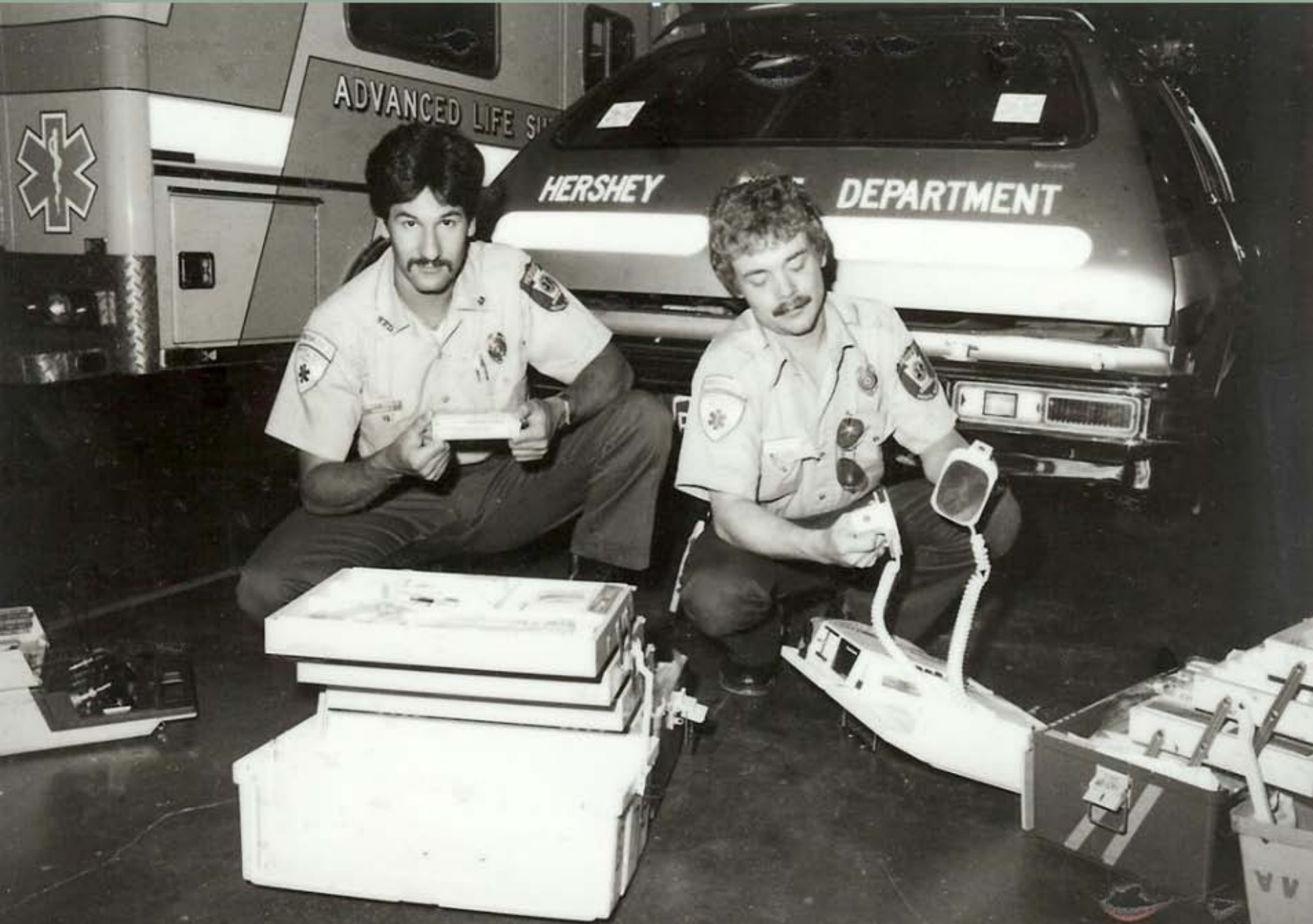
# Goals of Basic ECG Rhythm Interpretation:

- Identify the patient's ECG Rhythm (NSR, A-fib, SVT, etc).
- Identify possible **myocardial ischemia or infarction.**
- Identify **PROLONGED QT INTERVAL.**

# Wayne Ruppert – Bio:

- 1978 – 1996 EMT-Paramedic
- 1996 – 2012 Interventional Cardiovascular Technologist Cardiac Cath Lab and Electrophysiology Labs
- 2012 – 2023 Cardiovascular Programs Director / Coordinator

Present: ALS Coordinator, MedFleet



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



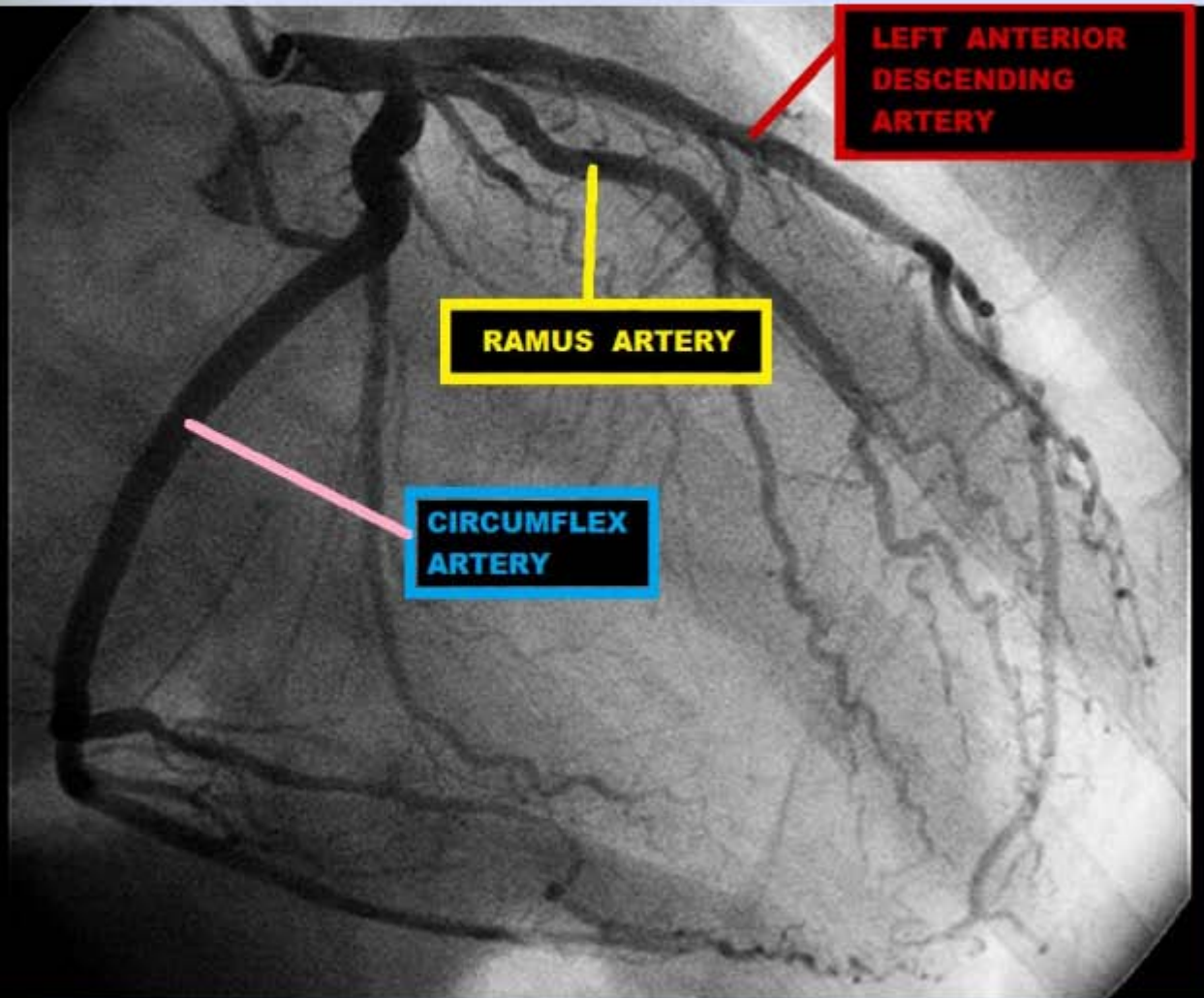
**Paramedics Christ Megoulas and Wayne Ruppert, 2024**  
-- both still active – (but off duty, for this pic, LOL)!

**13,000 – 15,000 EP and Cath Lab cases between 1996 - Today**

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

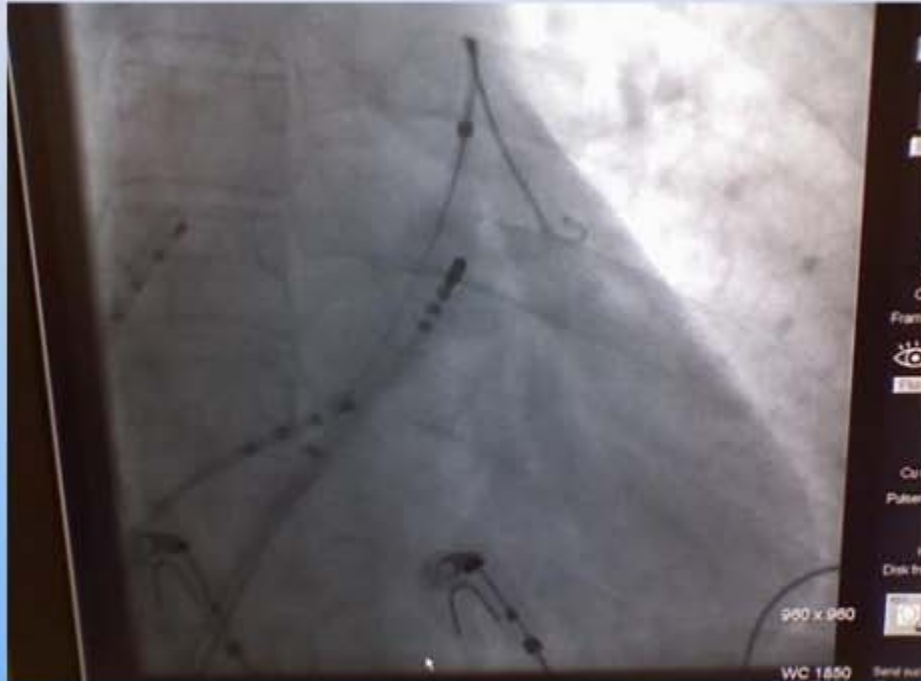
**7 . 29 06 : 55**

# Cardiac Cath Lab Advantage:



Correlation  
of ECG leads  
with  
SPECIFIC  
cardiac  
anatomic  
structures.

# Electrophysiology Lab Case Studies



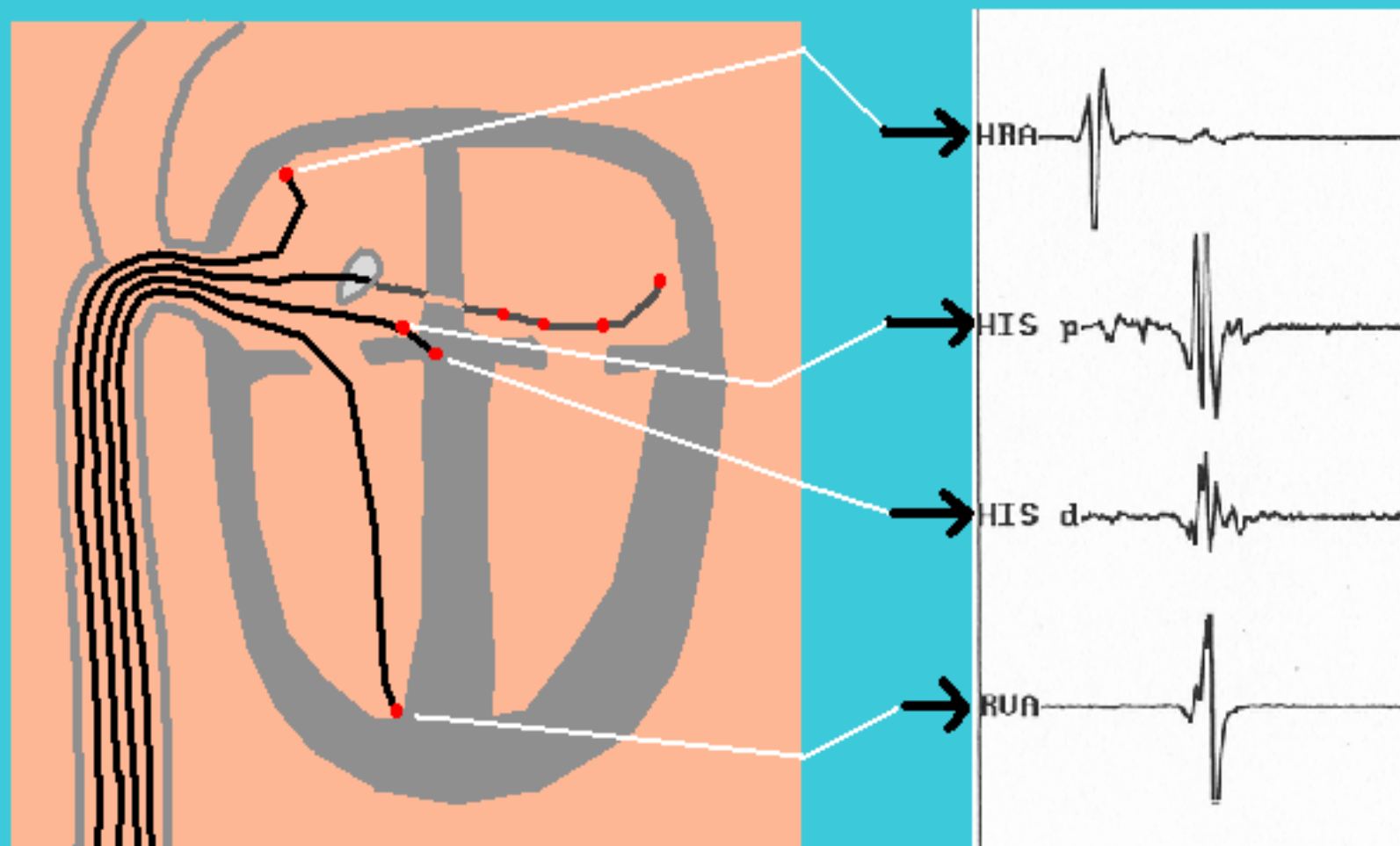
EP Catheters within the heart used for obtaining the Electrogram (the “internal ECG”) Tracing and for Pace-mapping, an integral component of an EP study



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

# ***THE ELECTROGRAM - THE INTERNAL EKG***

## **THE ELECTROPHYSIOLOGY ( EP ) LAB**





05551

INSPECTED

FOR SERVICE CALL  
CLINICAL ENGINEERING SERVICES  
BC14174

WHITE REVEAL FLUTTER ABLATION EP Workstation The Completely Integrated EP Platform (Galvani Version 2.6.0)  
Date: 11/15/11  
Views: Save  
Help: Recall



Display: [Icons] 150 mm/s

EP PACE

Mode	Cycle Len.	Current A	Stim. Dur.
A	250 msec	3.2 mA	2.0 msec

STIM

BKGD

SYNC

AUX

AUTO

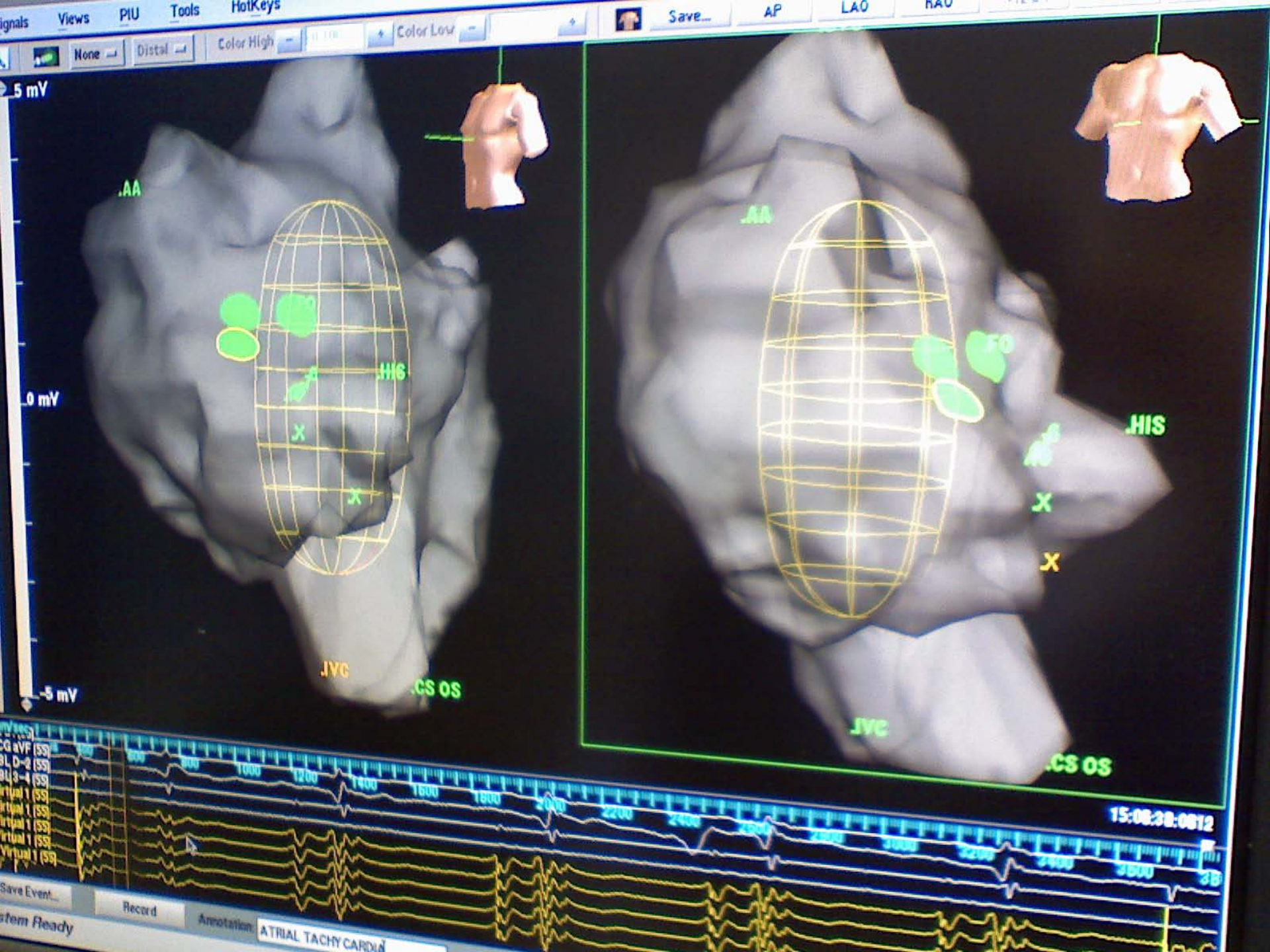
EDM

AUX OFF

670

EP MedSystems

SEK-072081



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 pathophysiology 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"*

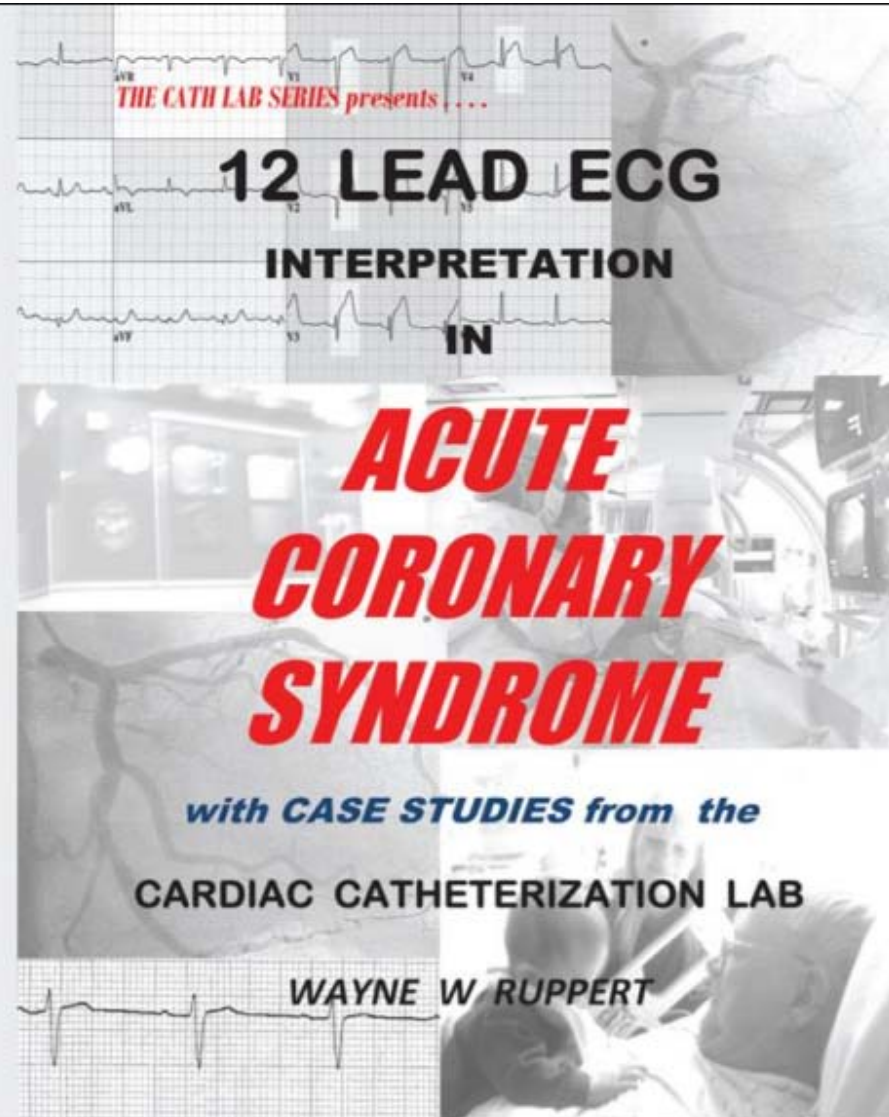
**Joseph P. Ornato, MD, FACP, FACC, FACEP**  
- Professor and Chairman, Department of Emergency Medicine  
Medical College of Virginia/Virginia Commonwealth University  
- Medical Director, Richmond Ambulance Authority,  
Richmond, Virginia

*"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



12 LEAD ECG INTERPRETATION IN ACUTE CORONARY SYNDROME with CASE STUDIES from the CATH LAB - WAYNE W RUPPERT



Published in 2010. Working on updated version.

# STEMI Assistant

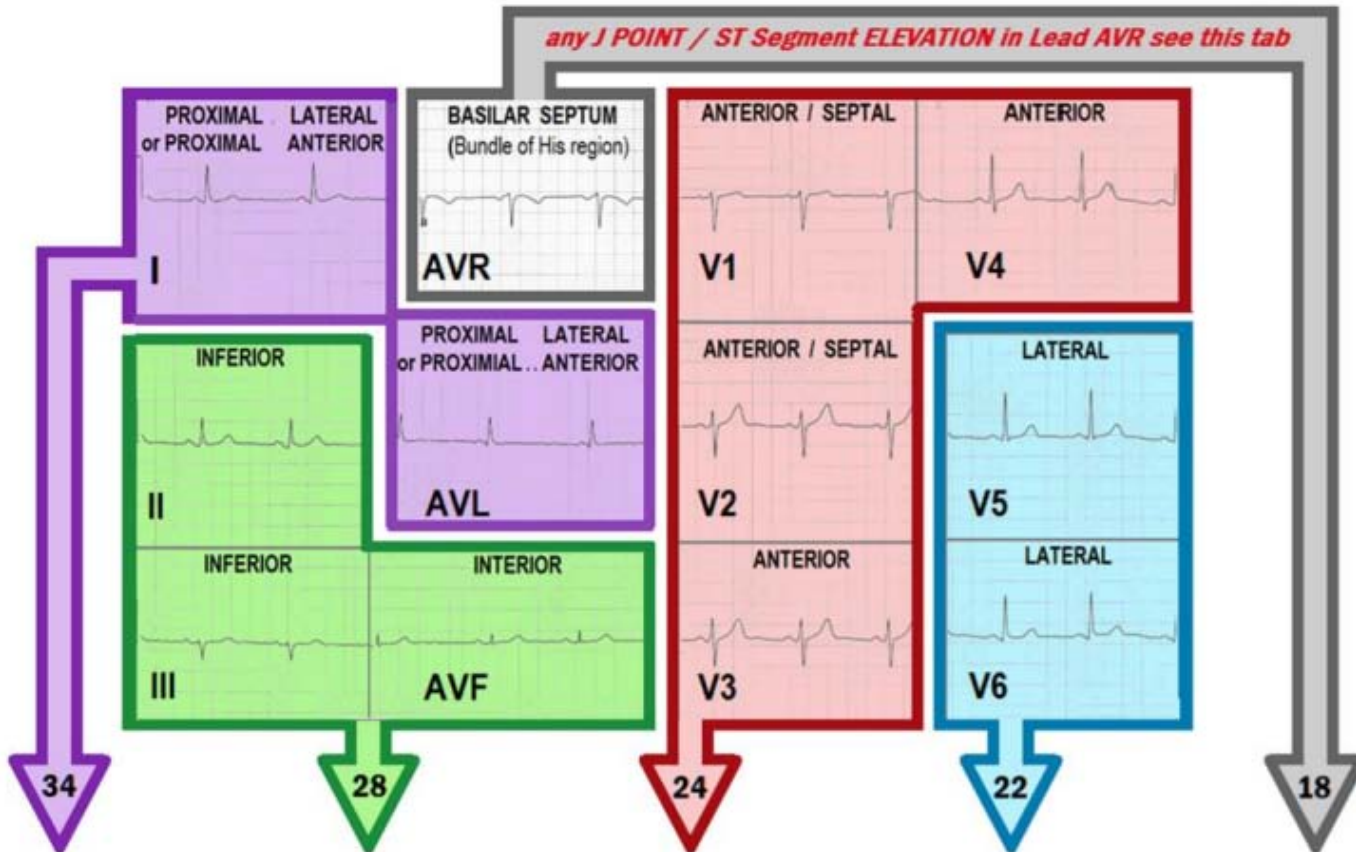
by Wayne Ruppert

UNIVERSAL ACS PATIENT MANAGEMENT ALGORITHM

--- See PAGE ONE ---

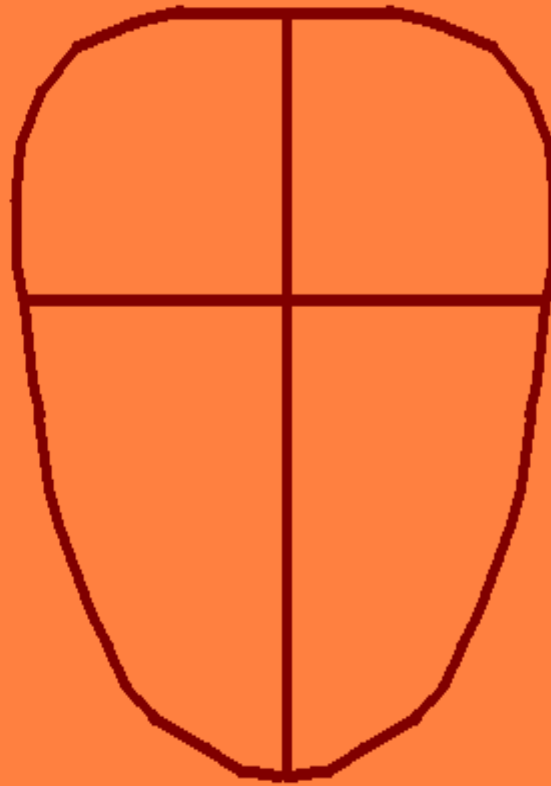
Select LEAD SET with HIGHEST ST ELEVATION and open to associated page ...

CRASH CART EMERGENCY REFERENCE



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# FOUR CHAMBERED PUMP



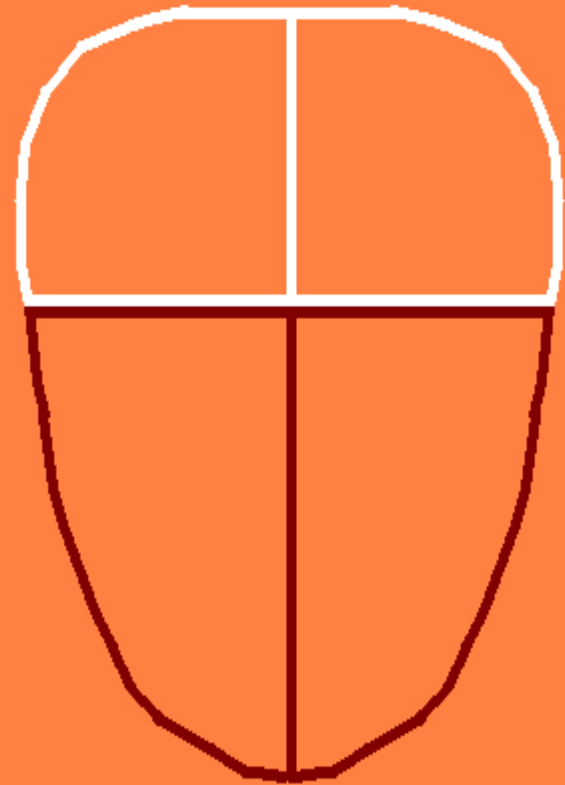
# FOUR CHAMBERED PUMP . . .

2 ATRIUM



PRIMARY JOB:

"PACK VENTRICLES  
FULL OF BLOOD"

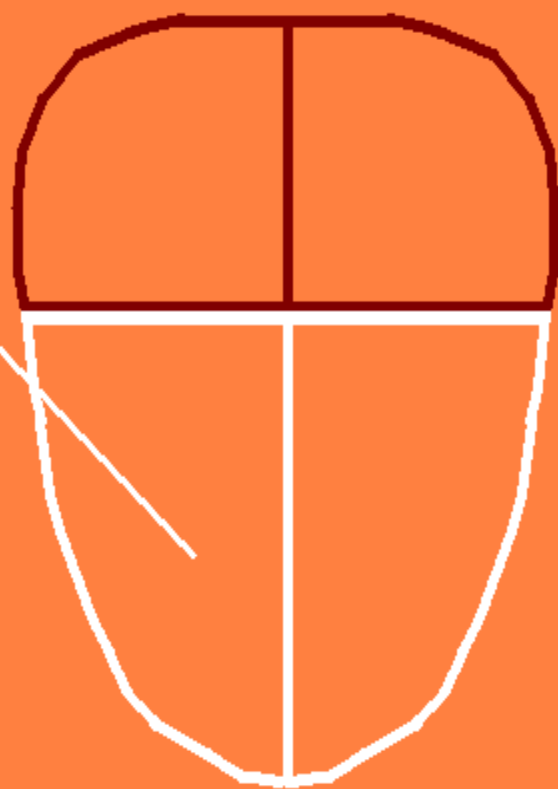


# FOUR CHAMBERED PUMP . . .

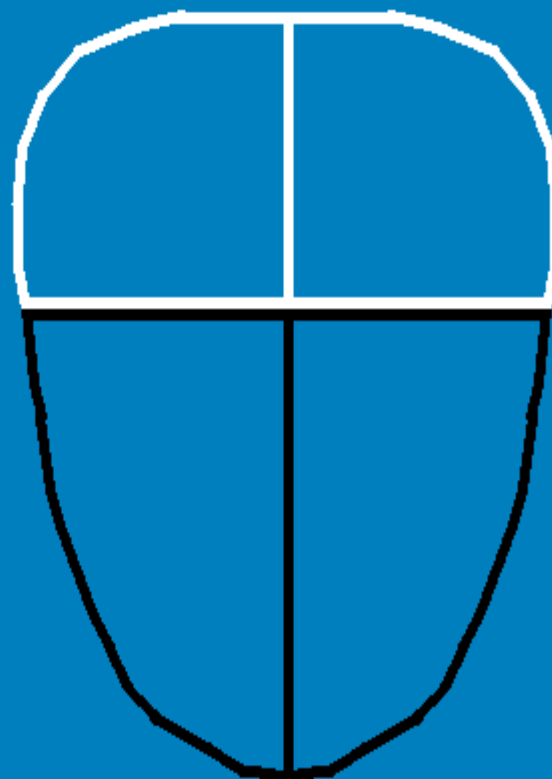
**2 VENTRICLES**

**PRIMARY JOB:**

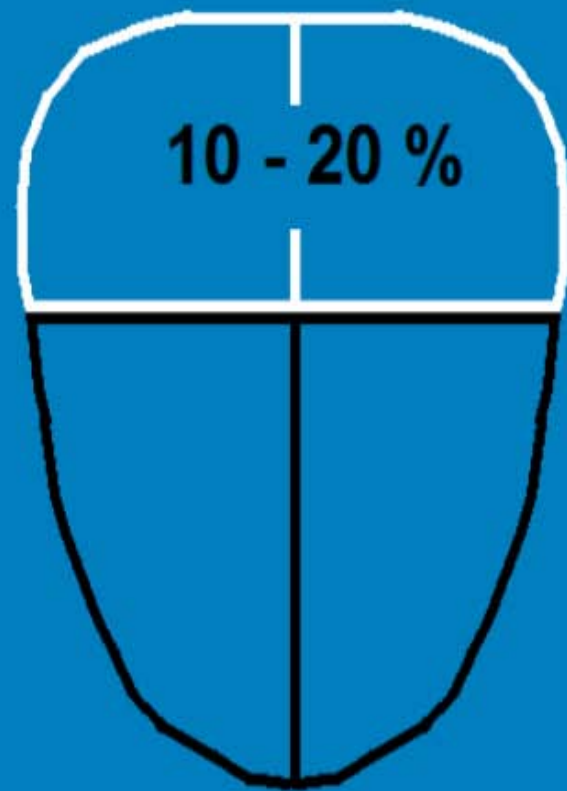
**"PUMP BLOOD TO THE  
LUNGS AND THE  
REST OF THE BODY"**



**WHEN FUNCTIONING PROPERLY,  
THE ATRIUM SUPPLY  
APPROXIMATELY  
WHAT  
PERCENTAGE  
OF THE  
CARDIAC OUTPUT ?**



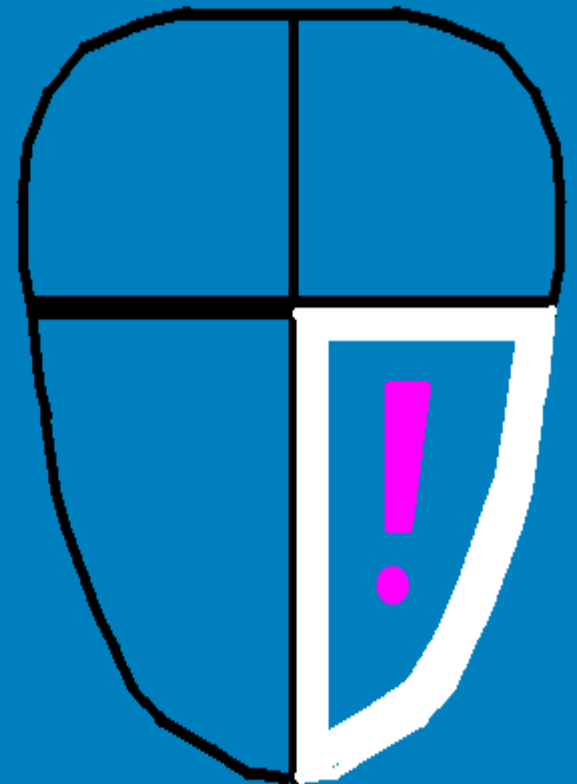
**WHEN FUNCTIONING PROPERLY,  
THE ATRIUM SUPPLY  
APPROXIMATELY  
WHAT  
PERCENTAGE  
OF THE  
CARDIAC OUTPUT ?**



**THE CHAMBER MOST IMPORTANT  
TO KEEPING THE PATIENT ALIVE**

**(and the ONLY one  
you can't live  
without )**

**IS THE  
LEFT VENTRICLE  
WHICH WE WILL REFER  
TO AS THE PUMP**



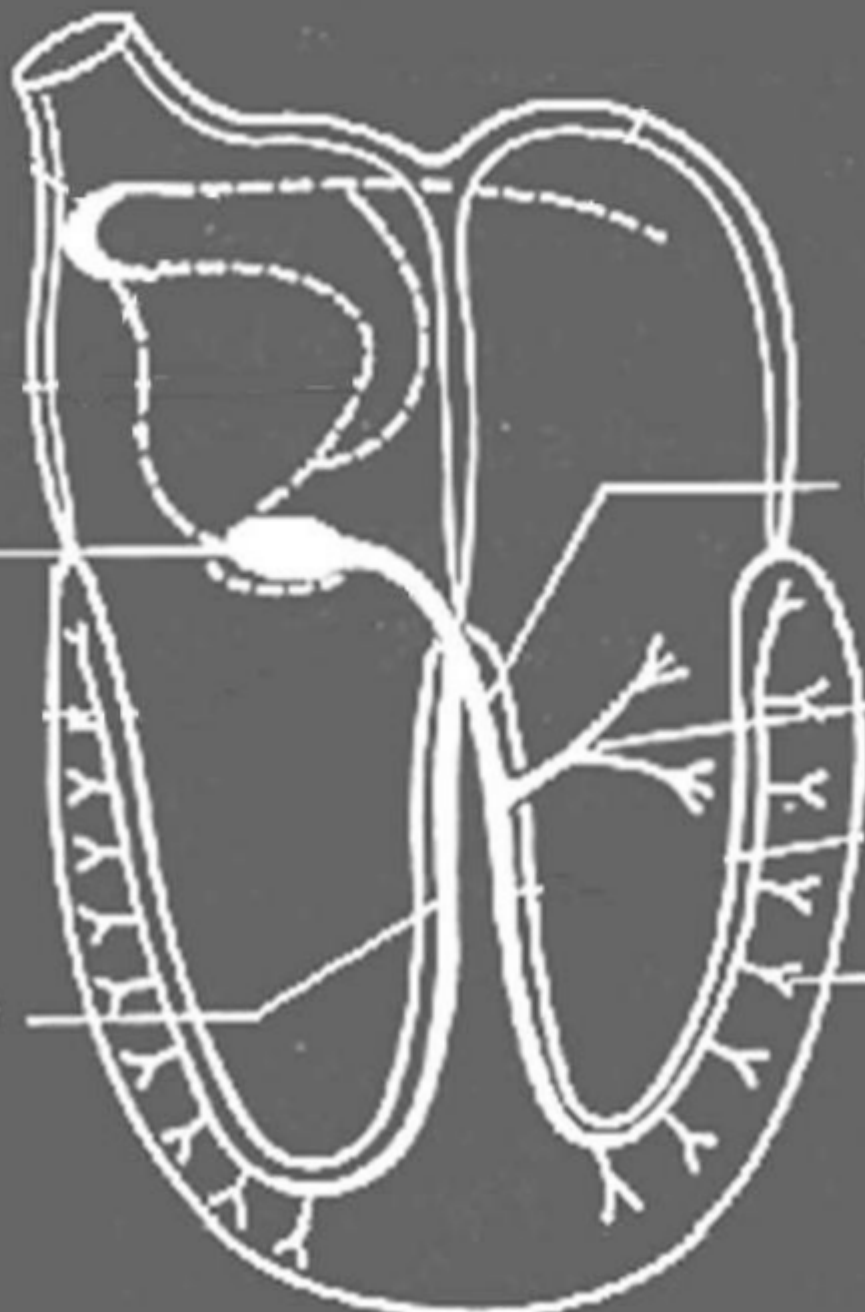
Sinus node

AV node

Right bundle branch

Left bundle branch

Purkinje fibers



Sinus node

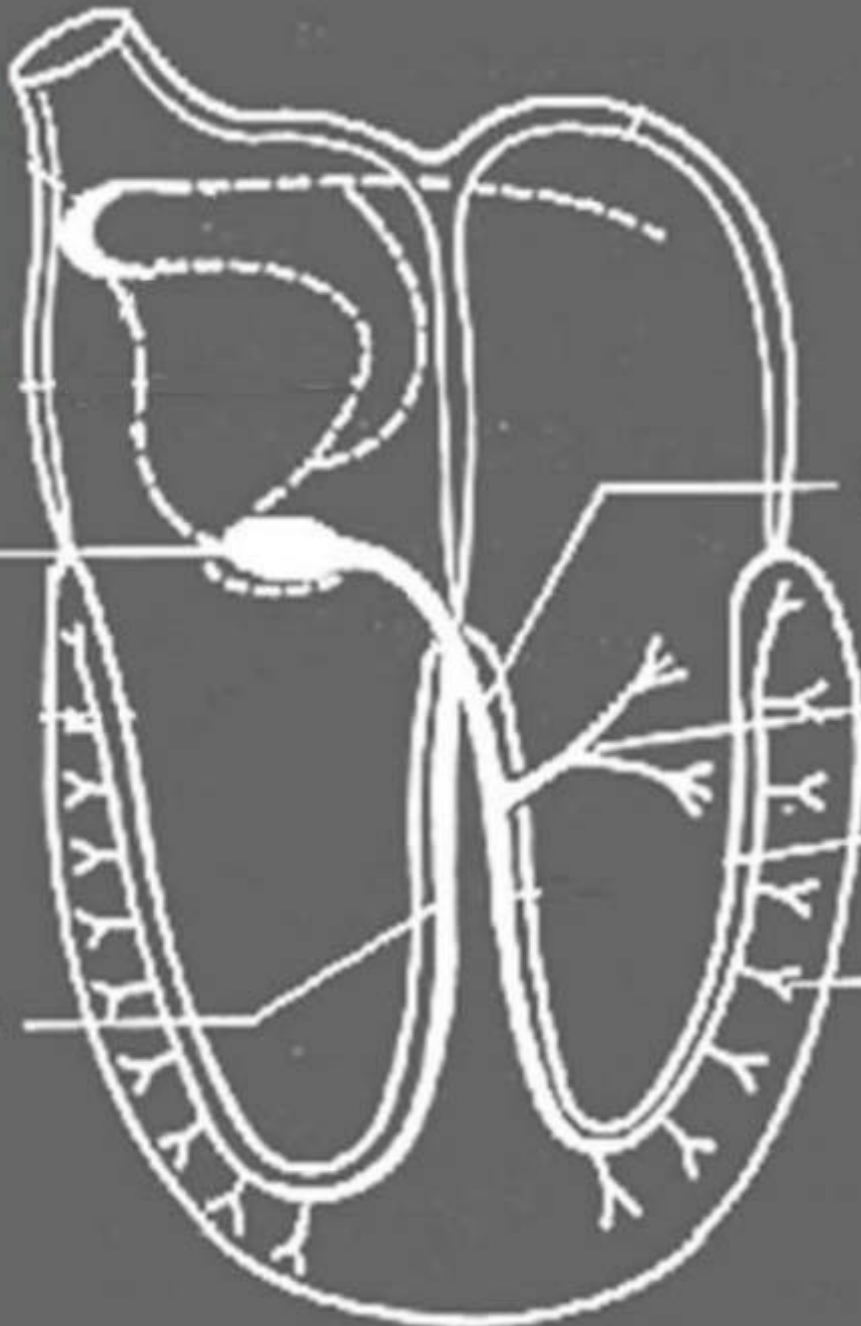
60 - 100  
beats / min.

AV node

Left bundle  
branch

Right bundle  
branch

Purkinje fibers



~~Sinus node~~

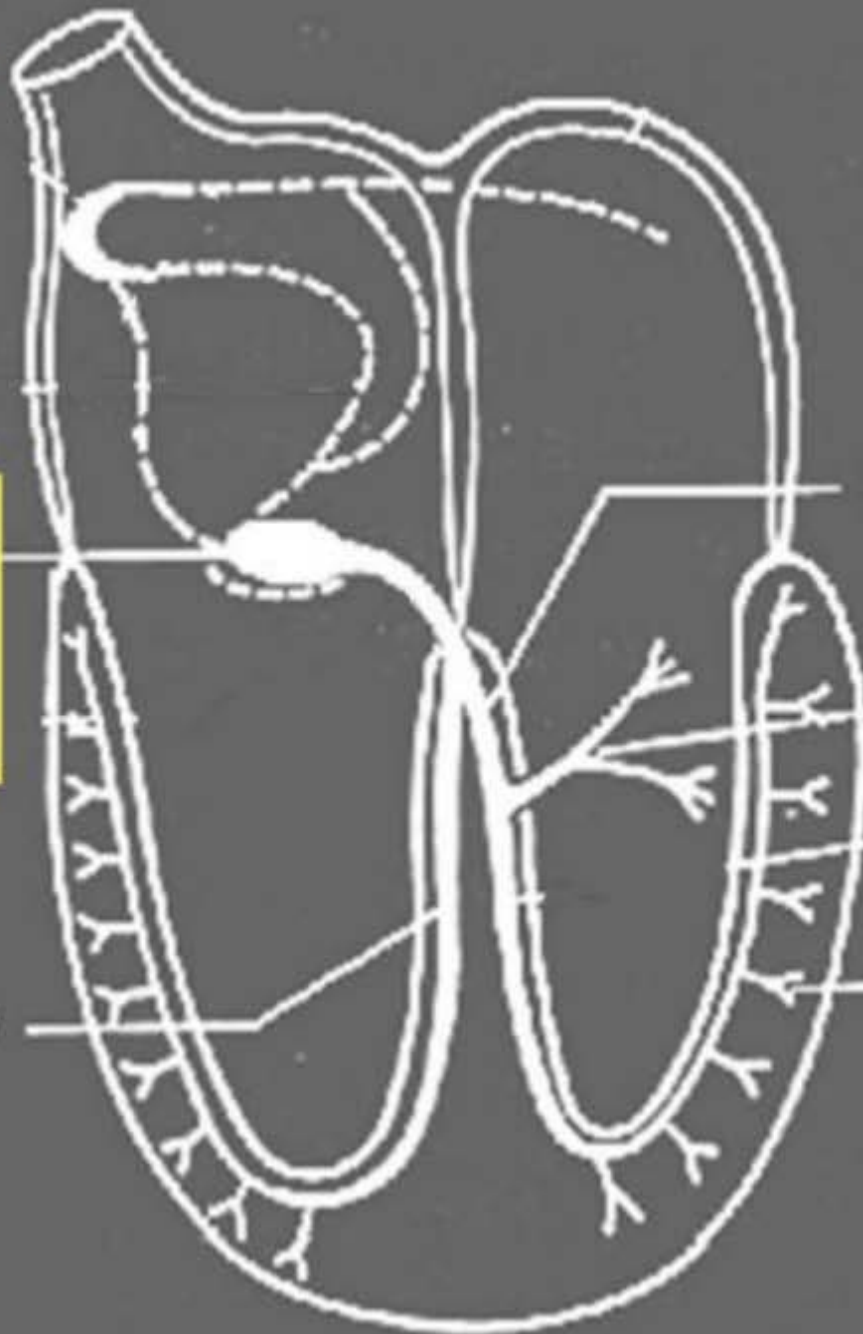
AV node

40 - 60  
beats / min.

Right bundle  
branch

Left bundle  
branch

Purkinje fibers



~~Sinus node~~

~~AV node~~

Right bundle branch

Left bundle branch

Purkinje fibers

Pacemaker site in the Ventricles:  
20 - 40 beats / min



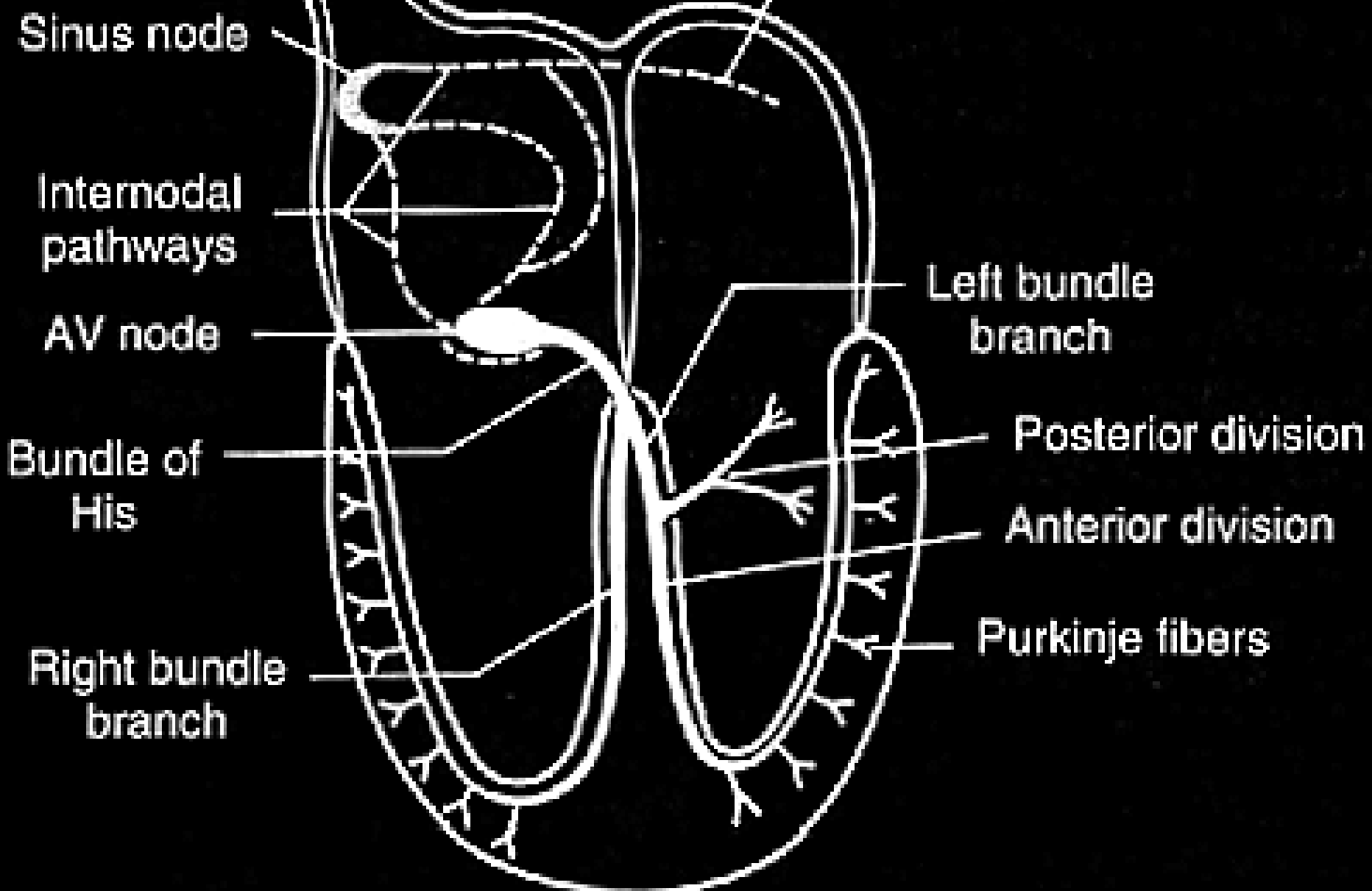
# NORMAL "INHERENT" RATES:

SA NODE: 60 - 100

AV NODE: 40 - 60

VENTRICLES: 1 - 40

# Bachmann's bundle



Sinus node

Internodal pathways

AV node

Bundle of His

Right bundle branch

Left bundle branch

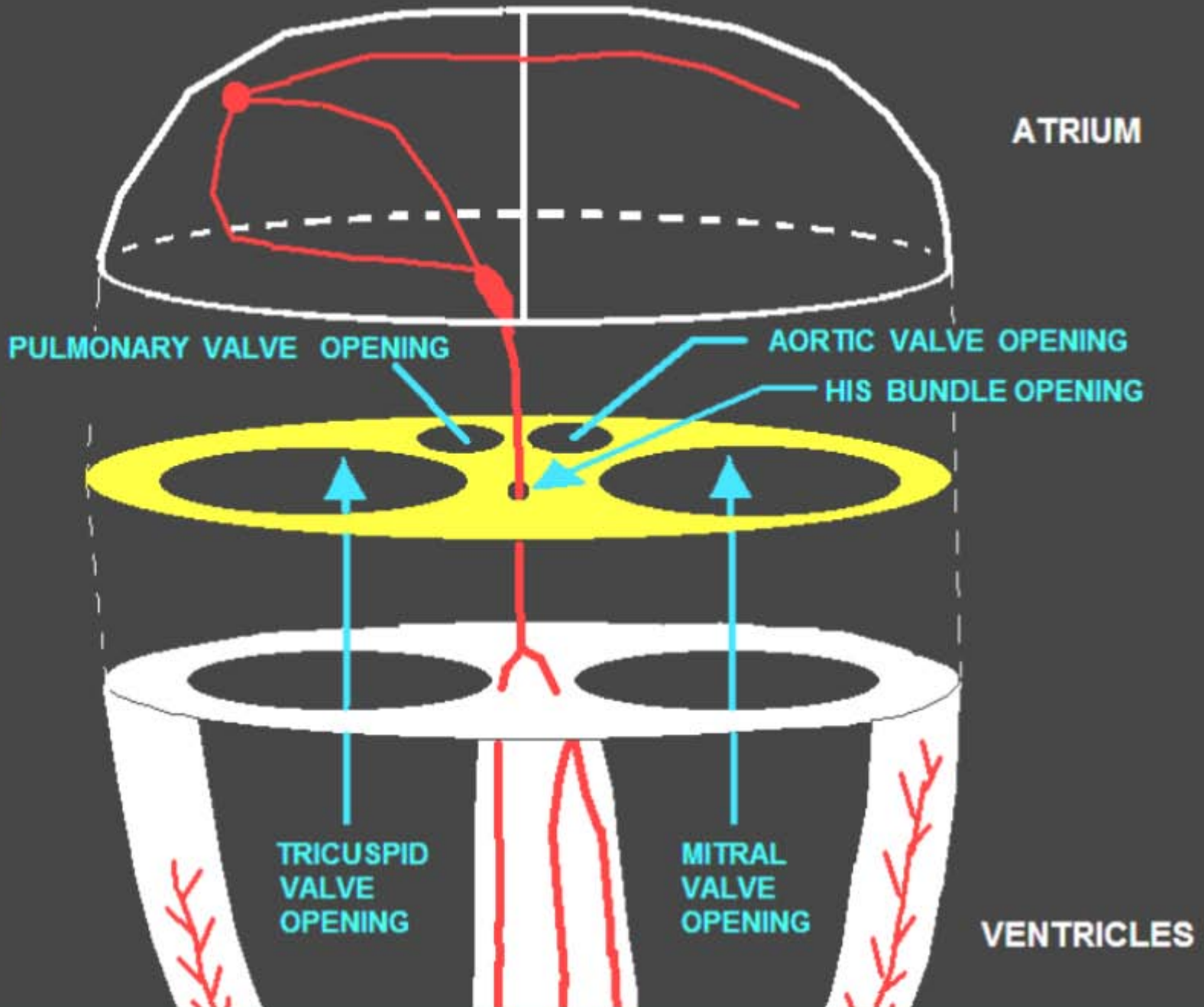
Posterior division

Anterior division

Purkinje fibers

# THE "SKELETON OF THE HEART"

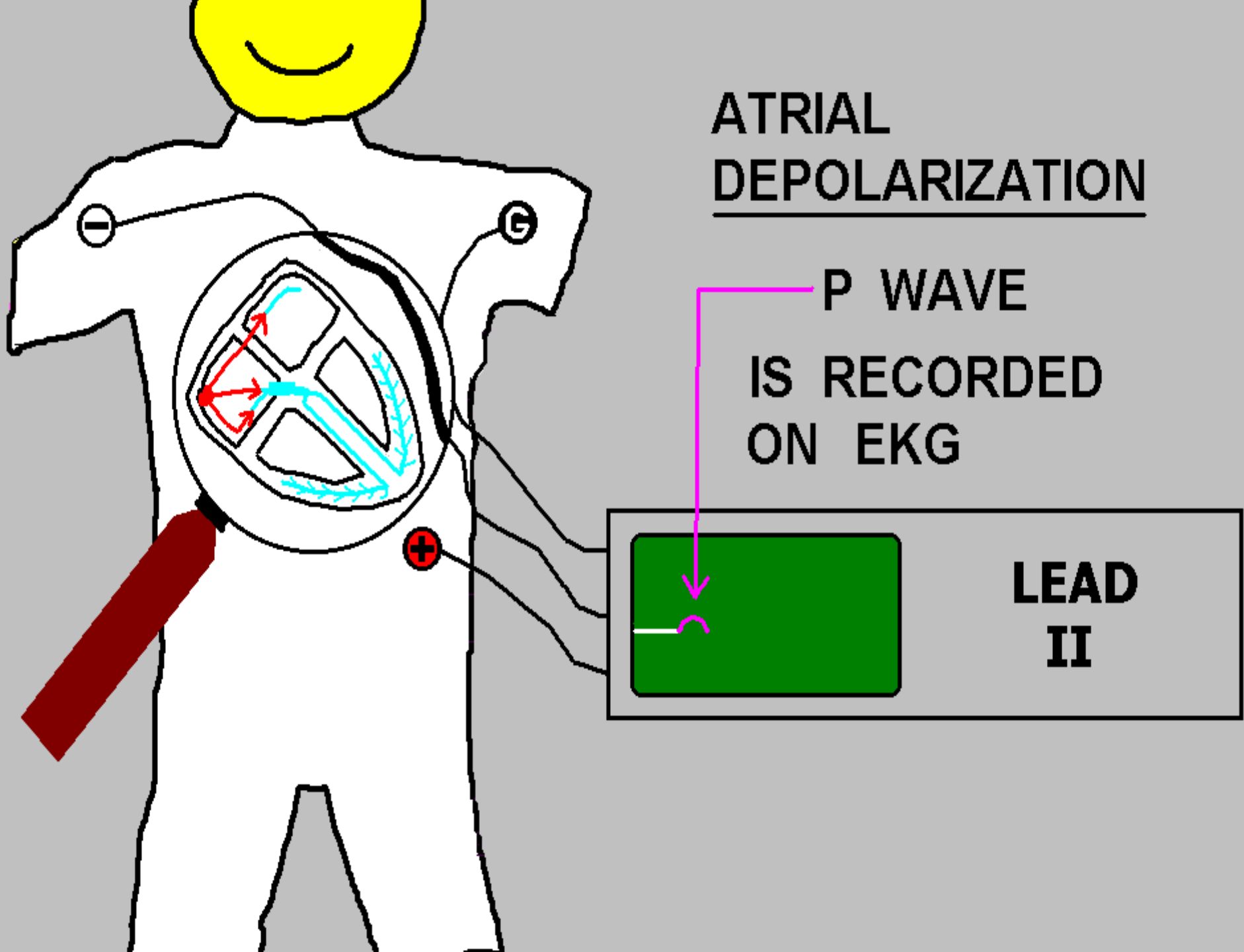
**FIBROUS  
"SKELETON  
of the  
HEART"**

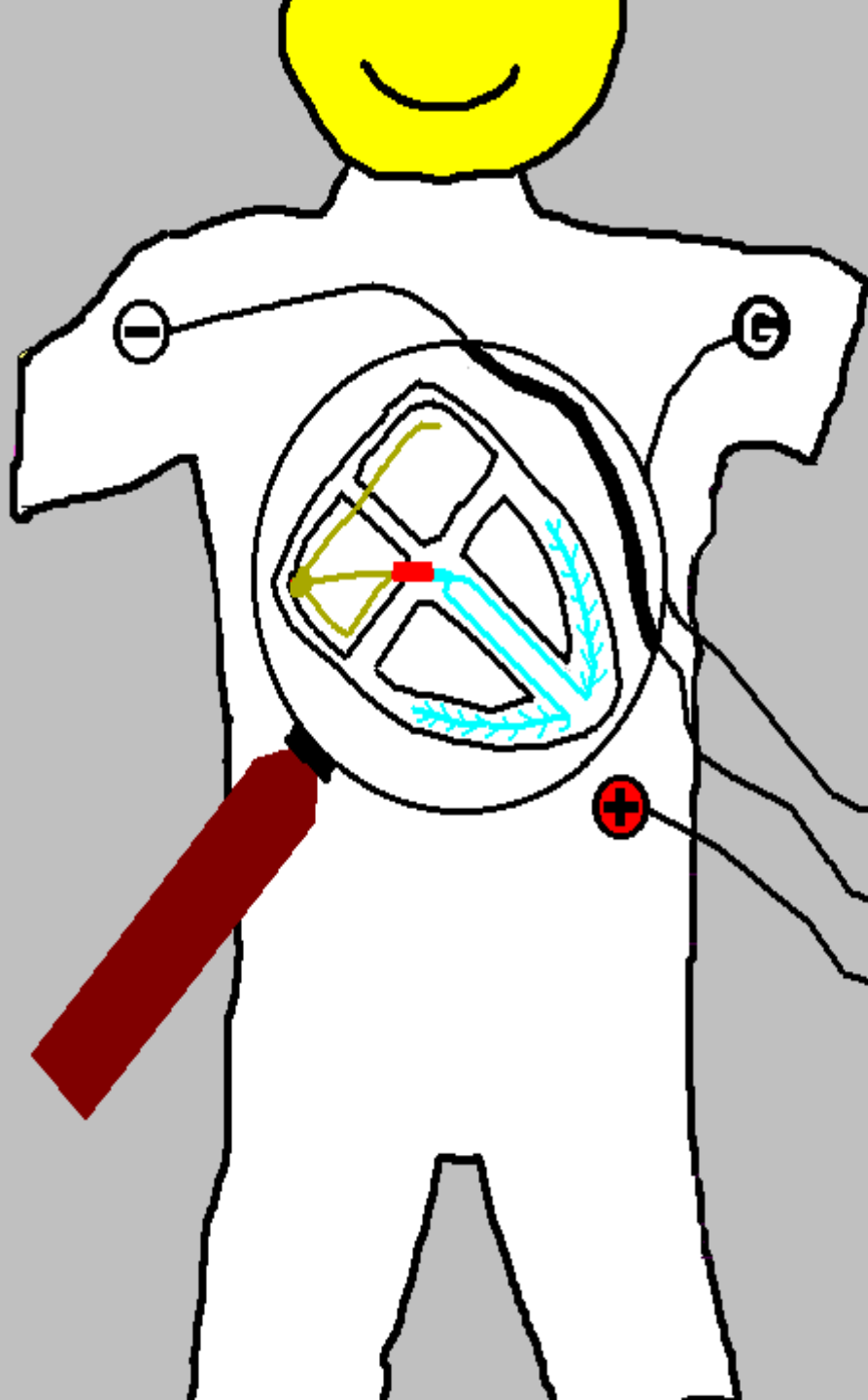


# ATRIAL DEPOLARIZATION

P WAVE  
IS RECORDED  
ON EKG

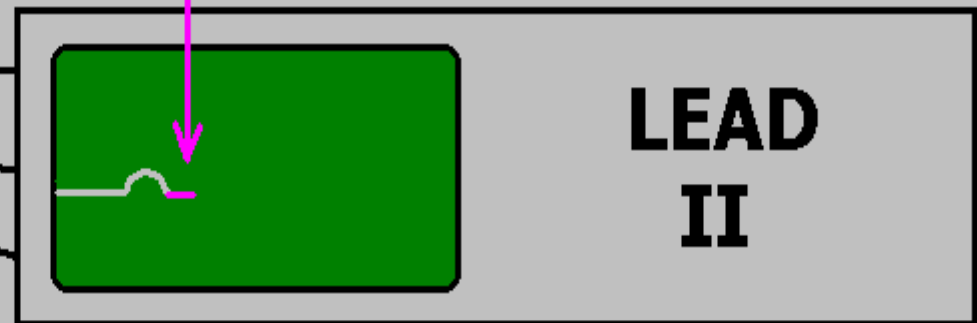
LEAD  
II





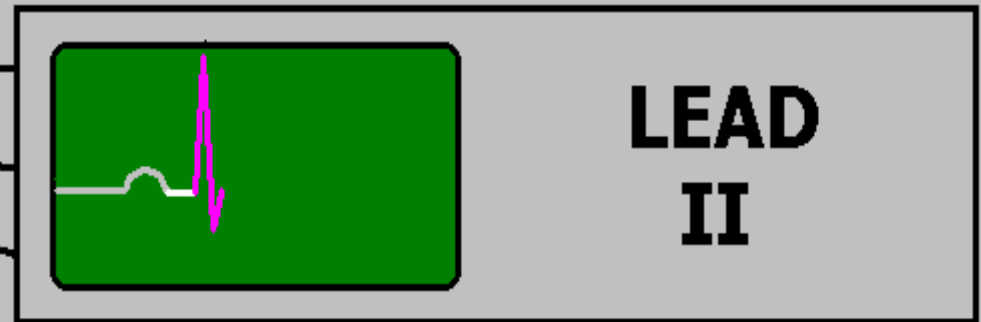
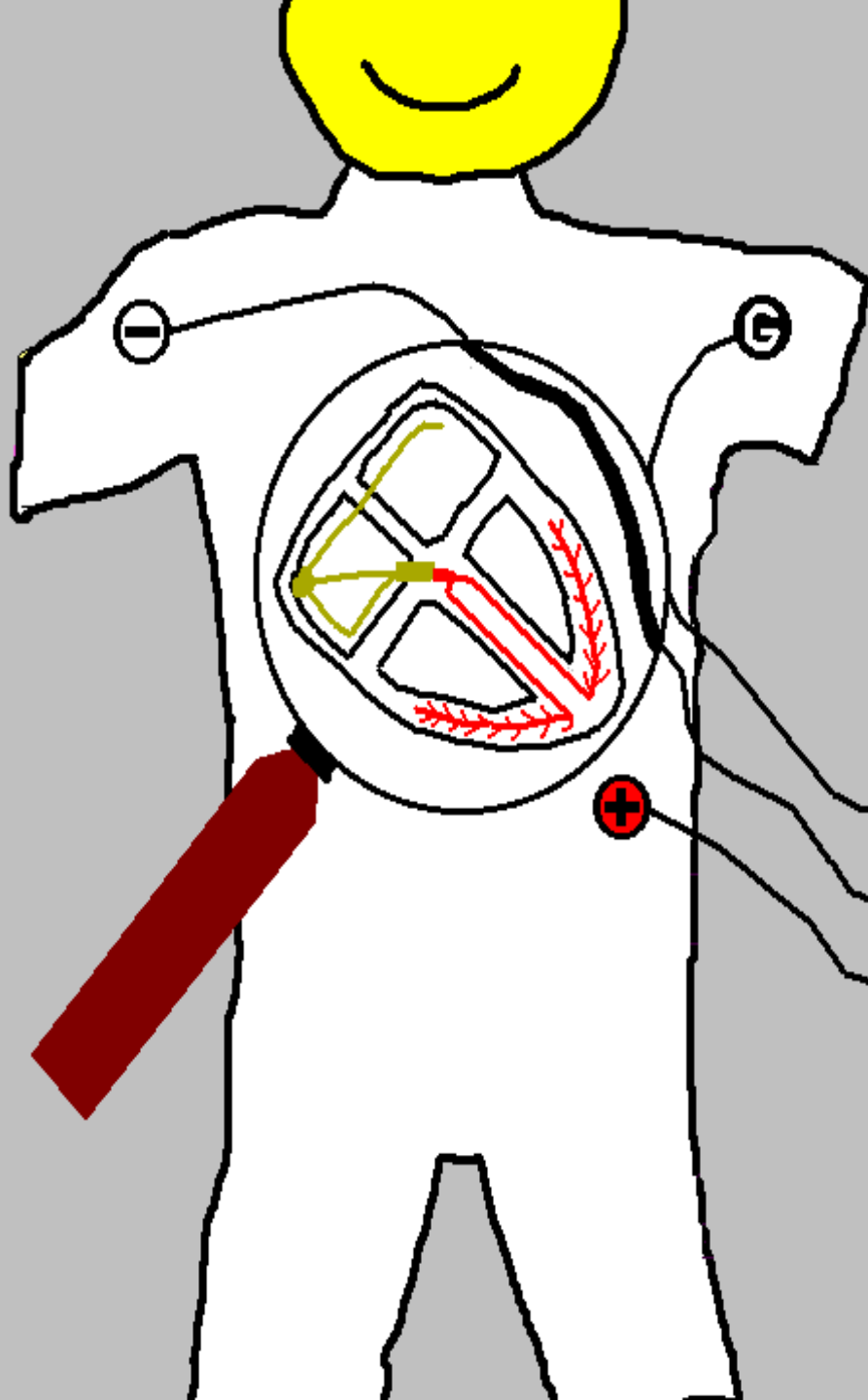
## CURRENT IN A-V NODE

P-R SEGMENT  
.10 SECOND ISO-  
ELECTRIC DELAY



# VENTRICULAR DEPOLARIZATION

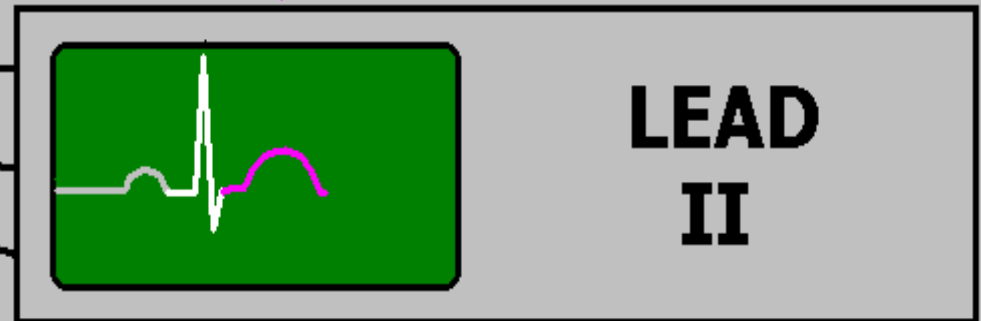
QRS COMPLEX  
IS RECORDED  
ON EKG



**LEAD  
II**

# VENTRICULAR REPOLARIZATION

WRITES A "T"  
WAVE ON THE  
ECG



# CARDIAC ANATOMY and PHYSIOLOGY "101"

**CARDIAC CELLS AT REST** have **POSITIVE** charged IONS on the **OUTSIDE** of the cell membrane, and **NEGATIVE** charged IONS on the **INSIDE**

Ca<sup>++</sup> Na<sup>+</sup> Ca<sup>++</sup> Na<sup>+</sup> Ca<sup>++</sup>

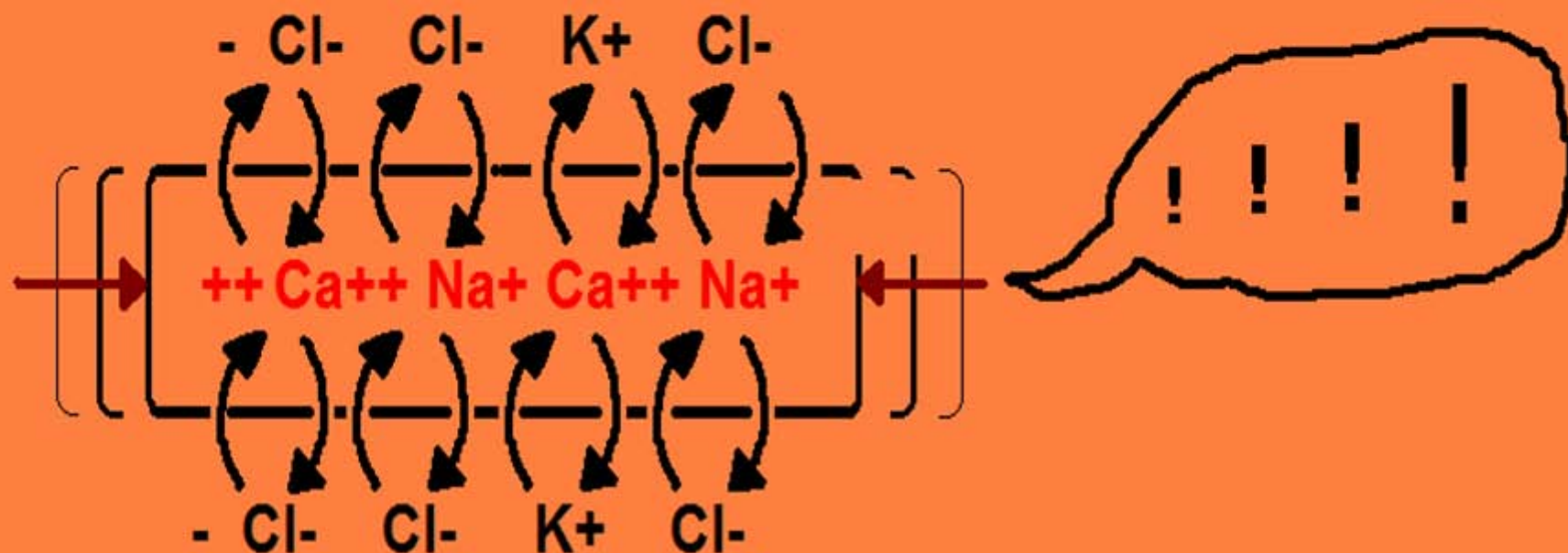
Cl<sup>-</sup> Cl<sup>-</sup> K<sup>+</sup> Cl<sup>-</sup> K<sup>+</sup> Cl<sup>-</sup> K<sup>+</sup> Cl<sup>-</sup>

Ca<sup>++</sup> Na<sup>+</sup> Ca<sup>++</sup> Na<sup>+</sup> Ca<sup>++</sup>



# CARDIAC ANATOMY and PHYSIOLOGY "101"

... when the IONS shift ... that is, the POSITIVE IONS that were on the outside TRADE PLACES with the NEGATIVE IONS that were on the INSIDE ....



... THE CELL CONTRACTS!

**THIS (OF COURSE) IS KNOWN AS . . .**

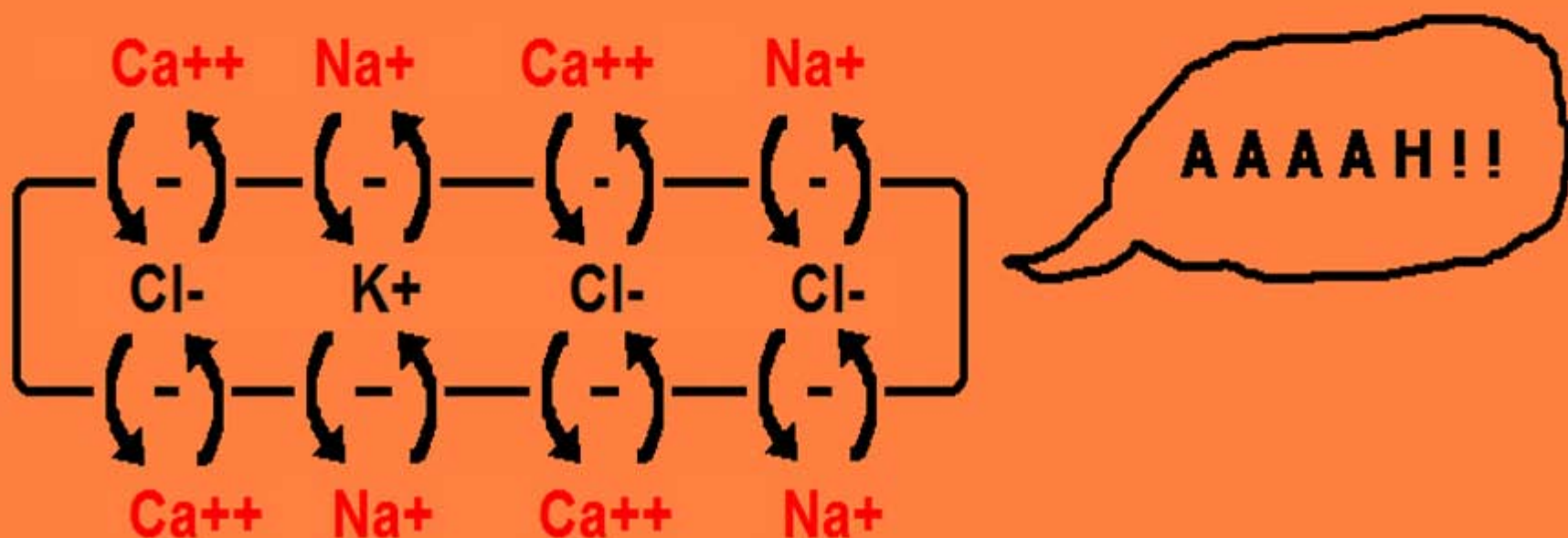
## **DEPOLARIZATION**

**WHEN EVERYTHING IS WORKING PROPERLY, THE WAVE OF DEPOLARIZING CELLS CAUSES THE HEART TO CONTRACT, AND PUMP BLOOD TO THE LUNGS AND THE SYSTEMIC CIRCULATION**

# CARDIAC ANATOMY and PHYSIOLOGY "101"

**AFTER DEPOLARIZATION, THE CELLS RELAX.**

**THE IONS RETURN TO THEIR ORIGINAL POSITIONS --  
THIS PROCESS IS KNOWN AS **REPOLARIZATION****



# CARDIAC ANATOMY and PHYSIOLOGY "101"

50 % REPOLARIZATION of VENTRICULAR CELLS

T wave

RELATIVE REFRACTORY PERIOD

ELECTRICAL STIMULUS TO VENTRICLES  
MAY CAUSE V-FIB / V-TACH

ABSOLUTE REFRACTORY PERIOD

ELECTRICAL STIMULUS TO VENTRICLES HAS

VERY HIGH PROBABILITY OF CAUSING V-FIB / V-TACH

# ROUTINE TEST OF ICD

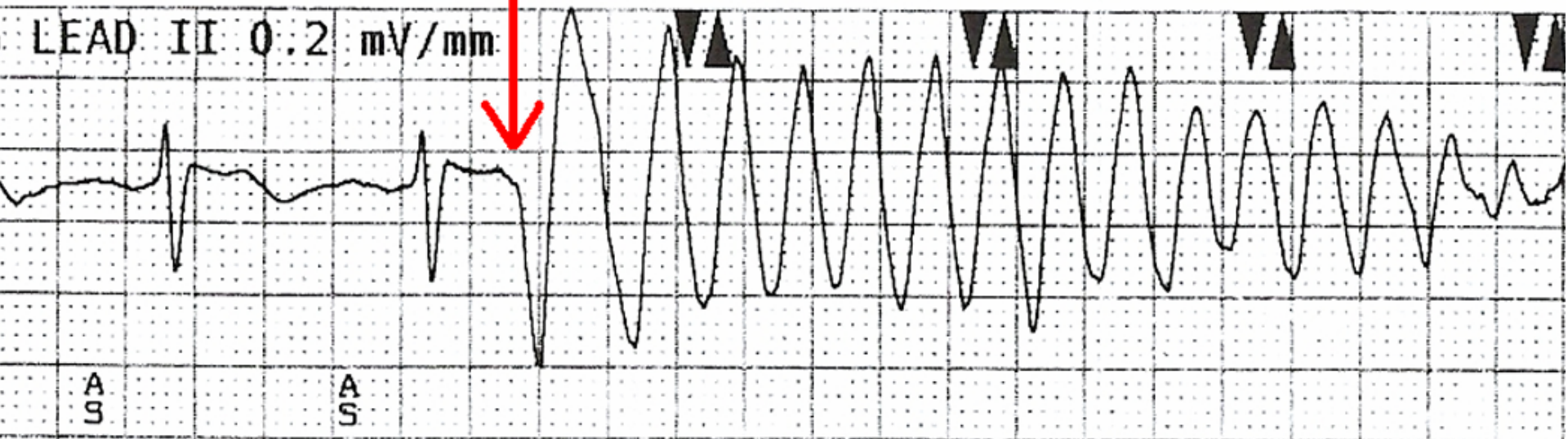
ELECTRICAL IMPULSE  
ADMINISTERED DURING ABSOLUTE  
REFRACTORY PERIOD -- INDUCES  
VENTRICULAR FIBRILLATION

08-Sep-2006 18:01:47

Test Started

SPECIAL THANKS TO:  
Ray Heinley  
Medtronic Corporation  
for this contribution

LEAD: II 0.2 mV/mm



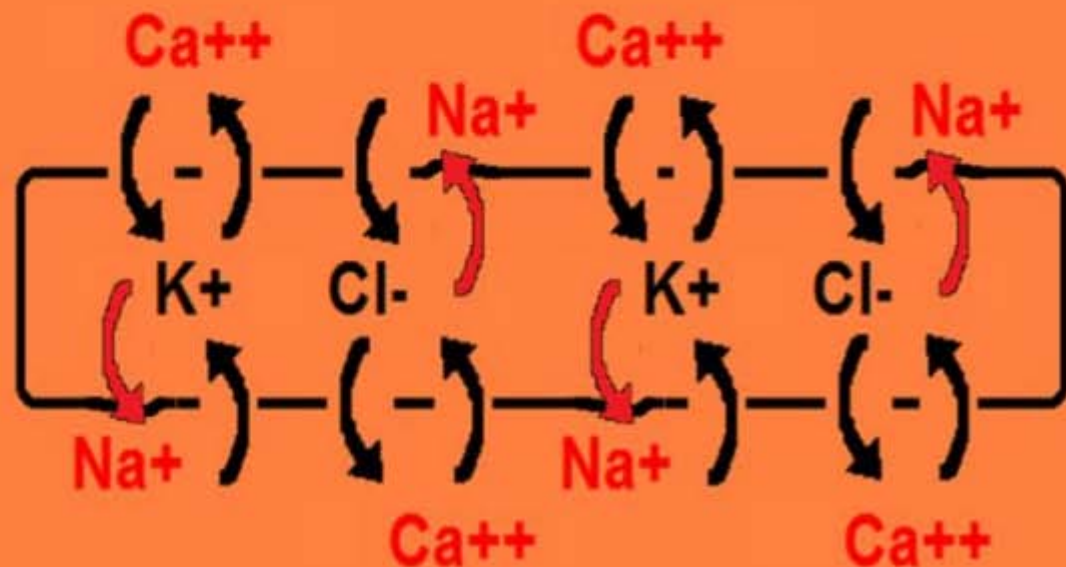
AS

AS

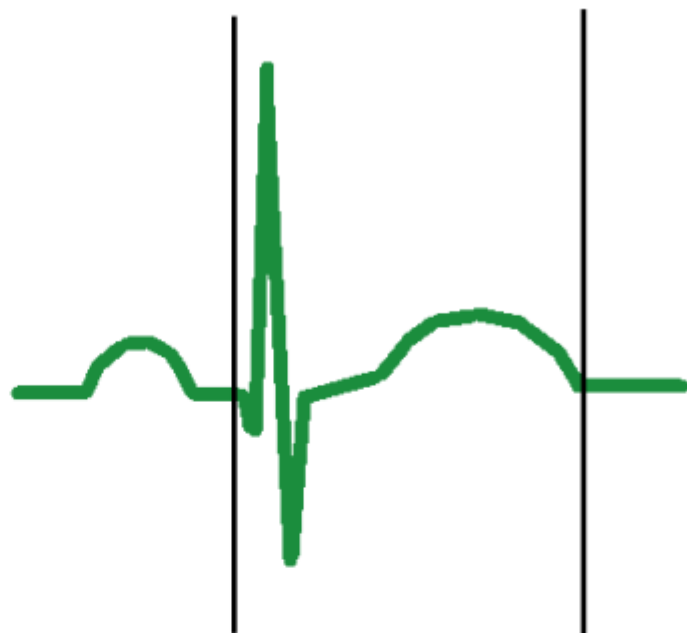
# CARDIAC ANATOMY and PHYSIOLOGY "101"

When **ION CHANNELS** are **MALFORMED**, the abnormal channel shape may **DELAY** the transfer of **IONS** . . . . .

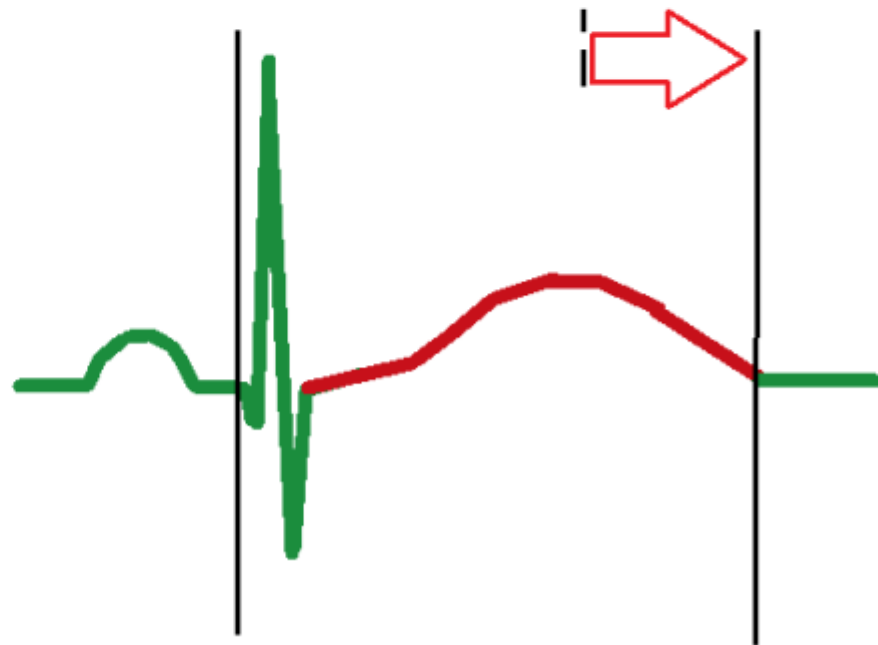
. . . . this can **DELAY REPOLARIZATION**, which will show on the ECG as "**QT Prolongation**"



**Normal  
QT Interval**



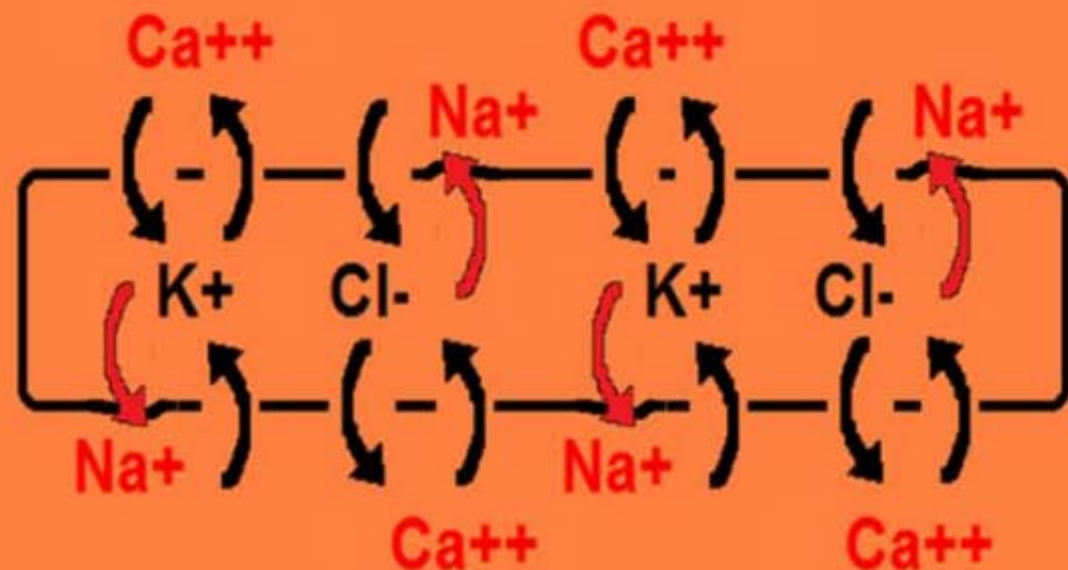
**ABNORMAL  
(prolonged)  
QT Interval**



# CARDIAC ANATOMY and PHYSIOLOGY "101"

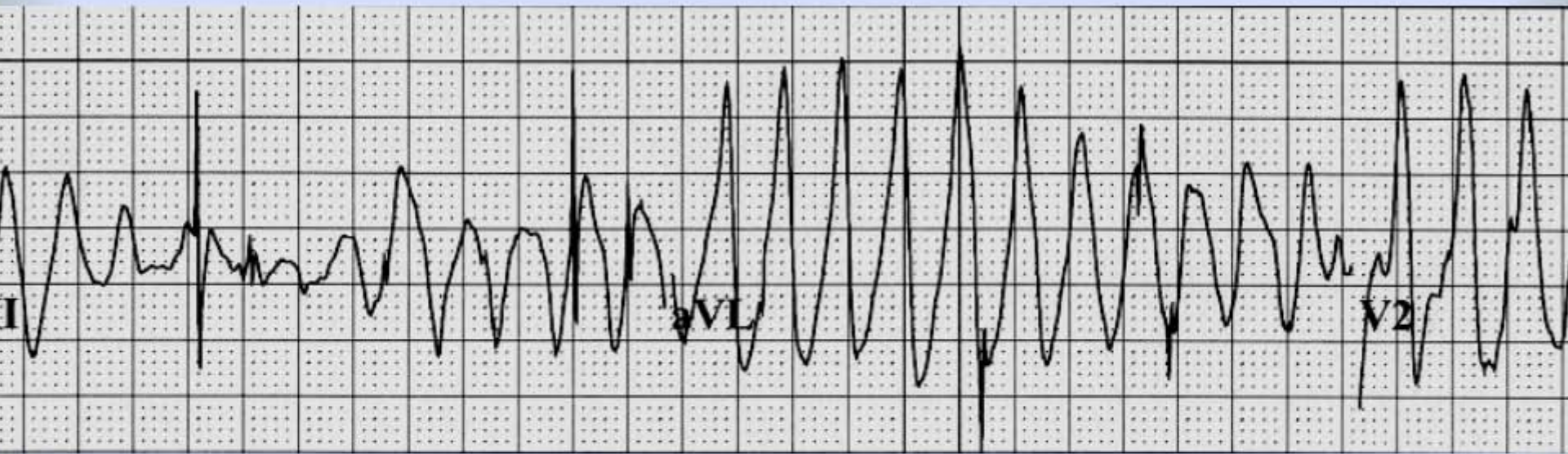
When ION CHANNELS are MALFORMED, the abnormal channel shape may DELAY the transfer of IONS . . . . .

. . . . . this can DELAY REPOLARIZATION, which will show on the ECG as "QT Prolongation"



which can lead  
to Torsades . .  
**Cardiac**  
**Arrest . . . and**  
**SUDDEN DEATH**

# *Torsades de Pointes (TdP)*

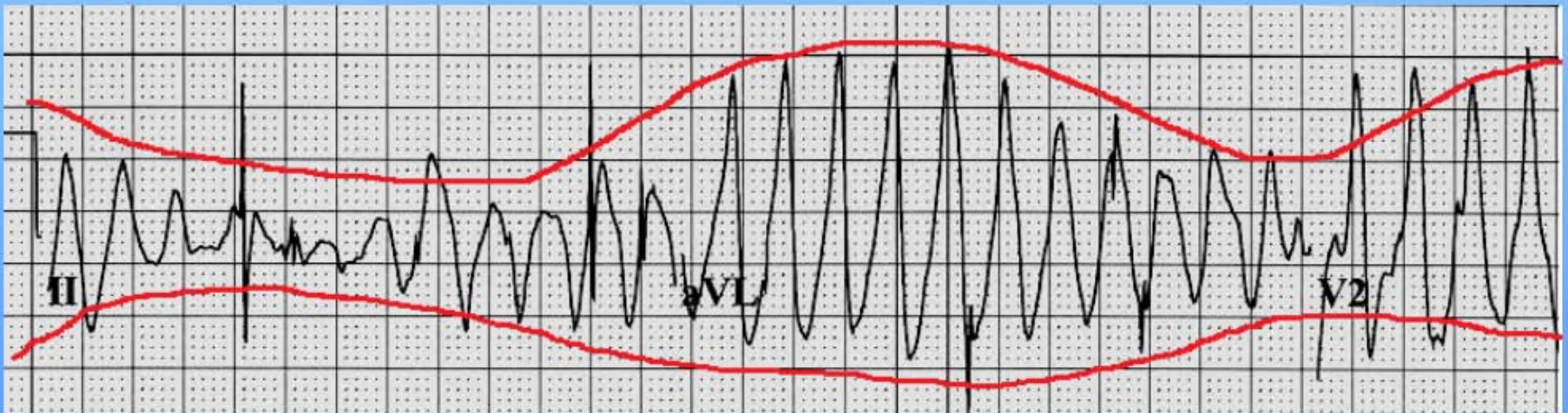


- **Common cause:  $QTc > 600$  ms**
- Patients typically have little to no cardiac output when in this rhythm
- TdP may self-terminate or deteriorate into **VENTRICULAR FIBRILLATION**

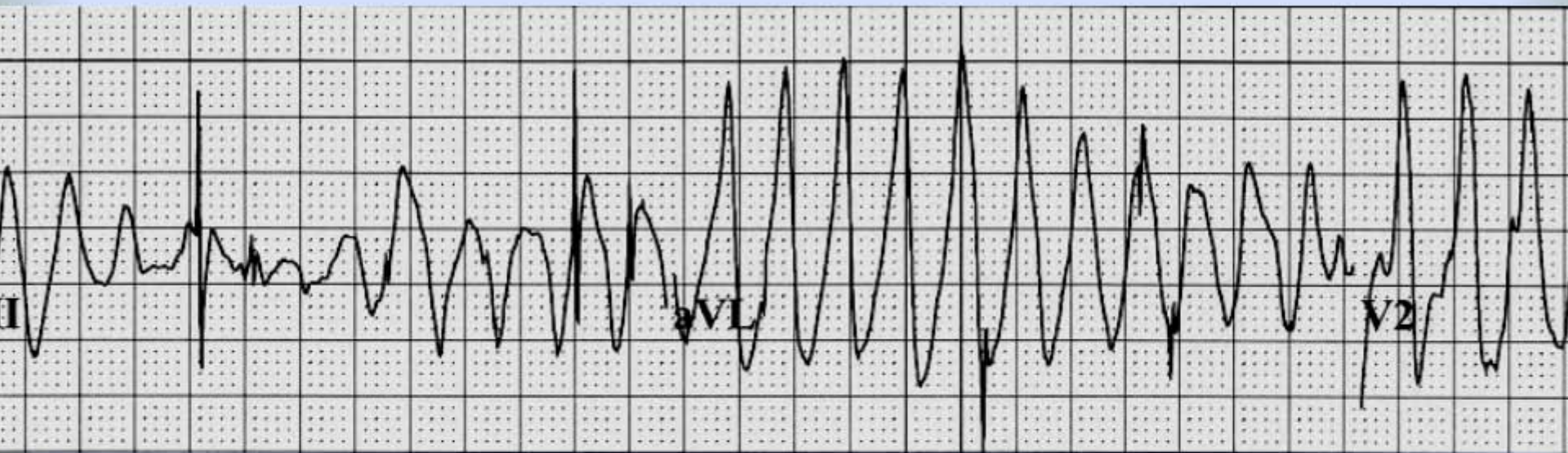
# ECG Characteristics of TdP: The QRS Pattern of *Torsades de Pointes* resembles . . . . .



*a piece of Twisted Ribbon !*



# *Torsades de Pointes (TdP)*



- Common cause:  $QTc > 600$  ms
- Patients typically have little to no cardiac output when in this rhythm
- TdP may self-terminate or deteriorate into **VENTRICULAR FIBRILLATION**

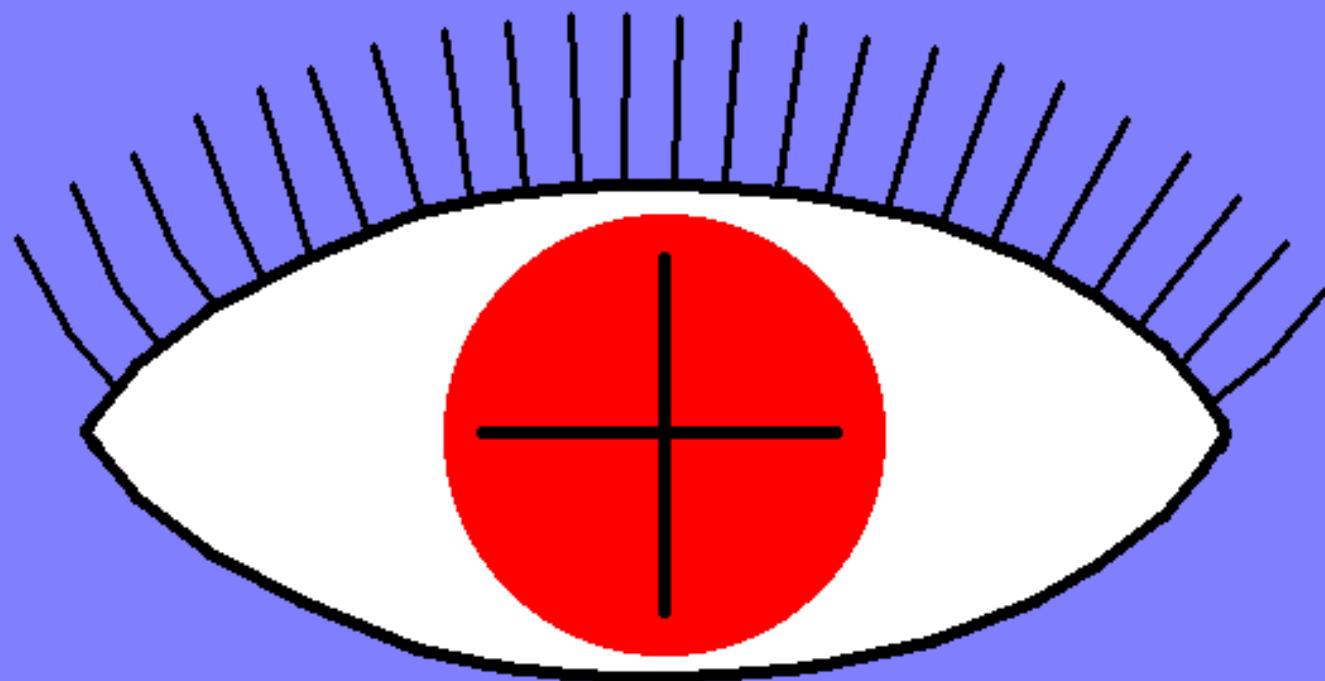
# THE EKG MACHINE

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

- I, II, III, and V1, V2, V3, V4, V5, V6  
EACH CONSIST OF:

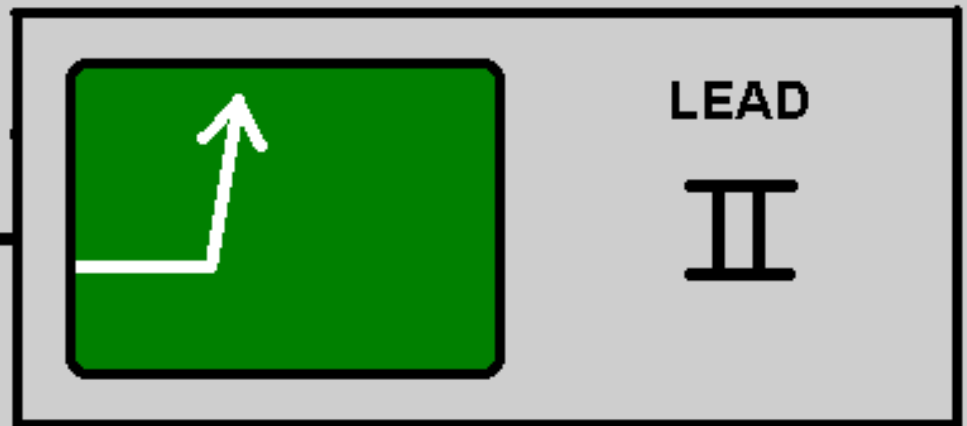
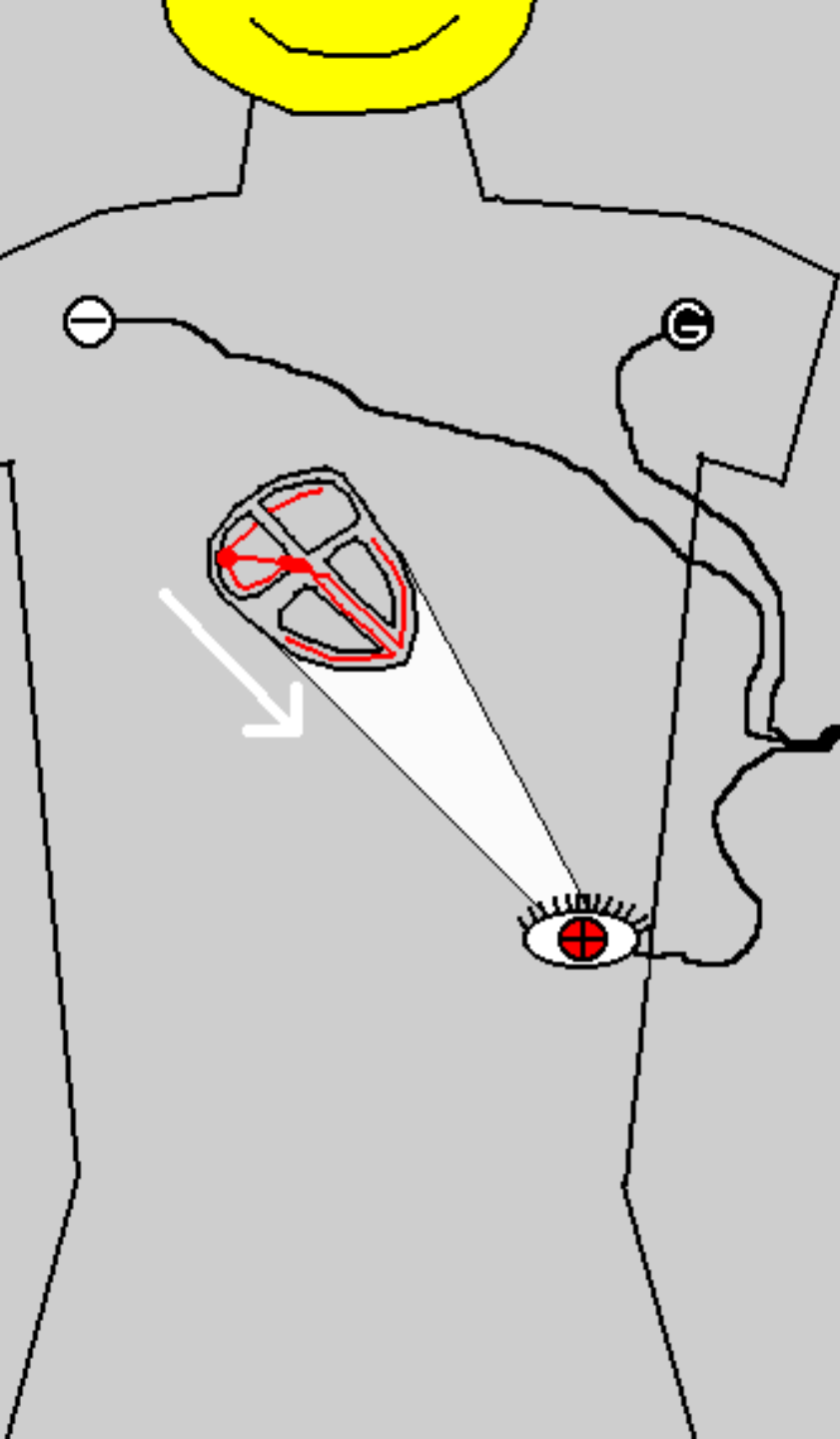
- 1 POSITIVE ELECTRODE
- 1 NEGATIVE ELECTRODE
- 1 GROUND ELECTRODE

# THE POSITIVE ELECTRODE

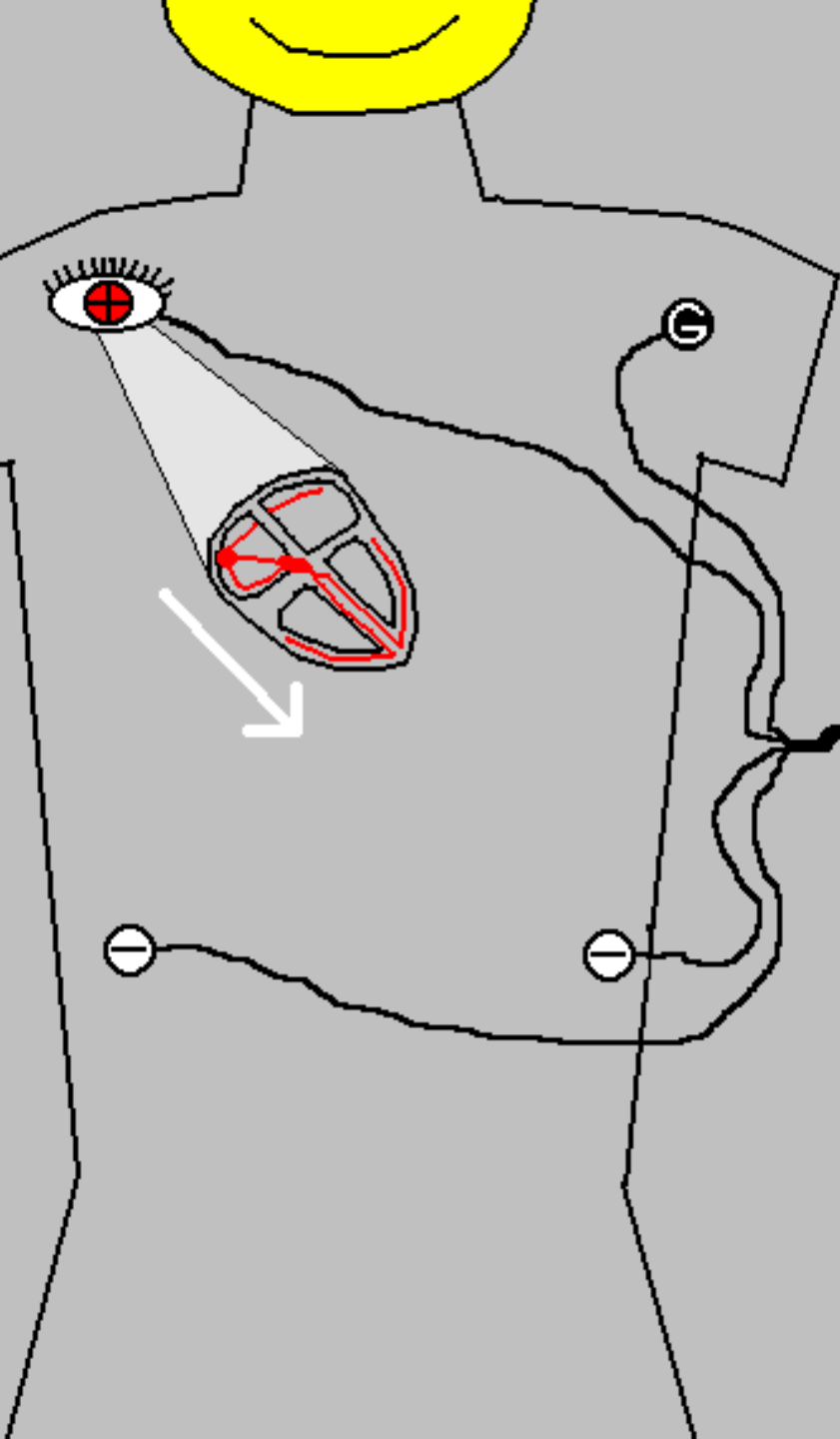


IS THE "EYE" . . .

**CURRENT MOVING  
TOWARD THE EYE  
(POSITIVE ELECTRODE)**



**RECORDS AN  
"UPWARD"  
DEFLECTION**

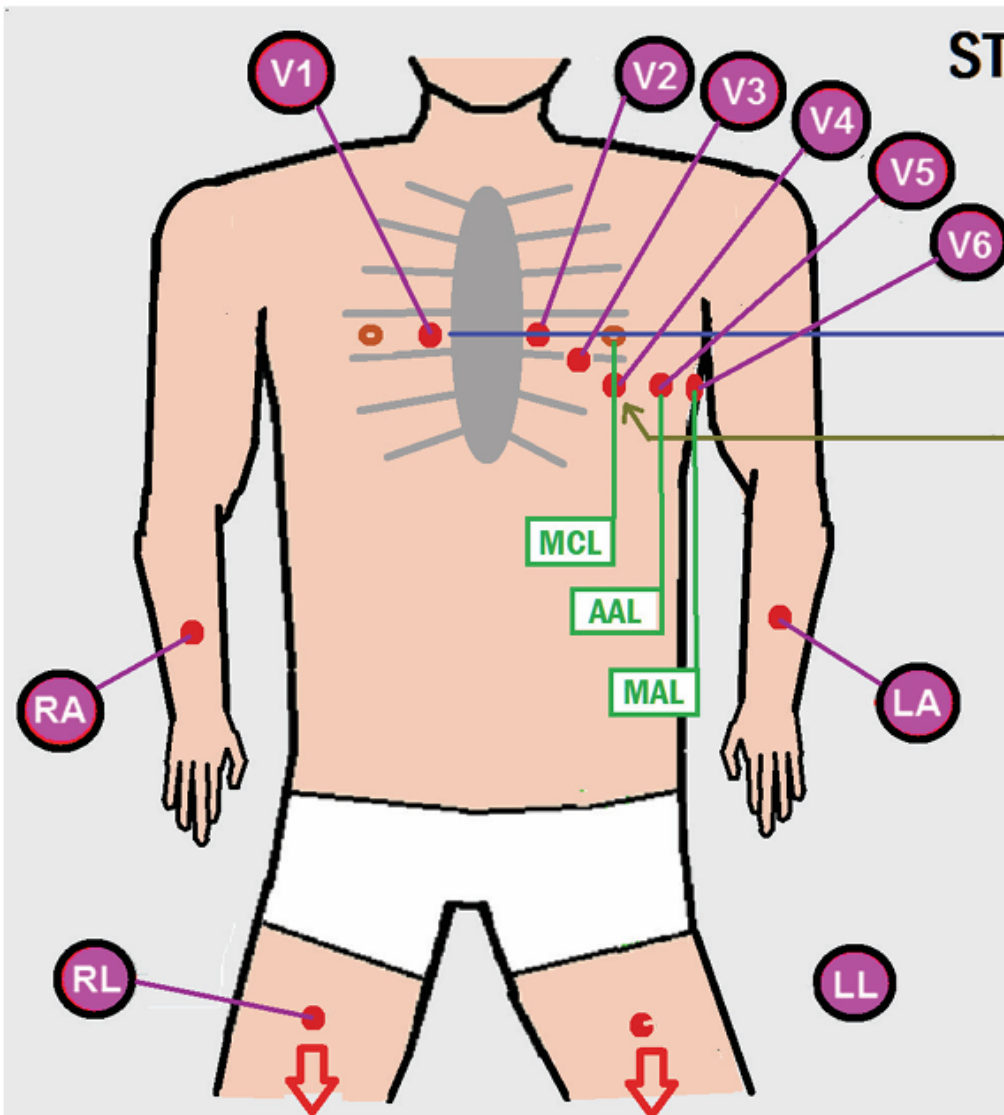


**CURRENT MOVING  
AWAY FROM  
THE EYE  
( POSITIVE ELECTRODE )**



**RECORDS A  
"DOWNWARD"  
DEFLECTION**

## GUIDELINES FOR OBTAINING 12 LEAD ECG:



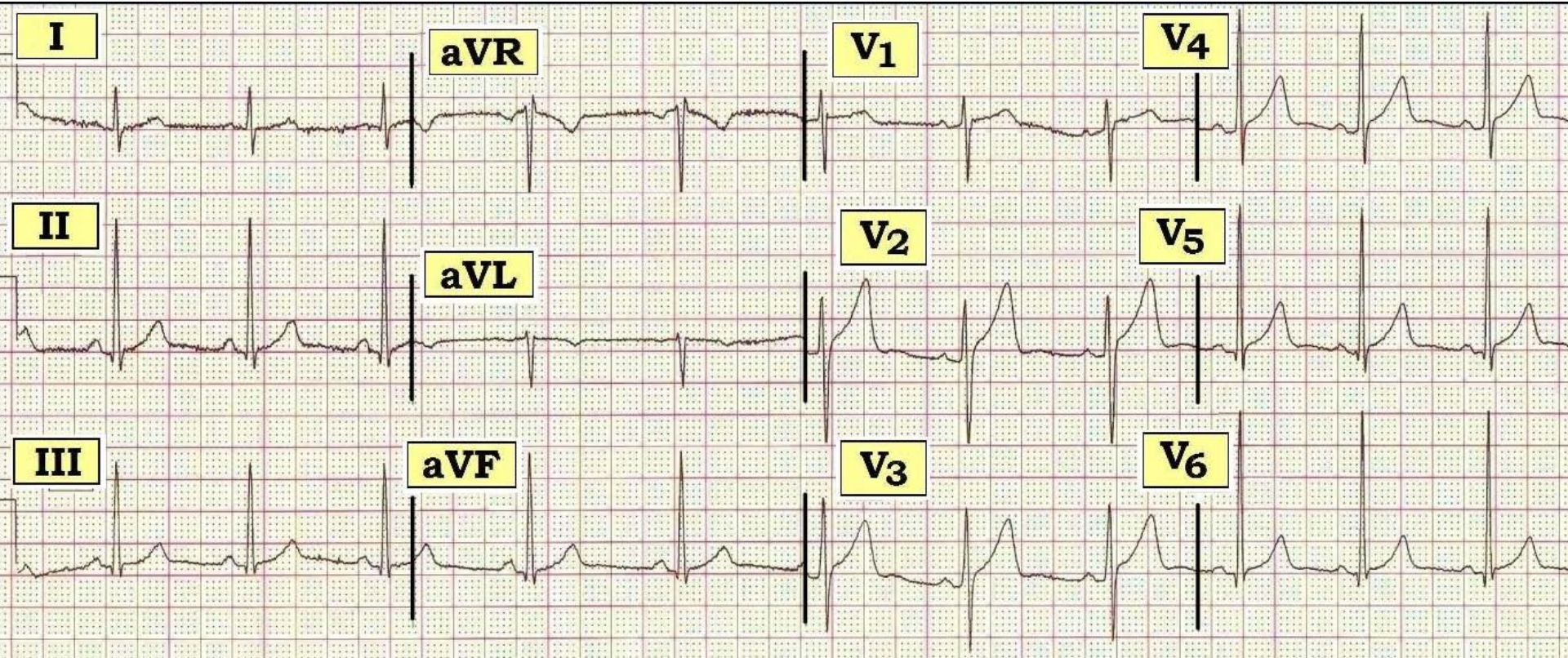
### STANDARD LEAD PLACEMENT --- 12 LEAD ECG

4 th INTERCOSTAL SPACE

V4 is at 5th INTERCOSTAL SPACE. V5 & V6 are on the SAME HORIZONTAL PLANE.

- PATIENT SHOULD LAY AS FLAT AS POSSIBLE
- LIMB LEADS SHOULD BE PLACED AS DISTALLY AS POSSIBLE

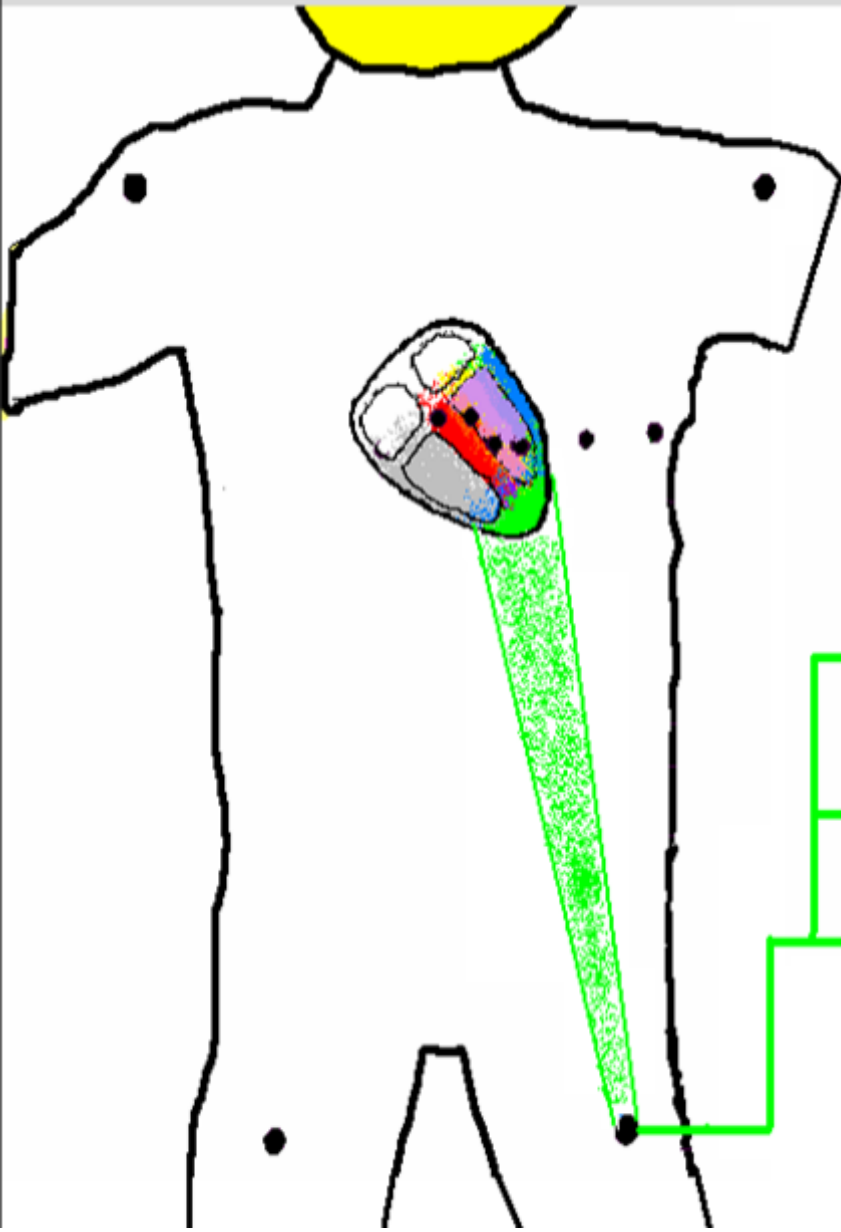
# Normal 12 Lead ECG



(stolen off the internet, lol)!

# LEADS II, III, and aVF VIEW

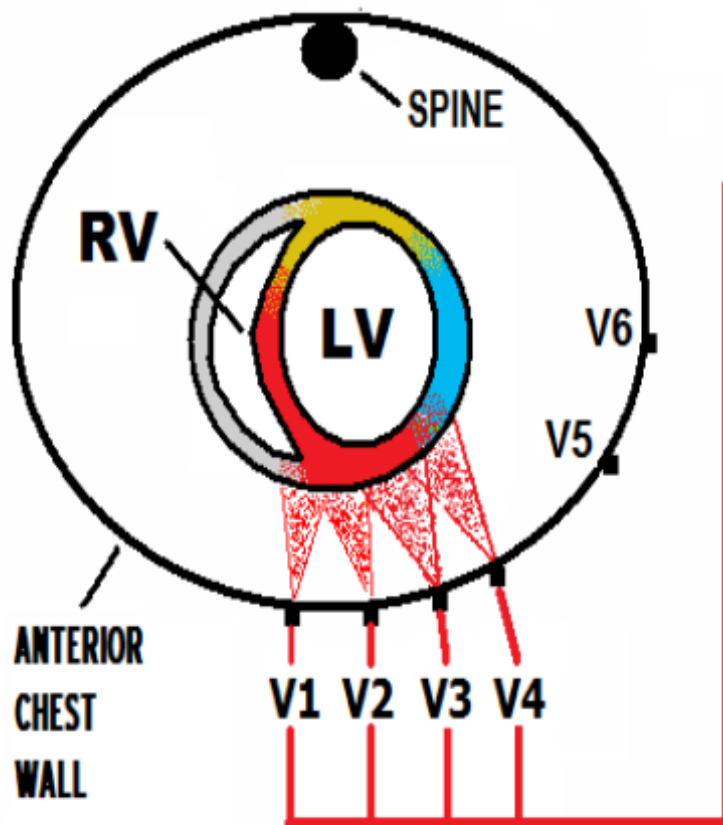
## INFERIOR WALL of the LEFT VENTRICLE



RUPPERT, WAYNE		ID: 7445683659	05-OCT-2006	JOHNS-HOPKINS UNIV.
38 Yrs		Vent. Rate: 68	NORMAL SINUS RHYTHM	
MALE		P-R Int.: 160 ms	Normal EKG	
		QRS: 100 ms	Very Healthy Athletic EKG !	
I	AVR	V1	V4	
II	AVL	V2	V5	
III	AVF	V3	V6	

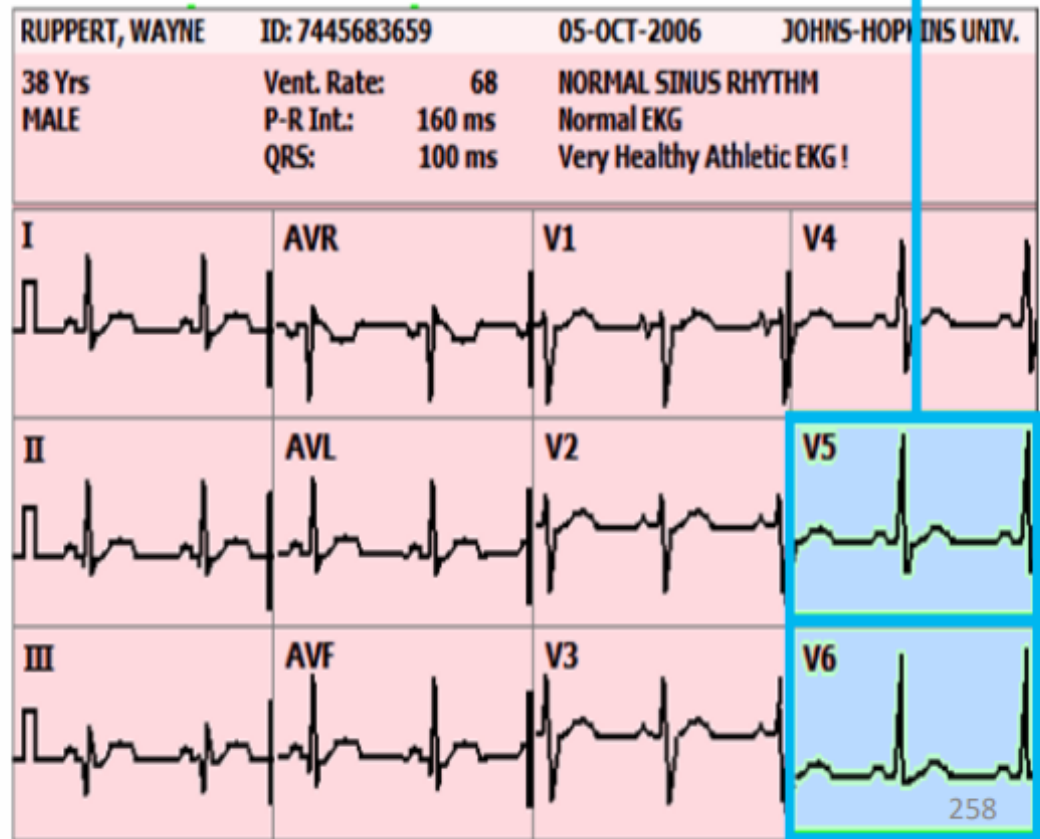
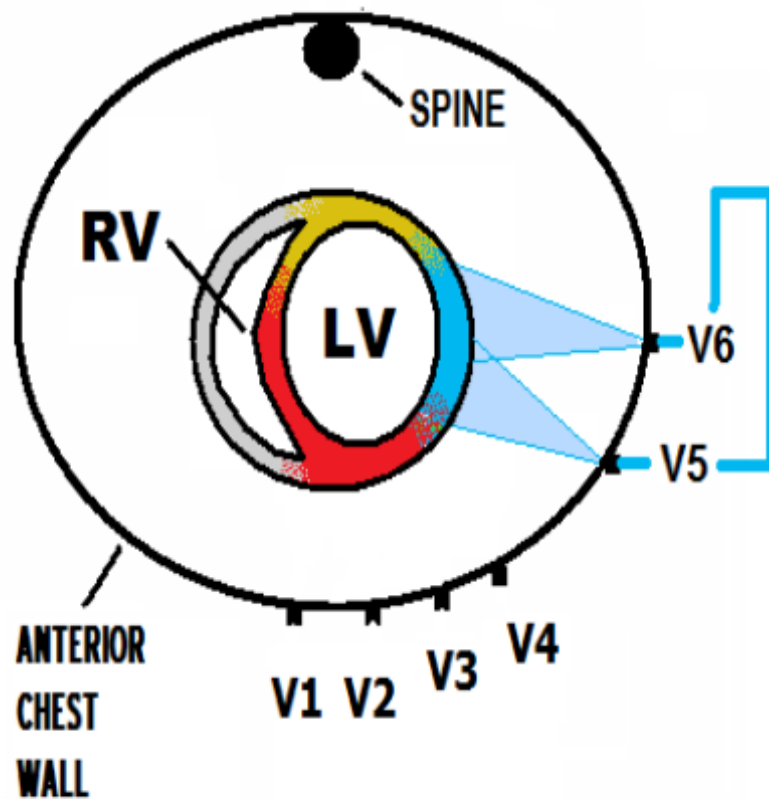
# V1 - V4 VIEW THE ANTERIOR-SEPTAL WALL of the LEFT VENTRICLE

V1, V2 - ANTERIOR / SEPTAL  
V3, V4 - ANTERIOR

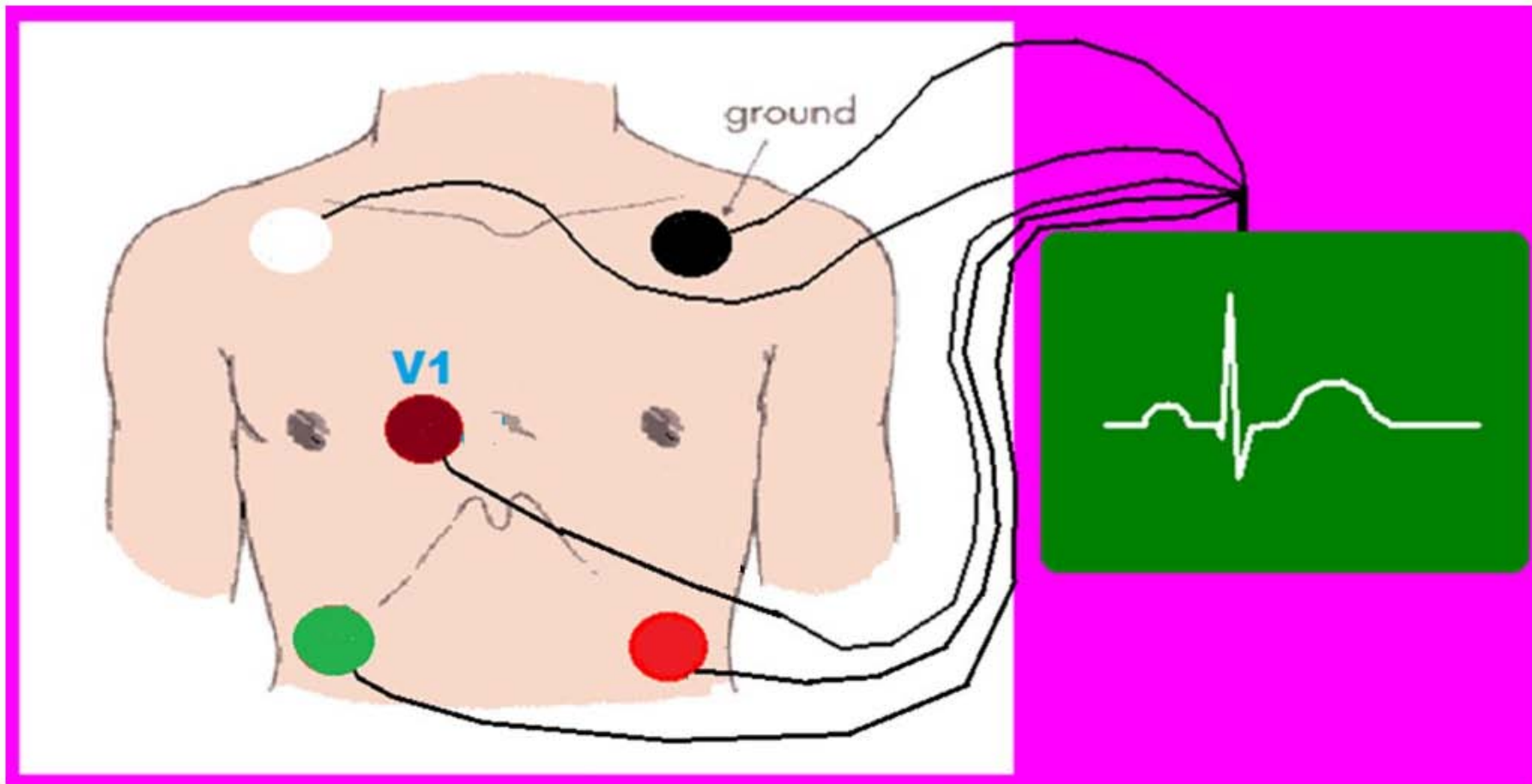


RUPPERT, WAYNE		ID: 7445683659	05-OCT-2006	JOHNS-HOPKINS UNIV.
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III	AVF	V3	V6	

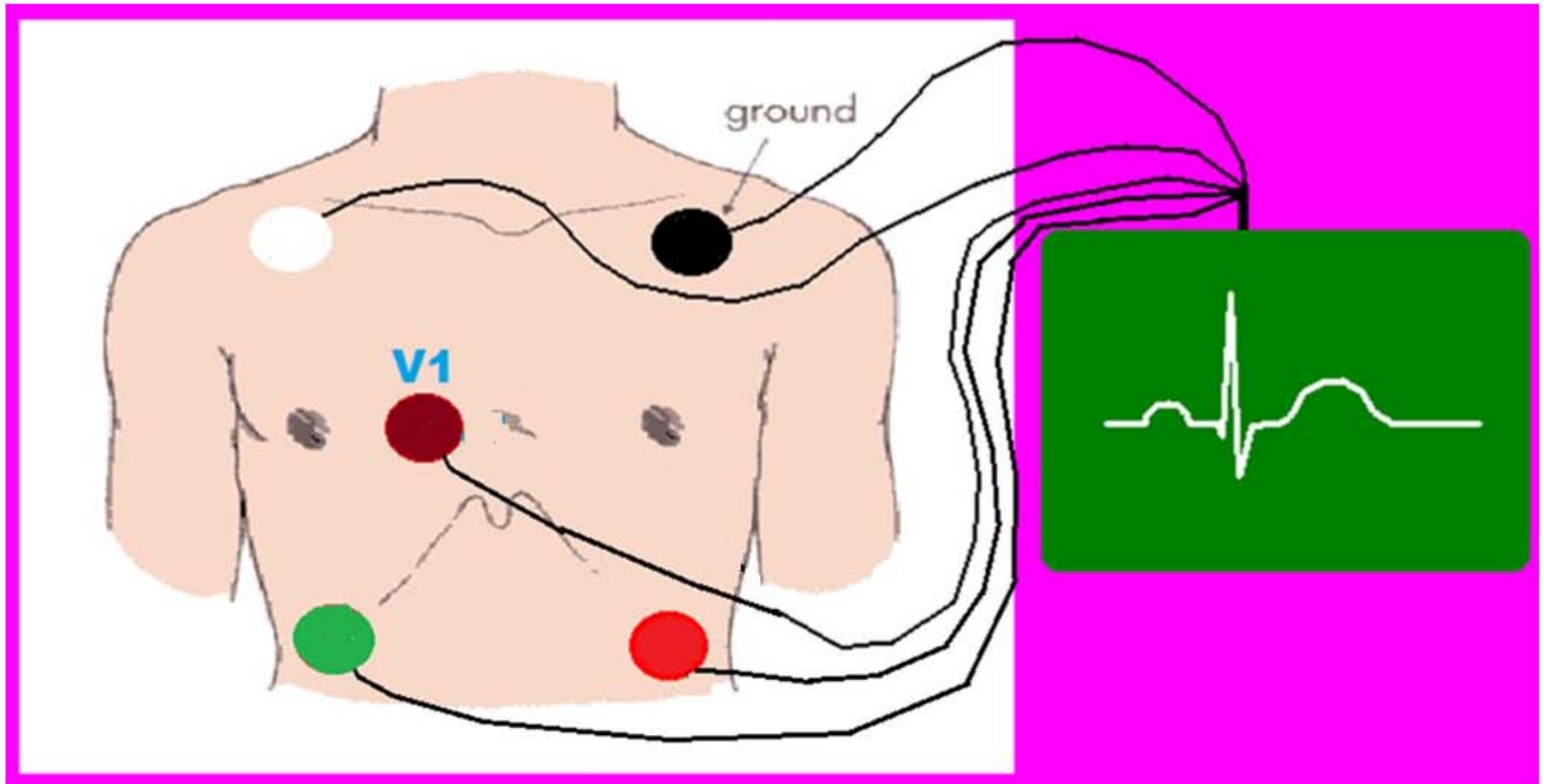
# V5 - V6 VIEW THE LATERAL WALL of the LEFT VENTRICLE



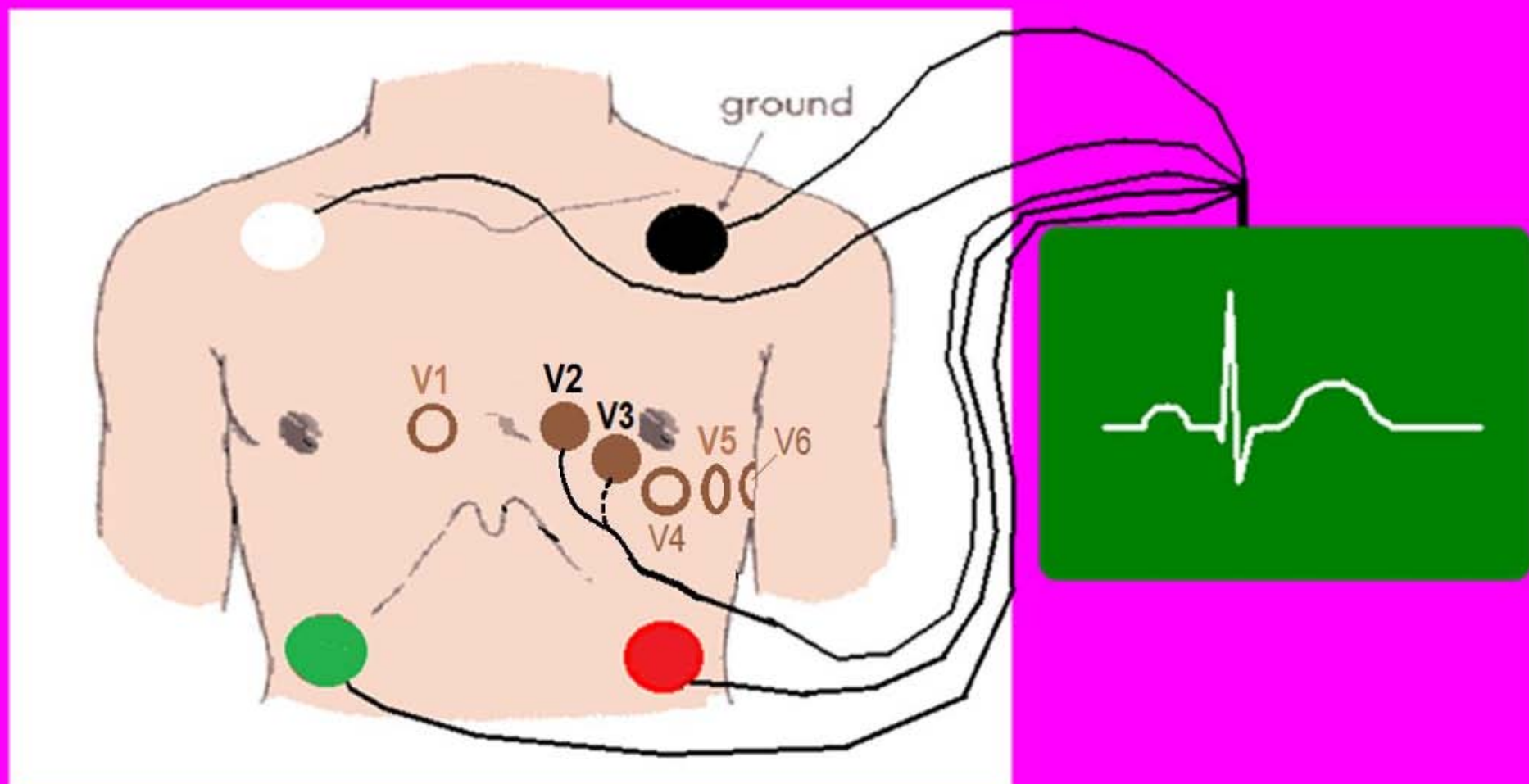
# TRADITIONAL 5 LEAD ECG CONFIGURATION



HOWEVER . . . . SCIENCE HAS  
DETERMINED IT'S NOT THE BEST...

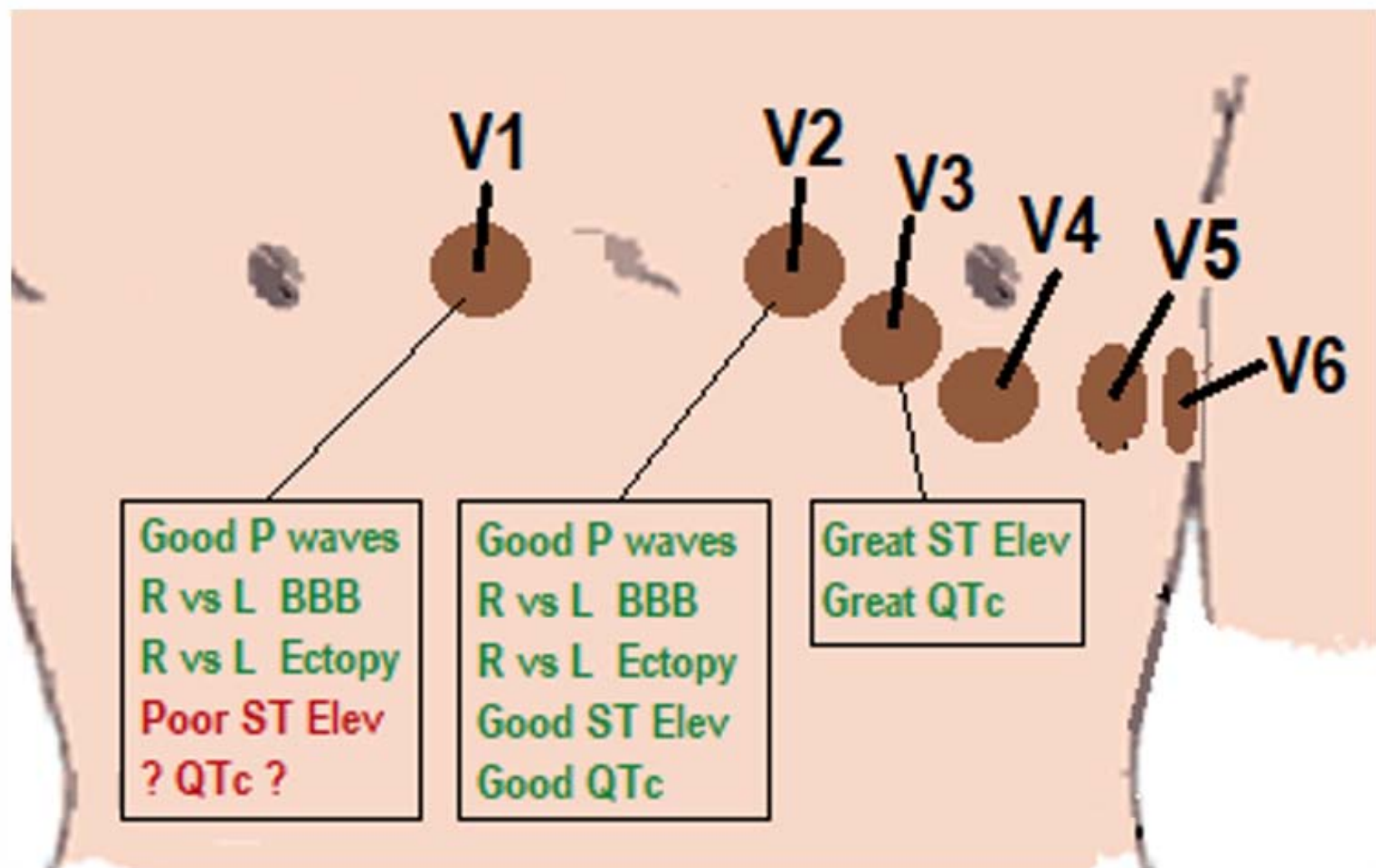


# LEAD PLACEMENT

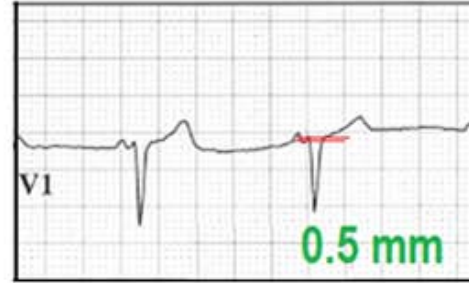


**5 WIRE TELEMETRY UNIT**

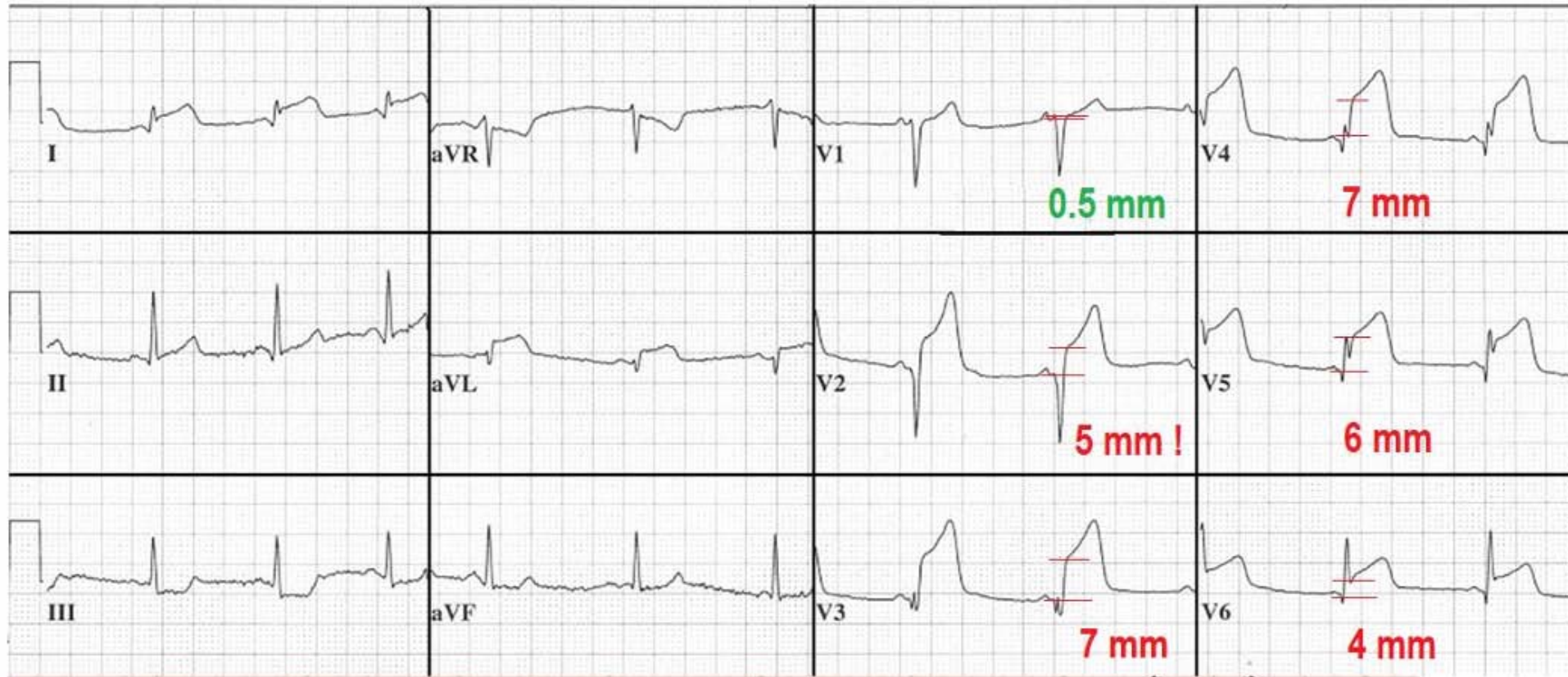
# Lead V2 – GOOD Choice.....



# *Why not V1 ?*

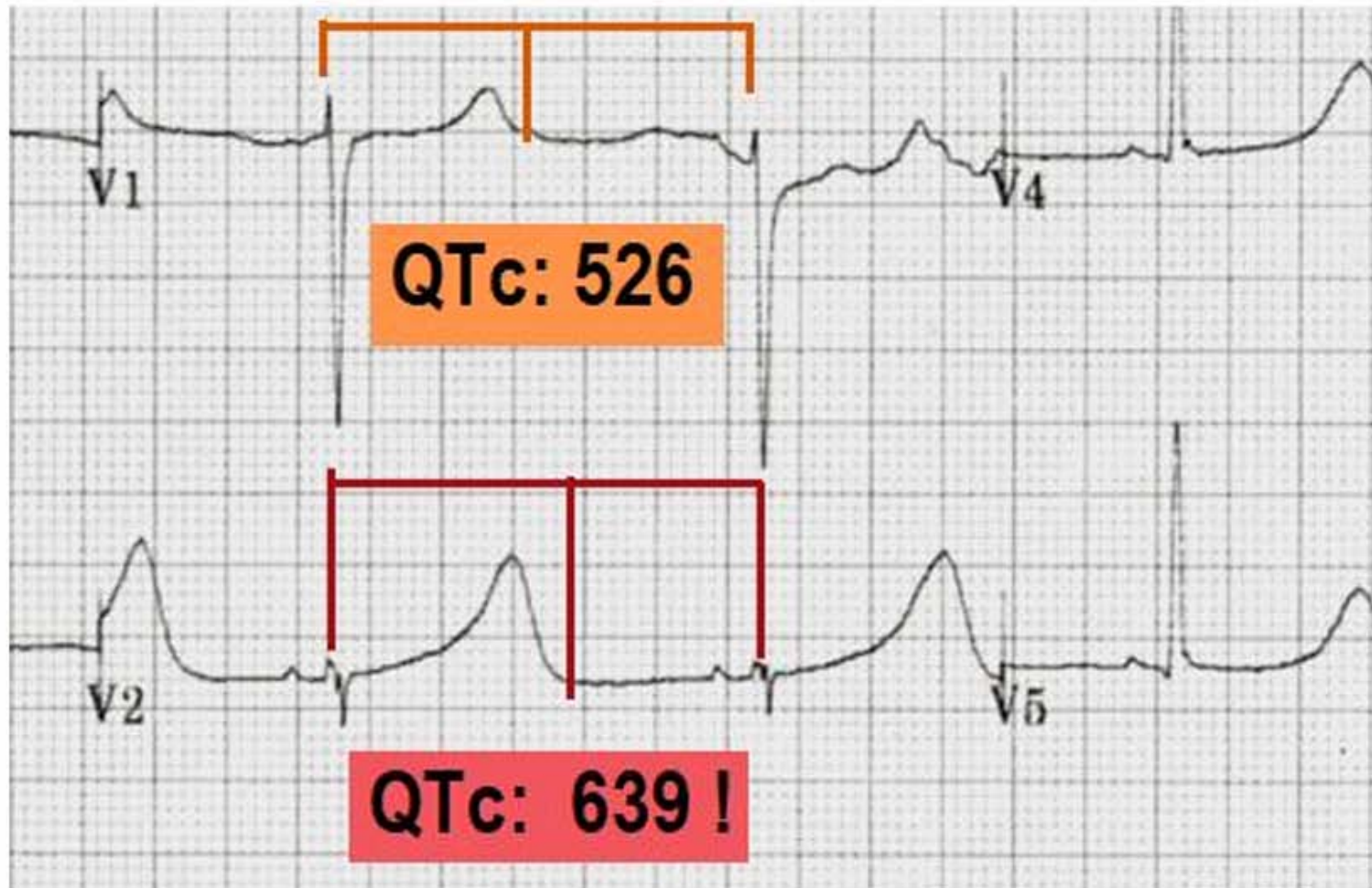


# Why not V1 ? *(often won't see STEMI !)*



If you were only monitoring Leads II and V1, you **would NOT detect this patient's STEMI !!**

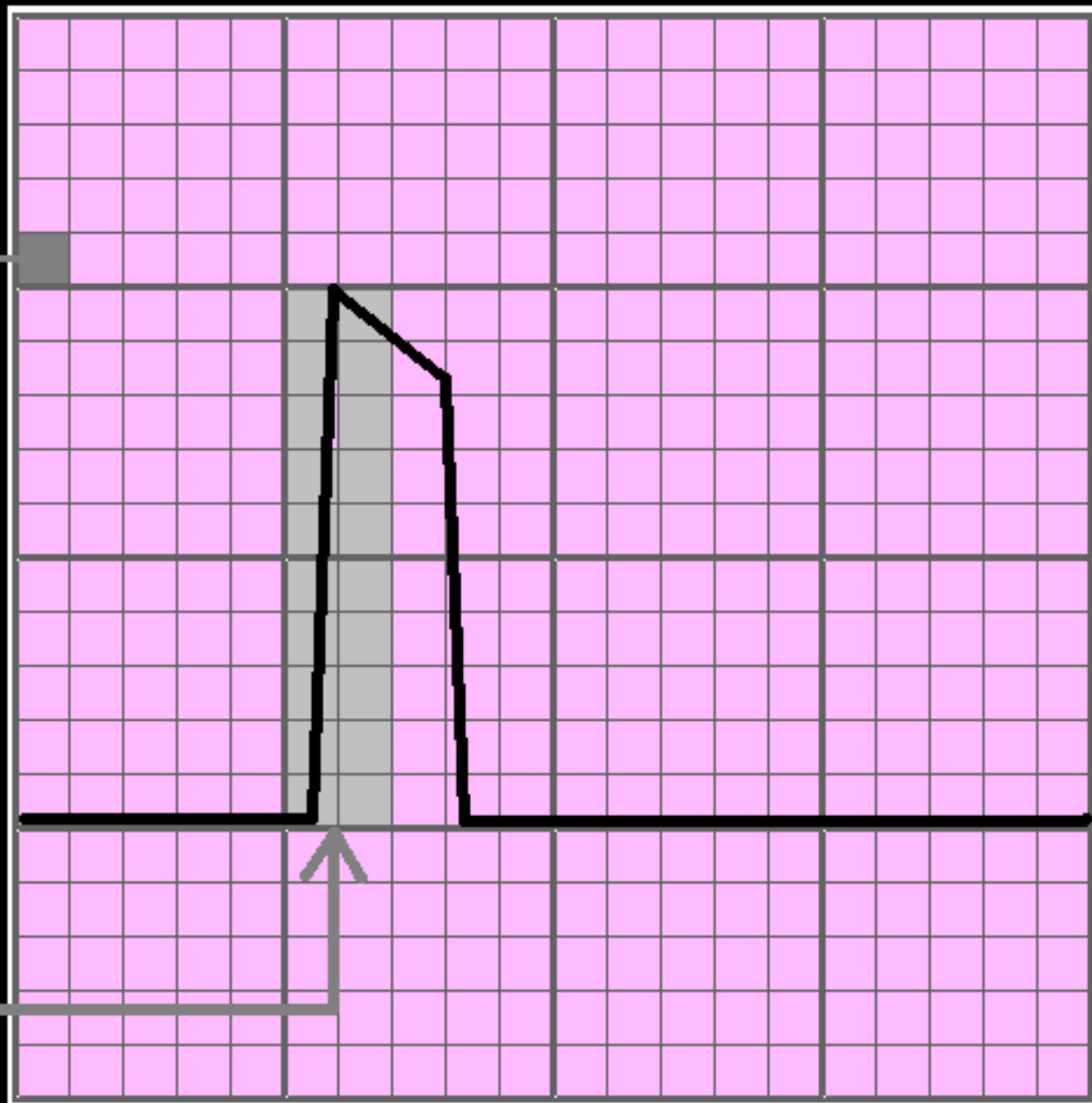
# Why not V1 ? *(may not detect critical QTc)*





# EKG PAPER - THE VERTICAL AXIS:

- SMALL BOXES = 1mm SQUARES
- THE VERTICAL AXIS REPRESENTS AMPLITUDE (VOLTAGE)
- IN VERTICAL DIRECTION, THERE ARE 5 SMALL BOXES IN EACH LARGE (5mm) BOX
- 1 mV CALIBRATION SPIKE = 10 mm



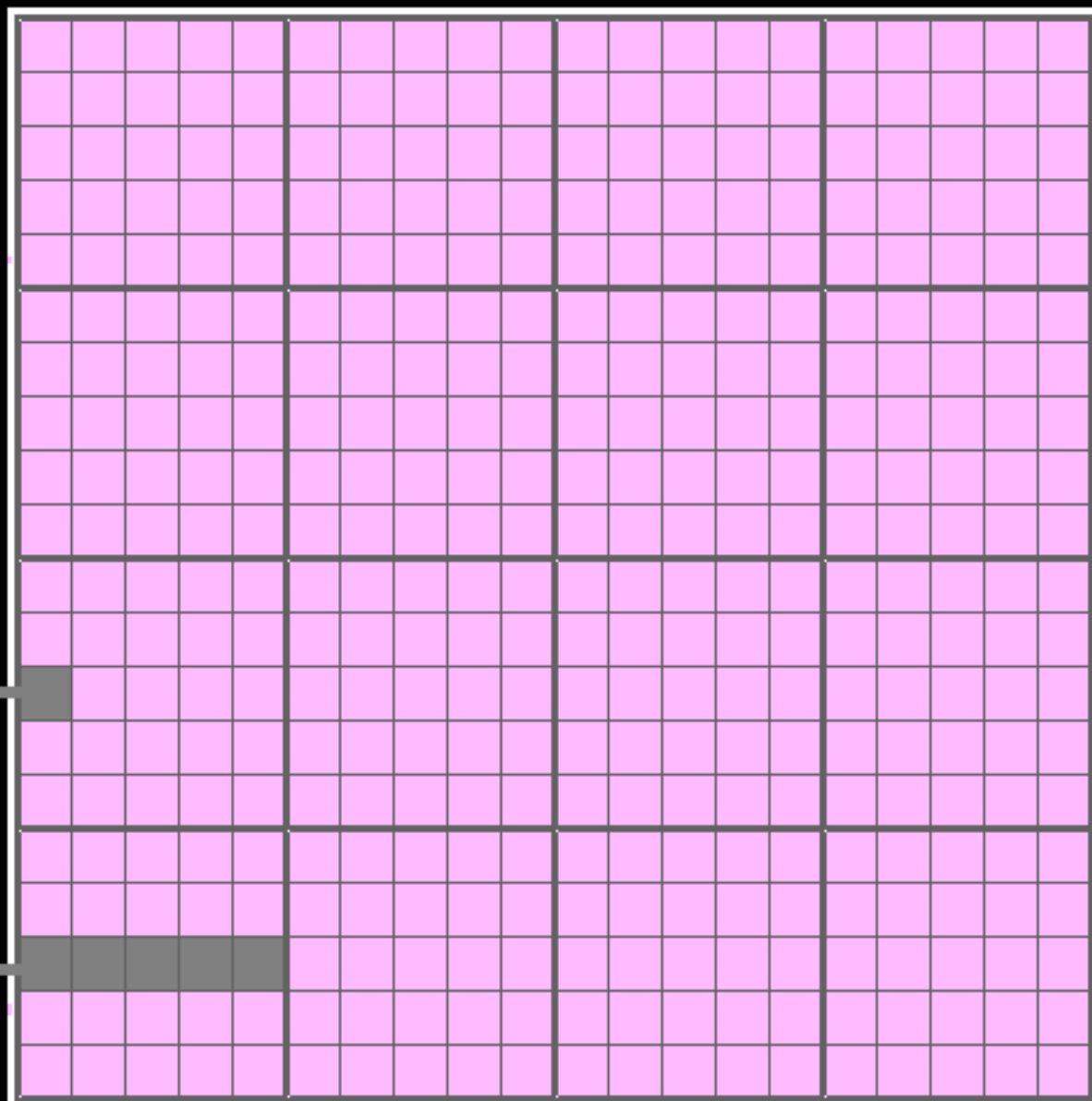
# EKG PAPER - THE HORIZONTAL AXIS:

THE HORIZONTAL  
AXIS REPRESENTS  
TIME . . .

STANDARD SPEED  
FOR RECORDING  
ADULT EKGs =  
25 mm / SECOND

EACH 1mm BOX =  
.04 SECONDS, or  
40 MILLISECONDS  
(40 ms)

5 SMALL BOXES =  
.20 SECONDS, or  
200 MILLISECONDS  
(200 ms)



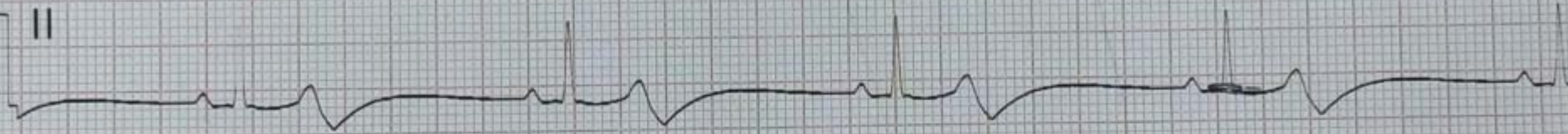
If you're going to use your ECG monitor to evaluate the patient's:

- J Points
- ST Segments
- T Waves

It **MUST** be in the “DIAGNOSTIC” mode

(Not the normal “Monitoring” mode).....

Record ID : 112724092816 27Nov24 9:30:16 HR:40



ECG DISPLAY — "STANDARD MONITOR"  
PRINTER — " " " "

BIPHASIC T WAVES = " "

x1.0 1-30Hz 25mm/sec

LP158137 000 3306808-007 0D355R0402000R LP1540548428

Record ID : 112724092816 27Nov24 9:30:58 HR:40



SAME PATIENT

PRINTER IN "DSA"



x1.0 .05-40Hz 25mm/sec

LP158137 000 3306808-007 0D355R0402000R LP1540548428

MONITOR mode bandwidth:

1.0 – 30 Hz

DIAGNOSTIC mode bandwidth:

0.5 - 40 Hz

MONITOR mode bandwidth:  
1.0 – 30 Hz

DIAGNOSTIC mode bandwidth:  
0.5 - 40 Hz

 ***A 12 Lead ECG is ALWAYS recorded  
in “DIAGNOSTIC Mode”***



# **ESTABLISH YOUR ROUTINE ECG EVALUATION . . . . .**

- RATE**
- RHYTHM**
- INTERVALS**
- P:QRS RATIO**



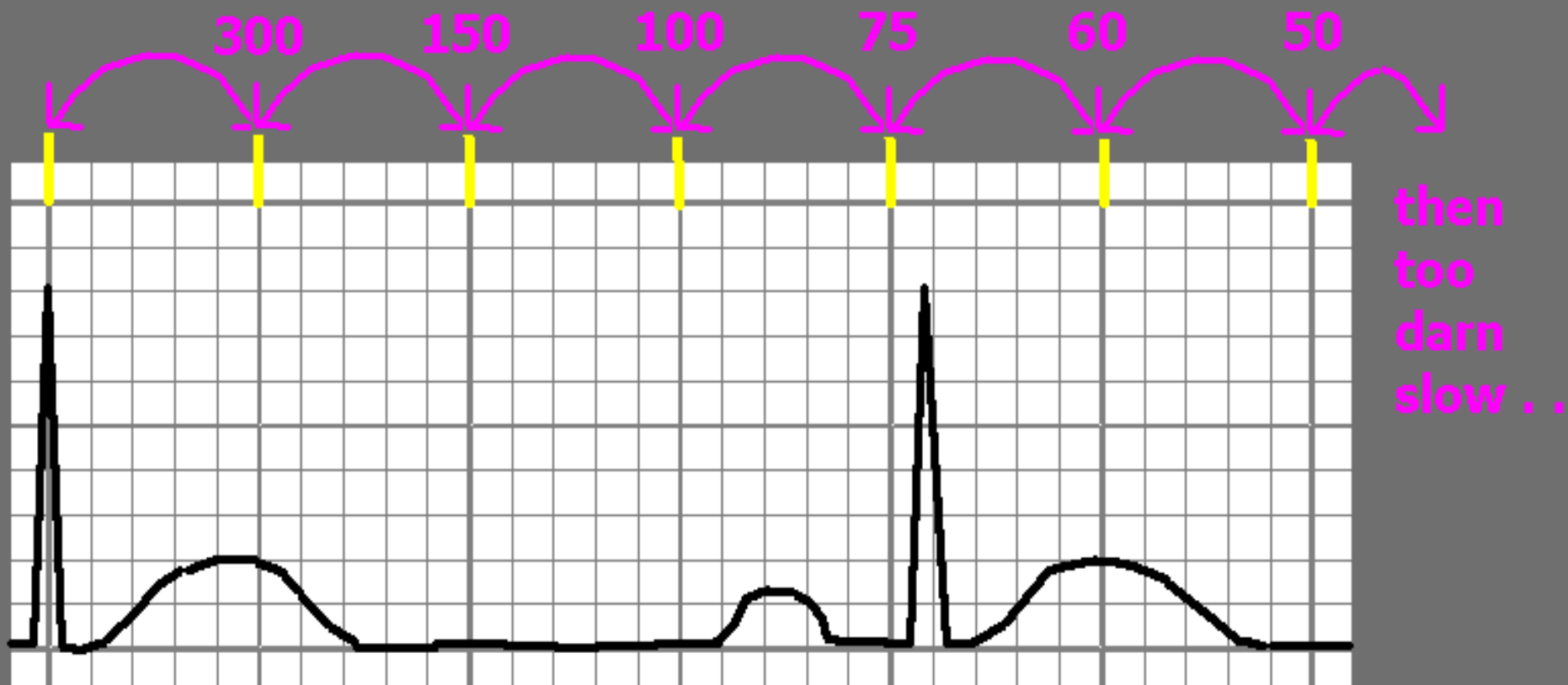
# ESTABLISH YOUR ROUTINE ECG EVALUATION . . . . .



- RATE
- RHYTHM
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- P:QRS RATIO

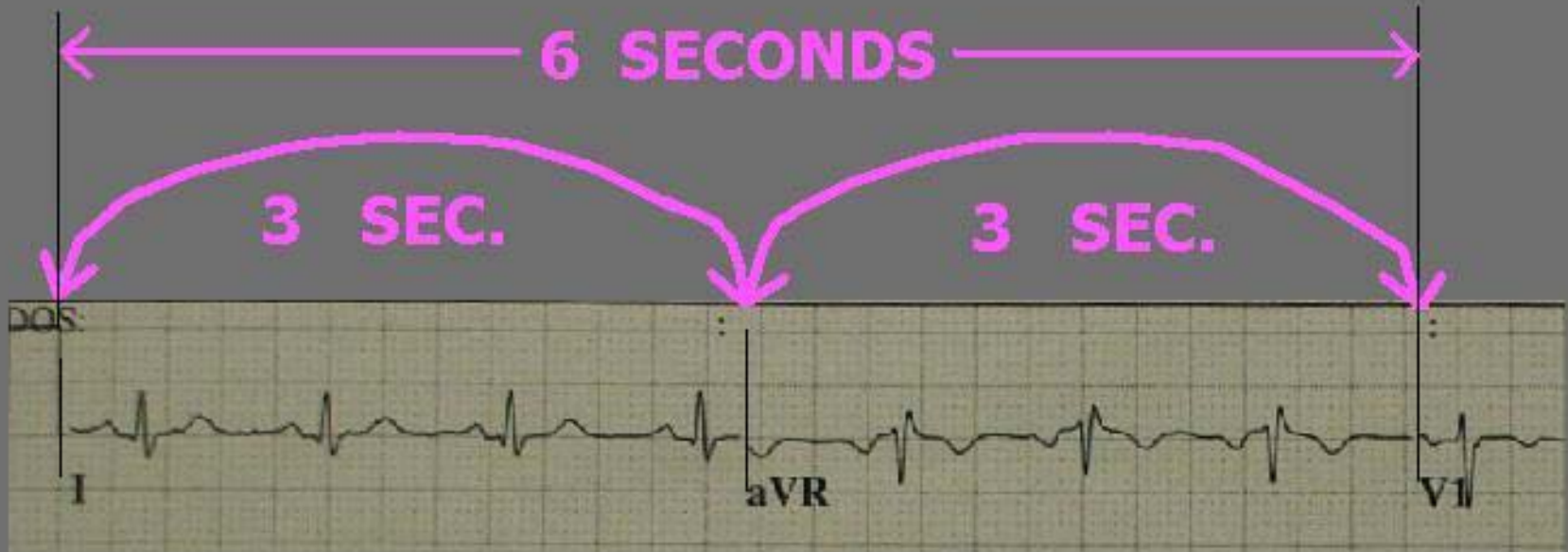
# DETERMINE HEART RATE

## METHOD 1: (regular rhythm)



# DETERMINE HEART RATE:

## METHOD 2:



**HR = 70**

. . . . OR MAKE IT EASY ON YOURSELF  
AND SIMPLY SAY . . . . .

	ID:
Vent. rate	65 bpm
PR interval	192 ms
QRS duration	104 ms
QT/QTc	362/376 ms
P-R-T axes	39 0 23

" HEART RATE IS SIXTY-FIVE ! "

— THE CONCERNS OF ACLS —

IS THE

**VENTRICULAR RATE:**

---

# — THE CONCERNS OF ACLS —

IS THE

**VENTRICULAR RATE:**

---



T O O S L O W

# — THE CONCERNS OF ACLS —

IS THE

**VENTRICULAR RATE:**

---



T O O S L O W



***TOO FAST***

# — THE CONCERNS OF ACLS —

IS THE

**VENTRICULAR RATE:**

---



T O O S L O W



***TOO FAST***



**JUST RIGHT.**

**HEART RATES THAT ARE:**

**BELOW 50 ARE TOO SLOW AND MAY  
CAUSE PATIENT TO BE UNSTABLE**

**50 – 150 JUST RIGHT ! SHOULD NOT  
CAUSE PATIENT TO BE UNSTABLE**

**ABOVE 150 ARE TOO FAST AND MAY  
CAUSE PATIENT TO BE UNSTABLE**



**" There is NO SUCH thing as an  
EP ( heart rate ) emergency . . .**

***If the rate's too slow -- PACE IT***

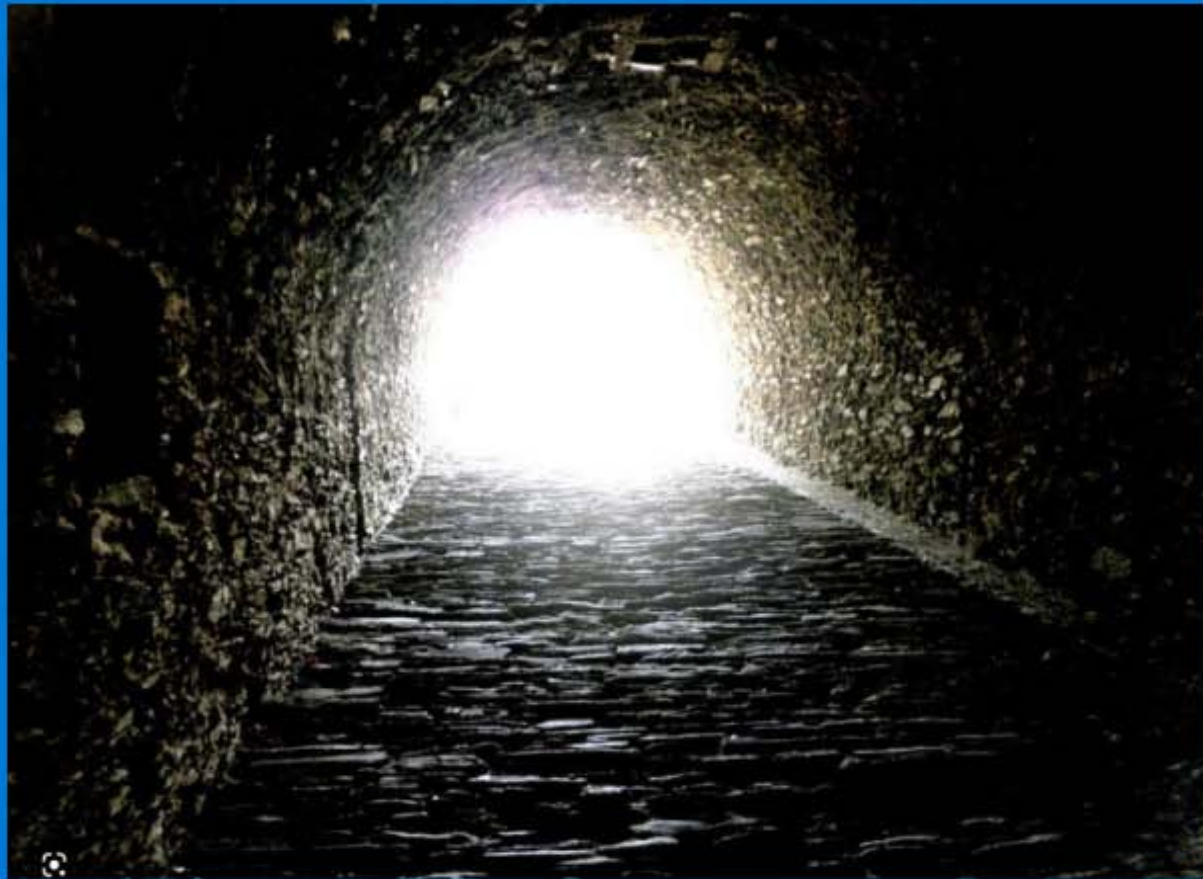
***If the rate's too fast -- SHOCK IT !"***

**Dr. James Irwin  
Electrophysiologist  
St. Joseph's Hospital  
Tampa, Florida**

# SHOCK ASSESSMENT

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

***SHOCK*** is the  
***CORRIDOR*** to ***DEATH***



# SHOCK – FIND CAUSE . . .

- HYPOVOLEMIC (internal or external bleeding)
- OBSTRUCTIVE (PE / tamponade)
- PSYCHOGENIC (sudden fear – self-correcting)
- NEUROLOGICAL (spinal injury)
- INSULIN (hypoglycemia)
- SEPTIC (systemic infection)
- CARDIOGENIC ( abnormal heart rate or contractility)

# SHOCK – FIND CAUSE . . .


- HYPOVOLEMIC (internal or external bleeding)
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- INSULIN (hypoglycemia)
- SEPTIC (systemic infection)
- **CARDIOGENIC** ( abnormal heart rate or contractility)

# CARDIOGENIC SHOCK

- **Ventricular Rate TOO SLOW** or **TOO FAST**
- **ARRHYTHMOGENIC**
- **WEAK PUMPING FUNCTION** (LOW EF < 30%)
  - DEAD HEART TISSUE (CURRENT STEMI and/or OLD DAMAGE FROM PREVIOUS MI)
  - CARDIOMYOPATHY (Pathogens, Infiltrative Disease, etc)
- **STRUCTURAL FAILURE** (typically “heart valve failure,” such as “ACUTE MITRAL VALVE RUPTURE”).



# ESTABLISH YOUR ROUTINE ECG EVALUATION . . . . .

- RATE
-   RHYTHM
- INTERVALS
- P:QRS RATIO

# DETERMINE RHYTHM

" WHEN YOUR R - R INTERVALS . . . "

REGULAR ——— 

" ARE ALWAYS CONSISTENT "

REGULARLY ——— 

IRREGULAR " FOLLOW A PATTERN "

IRREGULARLY - 

IRREGULAR " ARE TOTALLY CHAOTIC "

# DETERMINE RHYTHM

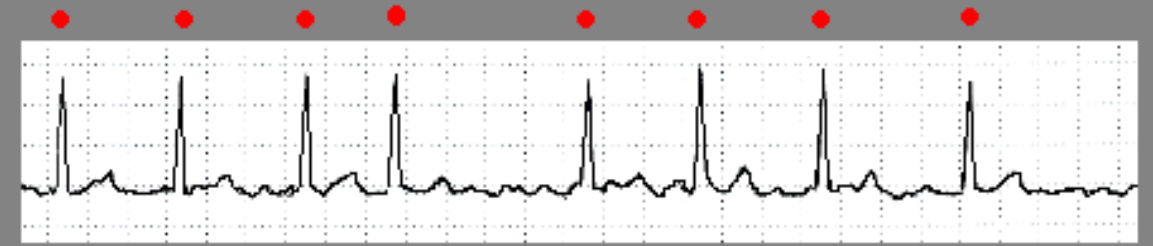
**REGULAR**



**REGULARLY  
IRREGULAR**



**IRREGULARLY  
IRREGULAR**



# DETERMINE RHYTHM

## EXAMPLES :

**REGULAR**

- **SINUS RHYTHM**
- **JUNCTIONAL RHYTHM**
- **VENTRICULAR RHYTHMS**

**REGULARLY  
IRREGULAR**

- **WENCKEBACH**  
(2nd Degree Type I HB)
- **BIGEMINY, TRIGEMINY, etc**

**IRREGULARLY  
IRREGULAR**

- **ATRIAL FIBRILLATION**
- **MULTIFOCAL ATRIAL RHYTHMS**



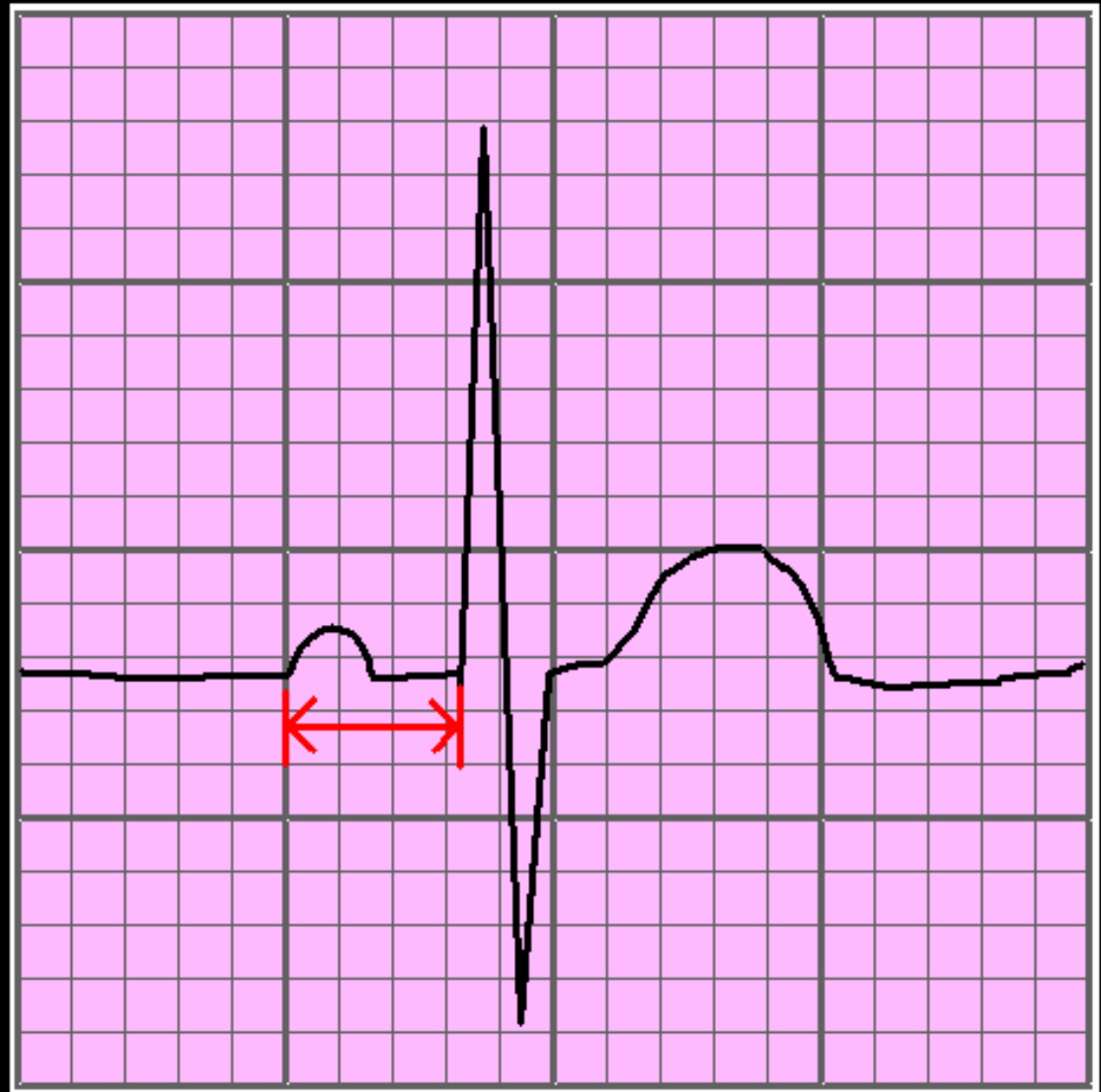
# ESTABLISH YOUR ROUTINE ECG EVALUATION . . . . .

- RATE
- RHYTHM
-   INTERVALS
- P:QRS RATIO

# NORMAL P-R INTERVAL

✓ .12 - .20 sec.  
or  
120 - 200 mSEC.

✓ MUST BE  
CONSISTENT  
FROM BEAT  
TO BEAT !!



**P - R INTERVAL TOO SHORT . . .**  
**LESS THAN 120 mSEC**

**THINK:**

- ECTOPIC ATRIAL ACTIVITY**
- PRE-EXCITATION (WPW)**
- JUNCTIONAL ( nearly on top of QRS,  
possibly inverted )**

**P - R INTERVAL TOO SHORT . . .**  
**LESS THAN 120 mSEC**

**THINK:**

- ECTOPIC ATRIAL ACTIVITY**
- PRE-EXCITATION (WPW)**
- JUNCTIONAL**



**P - R INTERVAL TOO LONG  
GREATER THAN 200 mSEC**

**THINK:**

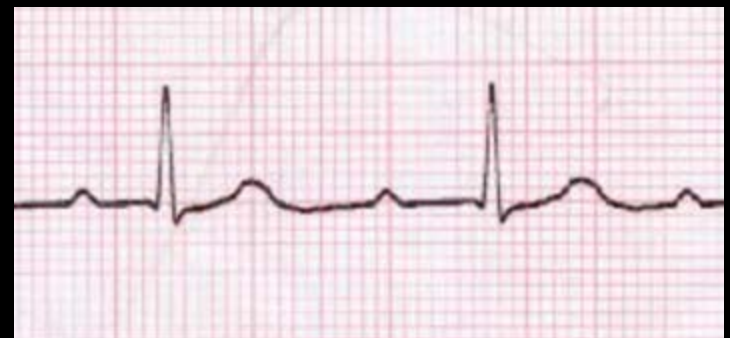
**- HEART BLOCK**

# P - R INTERVAL TOO LONG GREATER THAN 200 mSEC

**THINK:**



**- HEART BLOCK**

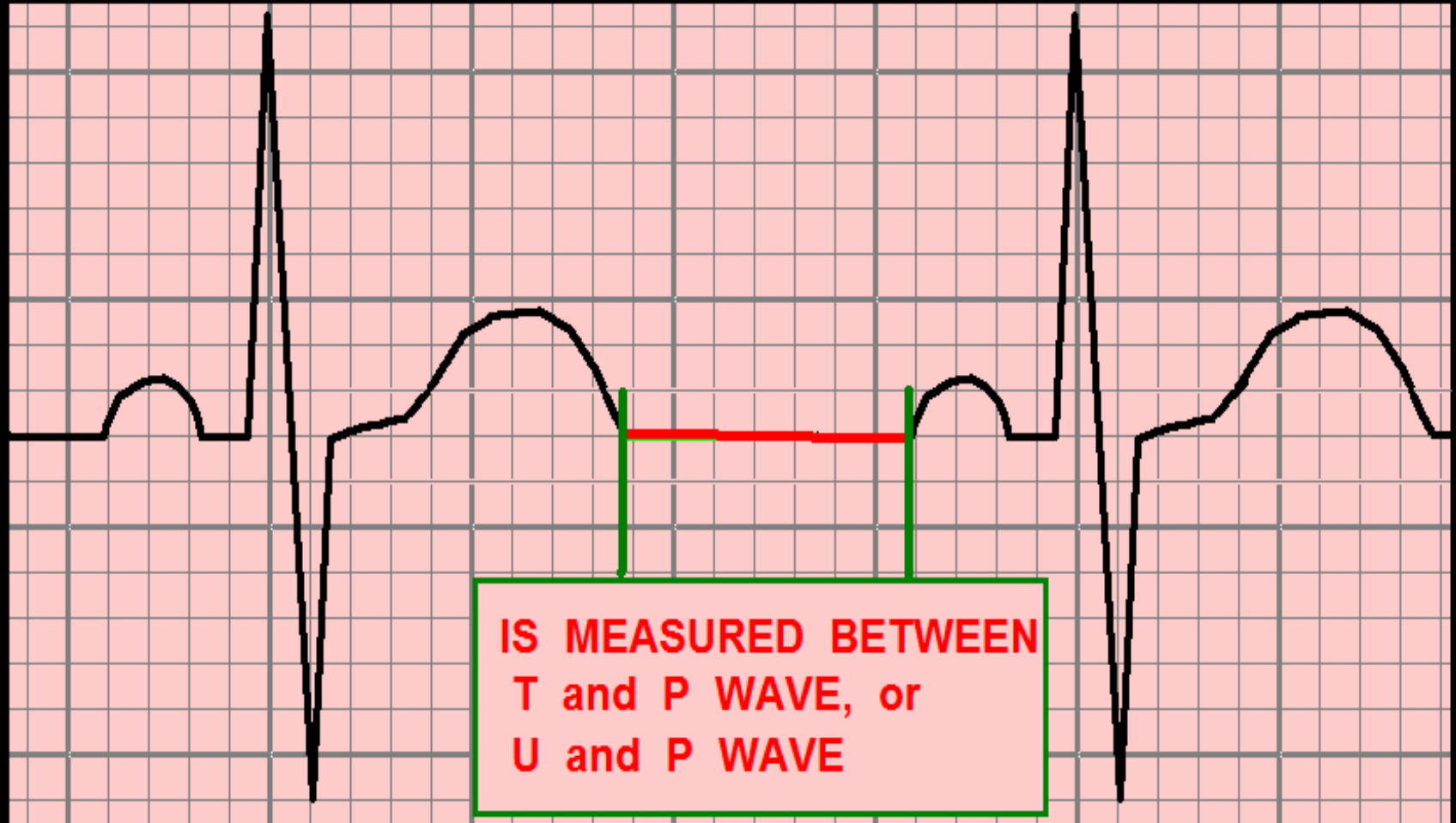


**P - R INTERVAL INCONSISTENT**  
(VARIES FROM BEAT TO BEAT)

**THINK:**

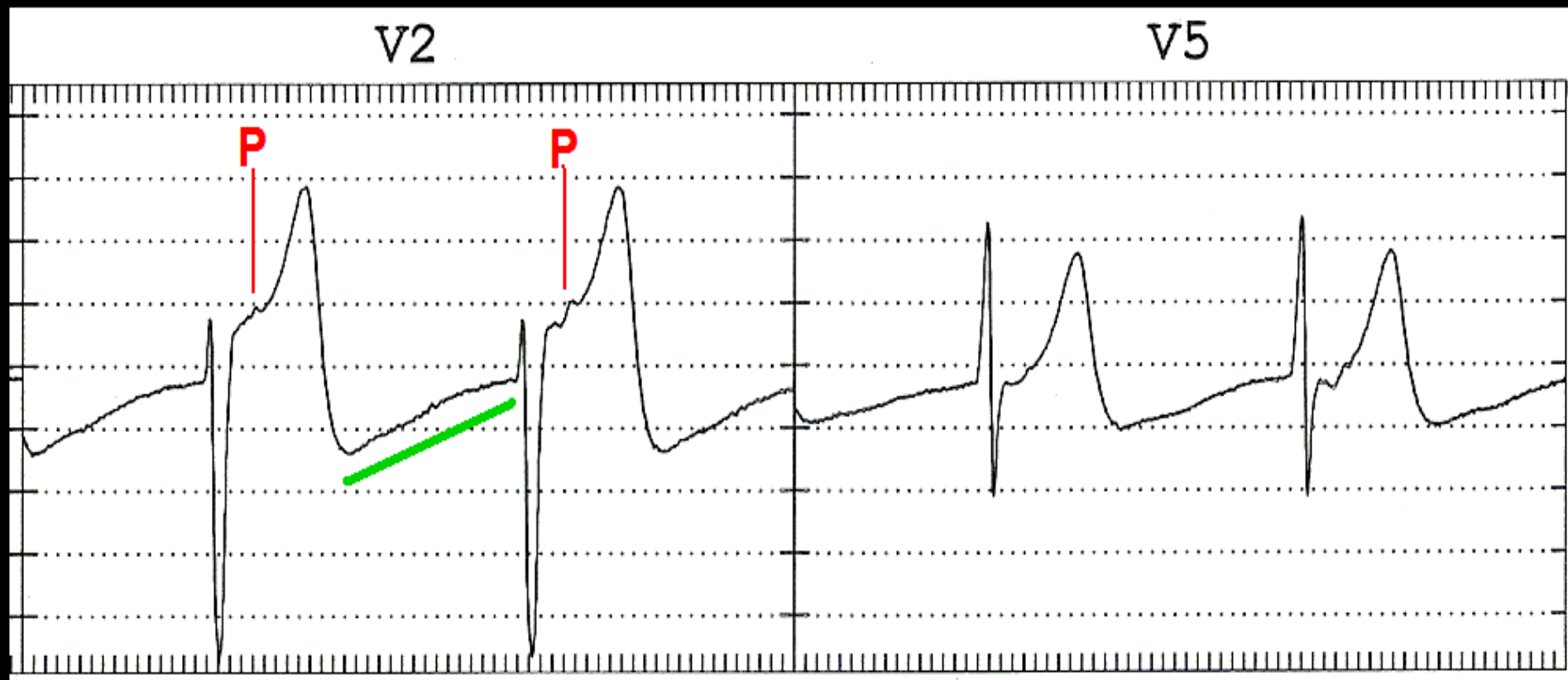
- **2° TYPE 1 HEART BLOCK**  
(WENKEBACH)
- **3° HEART BLOCK**  
(COMPLETE HEART BLOCK)

# THE ISOELECTRIC LINE



# THE ISOELECTRIC LINE

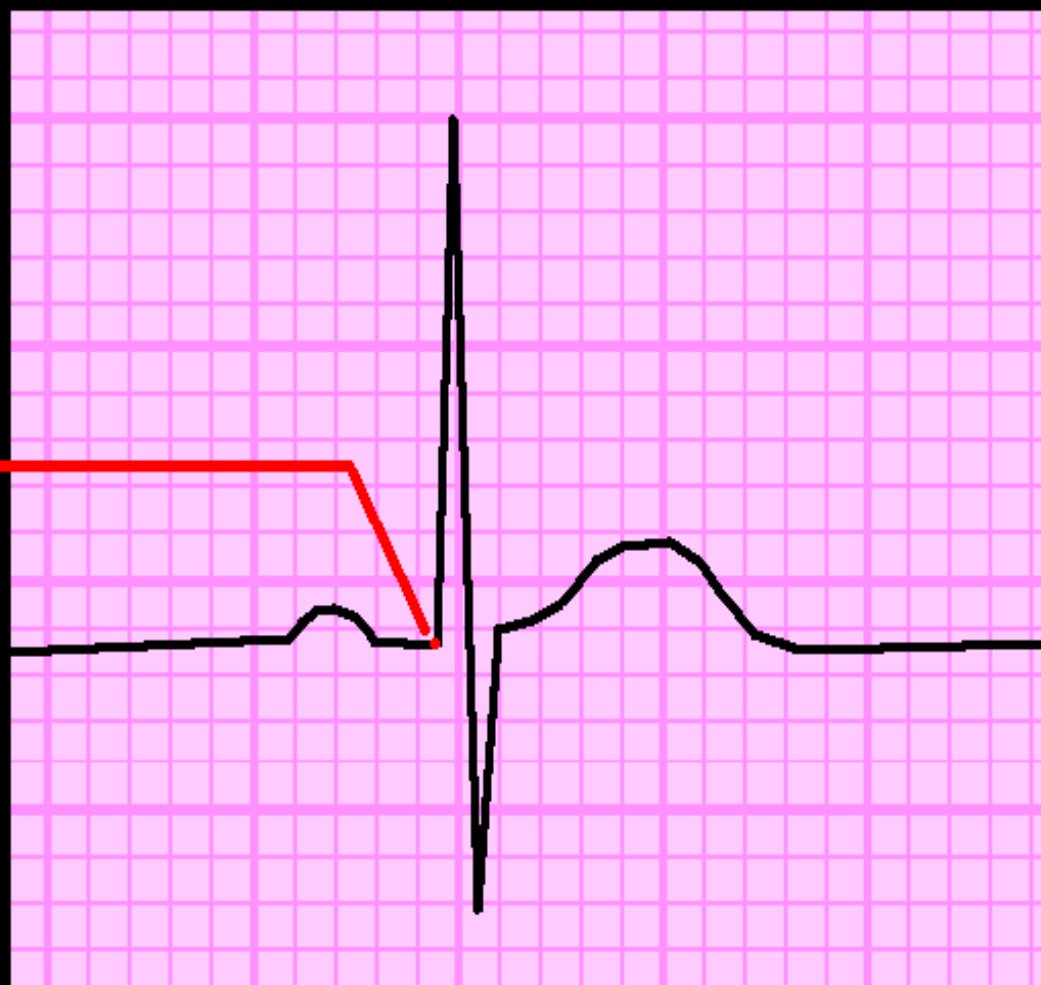
EKG from 13 y/o girl in ACCELERATED JUNCTIONAL RHYTHM.  
note: upsloping T-P interval, and P buried in T waves.



# 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

# QRS INTERVAL

LESS THAN

.12

OR

120 mSEC



**QRS COMPLEX TOO WIDE  
WIDER THAN 120 mSEC**

**THINK:**

- BUNDLE BRANCH BLOCK
- **VENTRICULAR COMPLEX (ES)**
- PACED RHYTHM
- L VENTRICULAR HYPERTROPHY
- **ELECTROLYTE IMBAL. (  $\uparrow K^+$   $\downarrow Ca^{++}$  )**
- DELTA WAVE (PRE-EXCITATION)

When the QRS is TOO WIDE  
( $>3\text{mm}$  -or-  $120\text{ms}$ ) .....

.....it DISTORTS the ECG markers  
we use to identify myocardial:

- ISCHEMIA
- INFARCTION

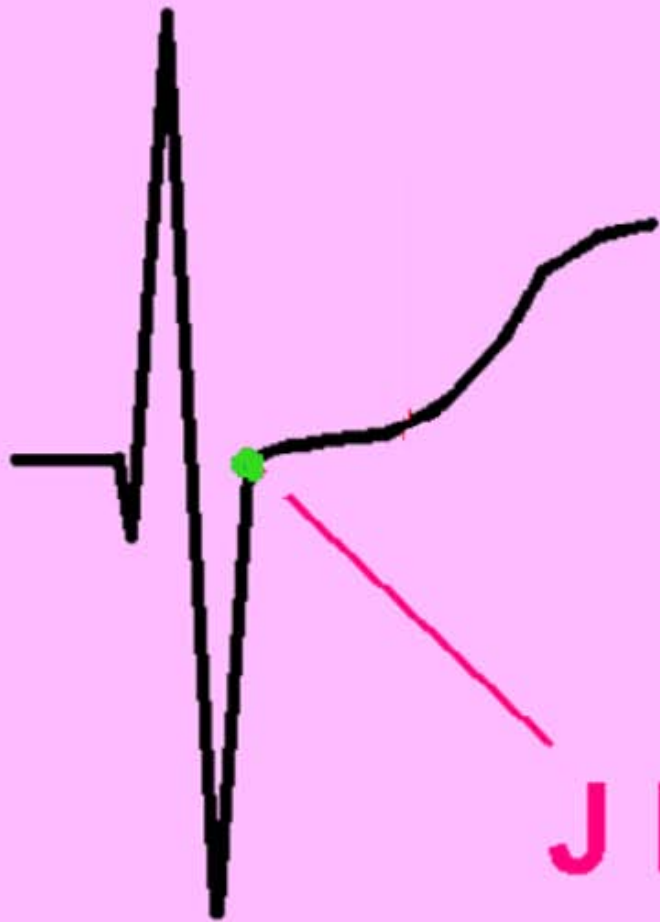
MORE ON THIS TOPIC COMING  
UP in a few minutes.

For now . . . .

“hold that thought” . . . . .

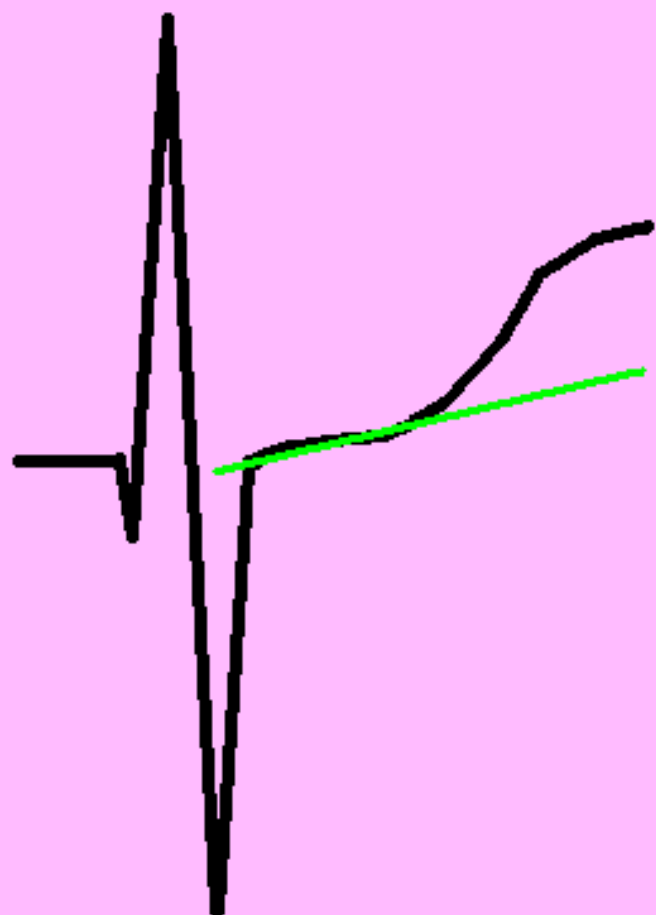
# THE J POINT

is where the QRS complex ends and the S-T Segment begins.



**J POINT**

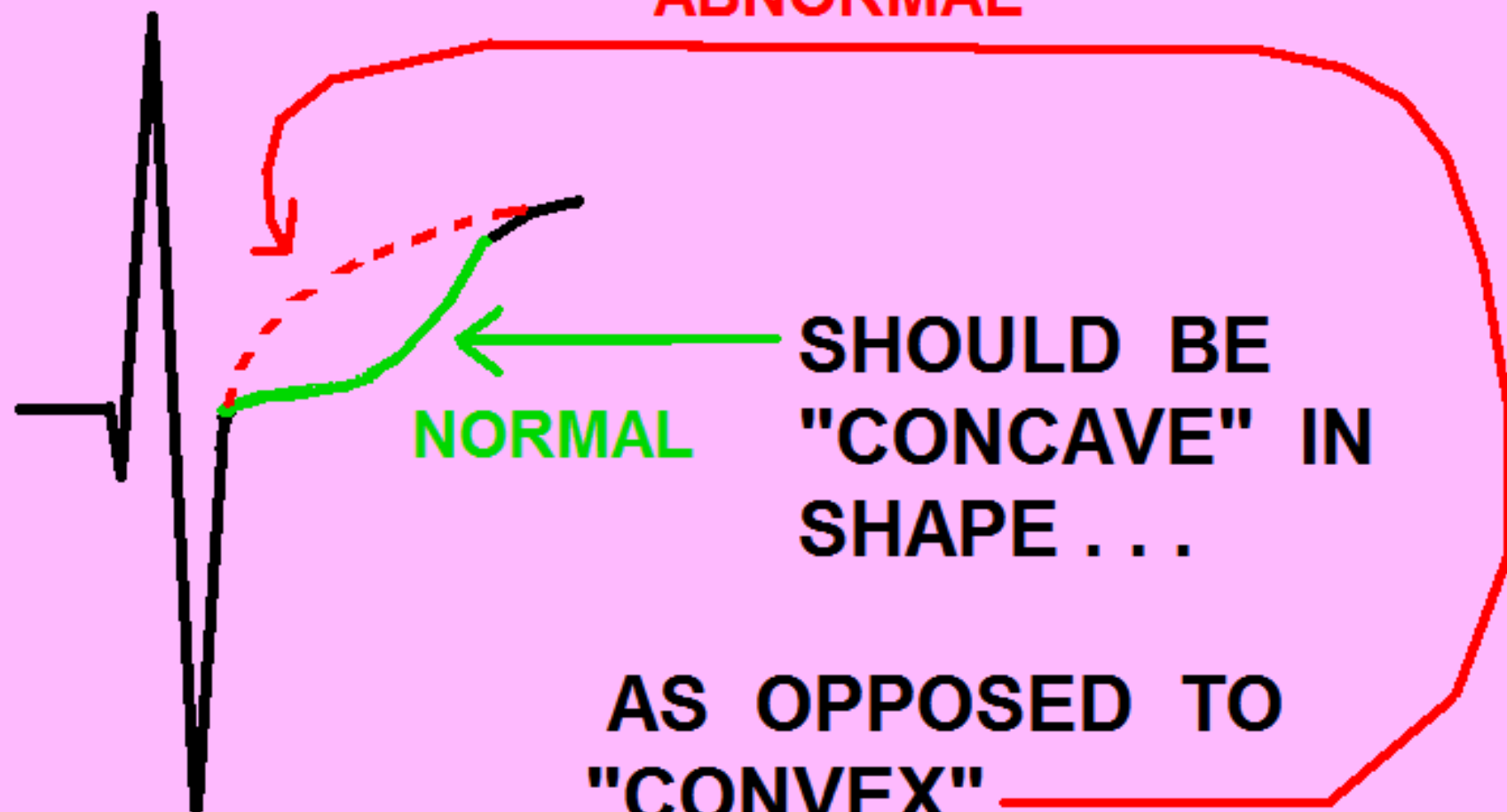
# THE S-T SEGMENT



**SHOULD HAVE  
A "SLIGHT POSITIVE"  
INCLINATION**

# THE S-T SEGMENT

**ABNORMAL**

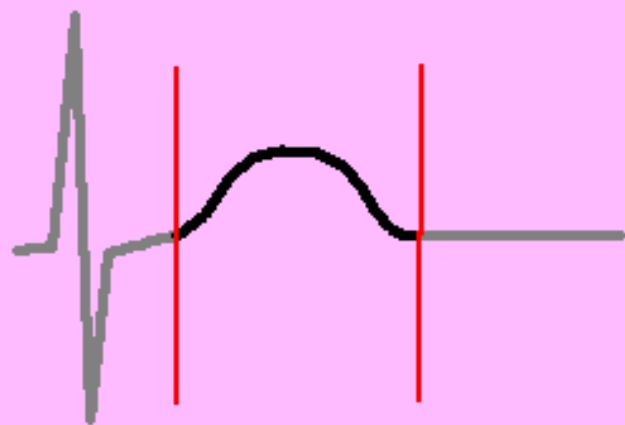


**NORMAL**

**SHOULD BE  
"CONCAVE" IN  
SHAPE . . .**

**AS OPPOSED TO  
"CONVEX"**

# THE T WAVE

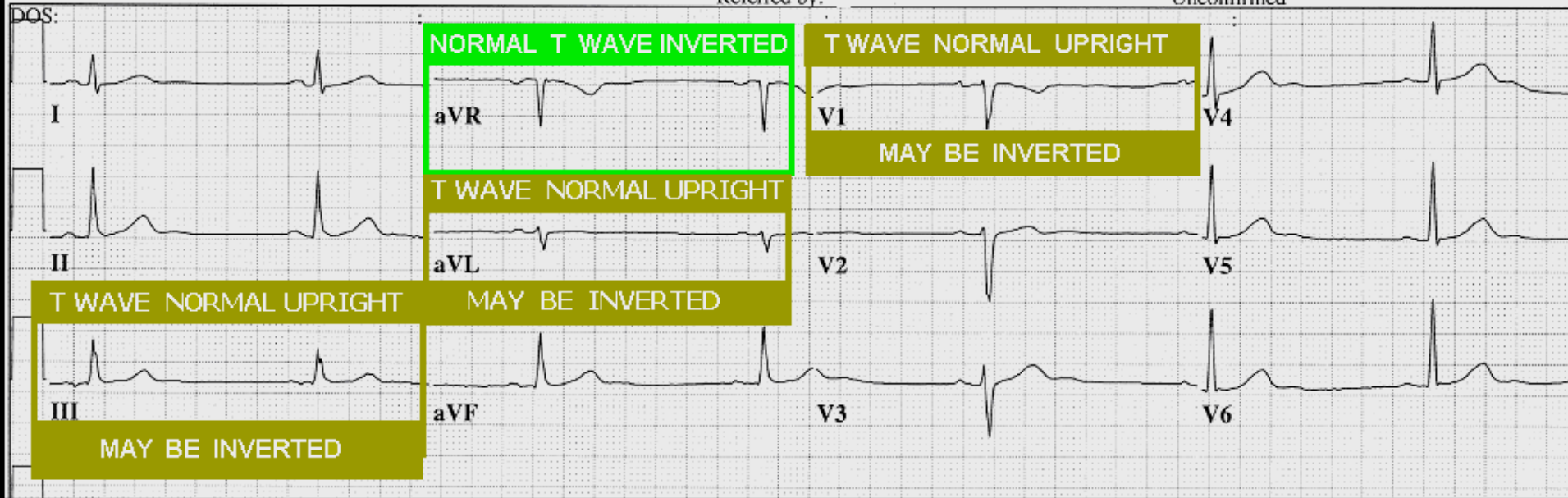


- SHOULD BE A "NICE," ROUNDED, CONVEX SHAPE
- SHOULD BE SYMMETRICAL
- SHOULD BE UPRIGHT IN ALL LEADS, EXCEPT AVR
- MAY BE INVERTED IN LEADS AVL, III, and V1

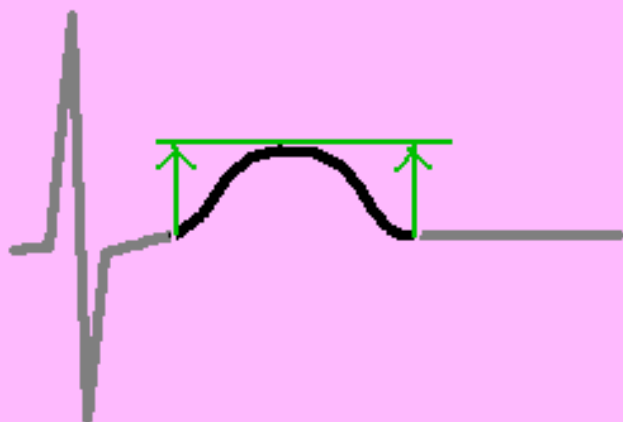
# Leads where the T WAVE may be INVERTED:

Referred by:

Unconfirmed



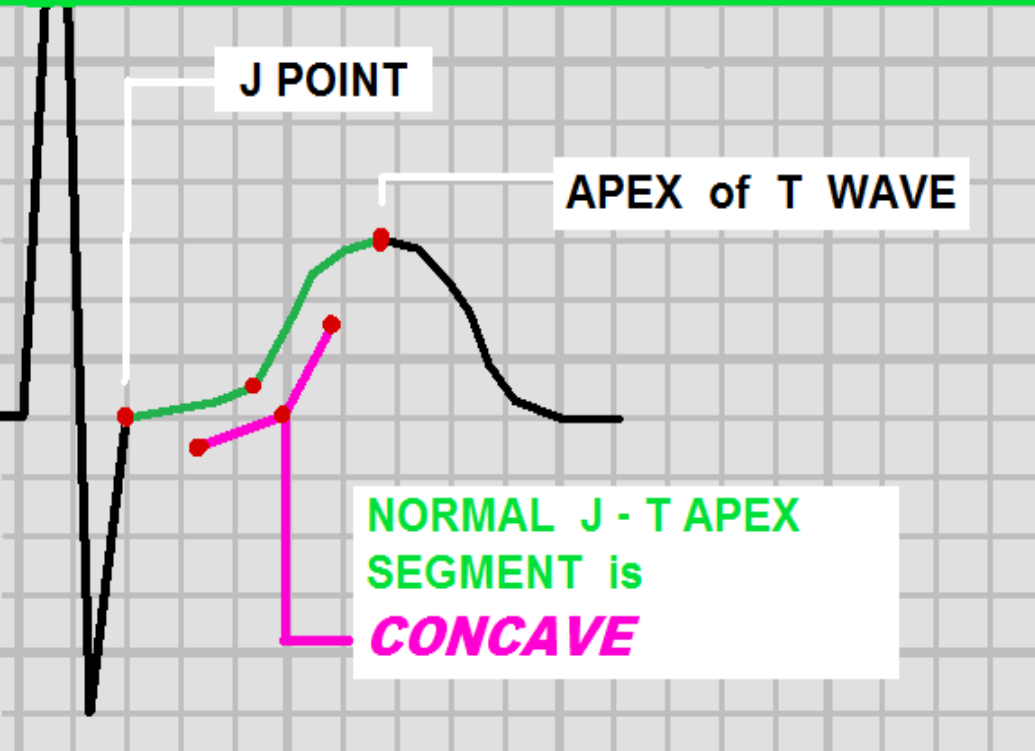
# THE T WAVE



## AMPLITUDE GUIDELINES:

- IN THE LIMB LEADS, SHOULD BE LESS THAN 1.0 mv ( 10 mm )
- IN THE PRECORDIAL LEADS, SHOULD BE LESS THAN 0.5 mv ( 5 mm )
- SHOULD NOT BE TALLER THAN R WAVE IN 2 OR MORE LEADS.

## NORMAL J-T APEX SEGMENT



## J-T APEX SEGMENT CONSISTS OF:

- ST SEGMENT (J POINT - BEGINNING of T WAVE)
- FIRST  $\frac{1}{2}$  OF T WAVE (onset to the APEX of the T wave).

ALL KINDS of  
**WEIRD**

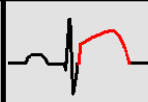
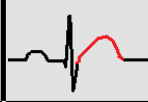
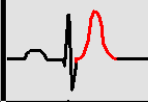
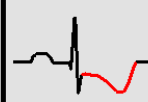
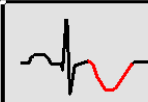
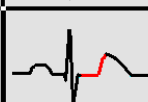
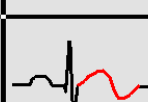
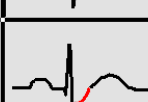
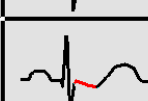
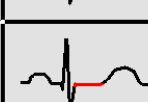

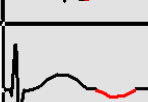
ST SEGMENT and  
T WAVE  
VARIATIONS . . . .

ALL CAN SPELL  
**T-R-O-U-B-L-E.**

“IF IT’S NOT  
NORMAL, it’s  
**ABNORMAL !**

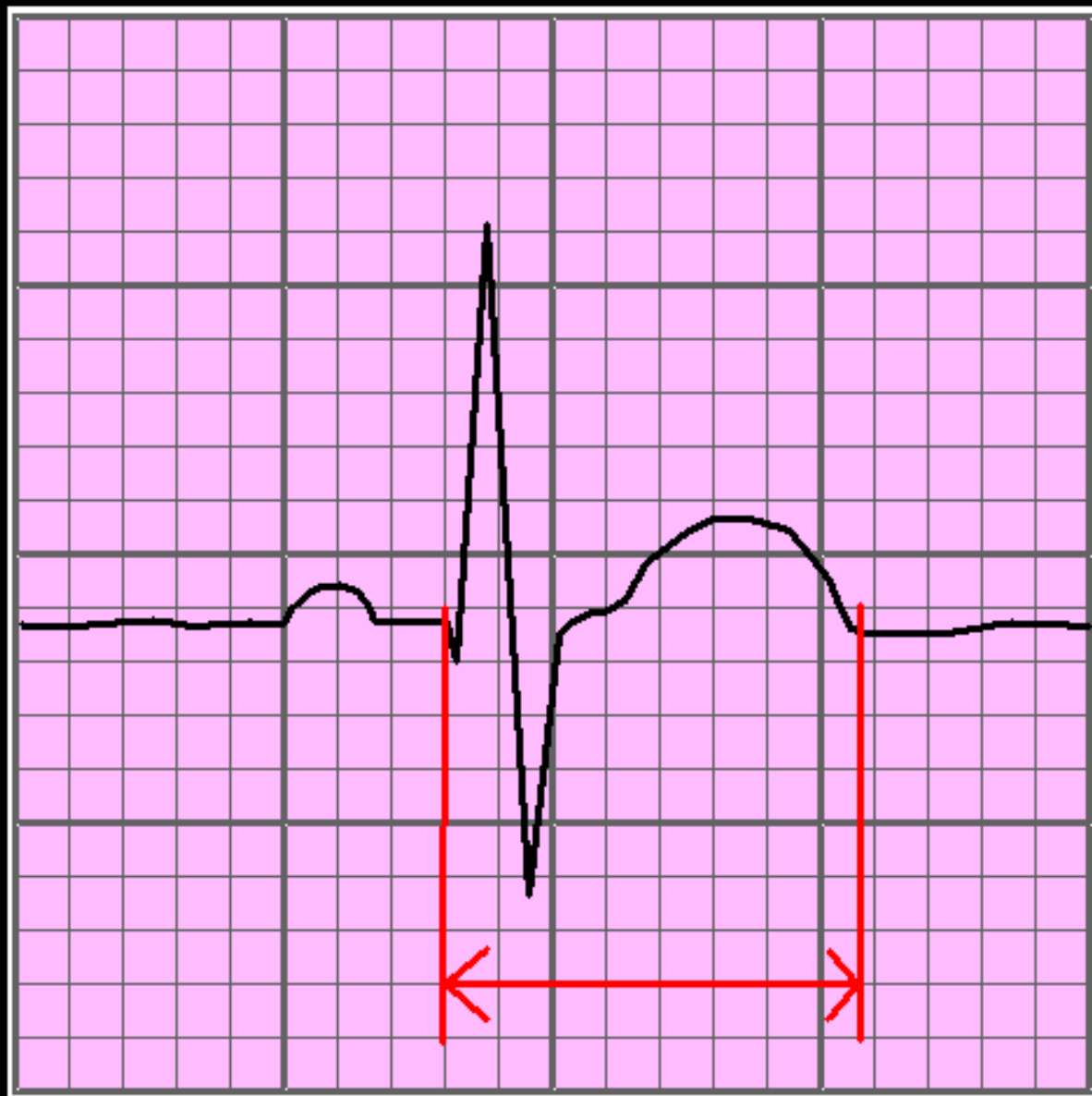
# **EKG PATTERNS of ACS & ISCHEMIA**

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

!	S-T SEGMENT ELEVATION at J POINT		- ACUTE MI - ACUTE PERICARDITIS / MYOCARDITIS - EARLY REPOLARIZATION
!	FLAT or CONVEX J-T APEX SEGMENT		- ACUTE MI - ISCHEMIA
!	HYPER-ACUTE T WAVE		- HYPERKALEMIA - TRANSMURAL ISCHEMIA - ACUTE MI - HYPERTROPHY
!	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
?	FLAT S-T SEGMENT > 120 ms		- ISCHEMIA
?	LOW VOLTAGE T WAVE WITH NORMAL QRS		- ISCHEMIA
?	U WAVE POLARITY OPPOSITE THAT OF T WAVE		- ISCHEMIA

## Q - T INTERVAL

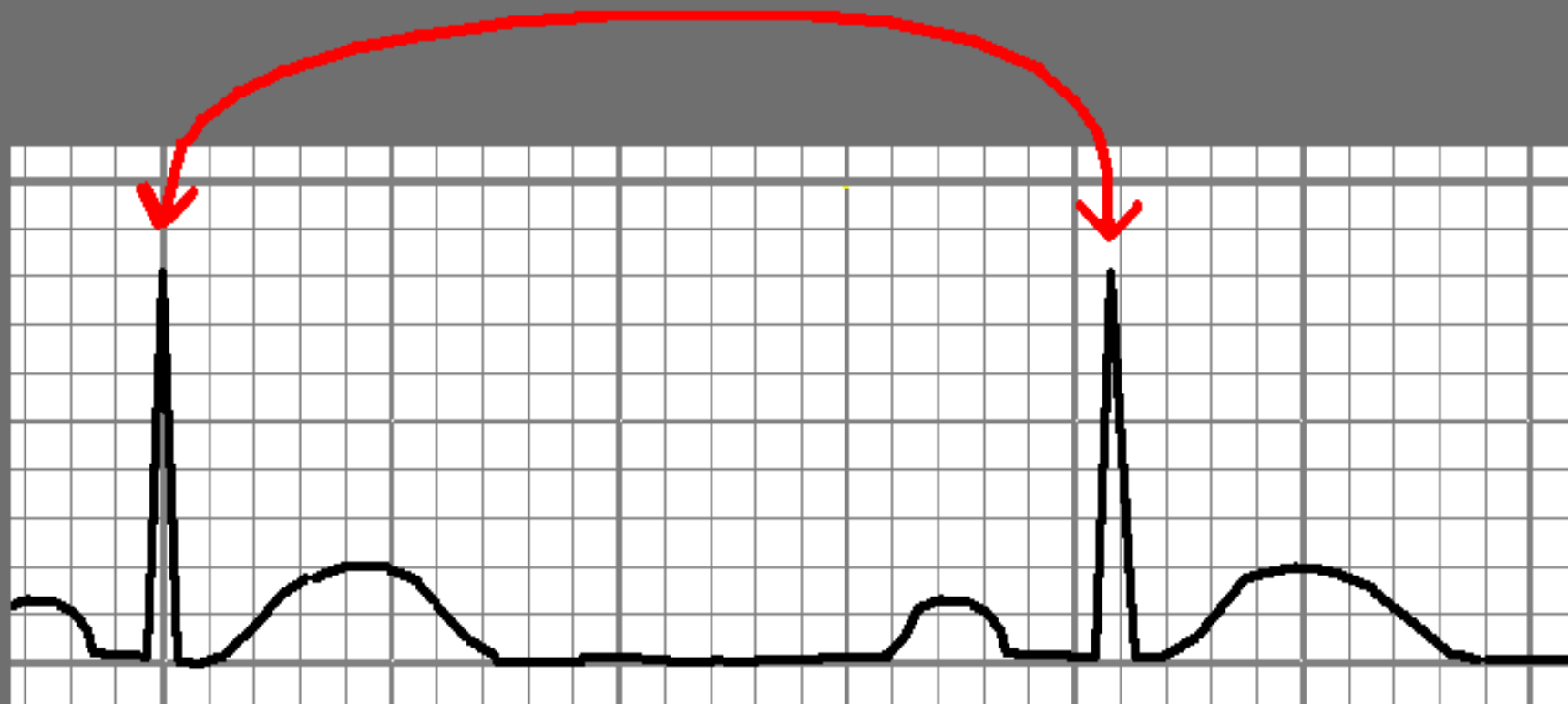
- VARIES BASED ON HEART RATE AND SEX
- FOR NORMAL HEART RATES: SHOULD BE  $< 1/2$  R - R INTERVAL



# DETERMINING Q-T INTERVAL LIMITS

## THE "QUICK PEEK" METHOD

( for Heart Rates 60 - 100 )



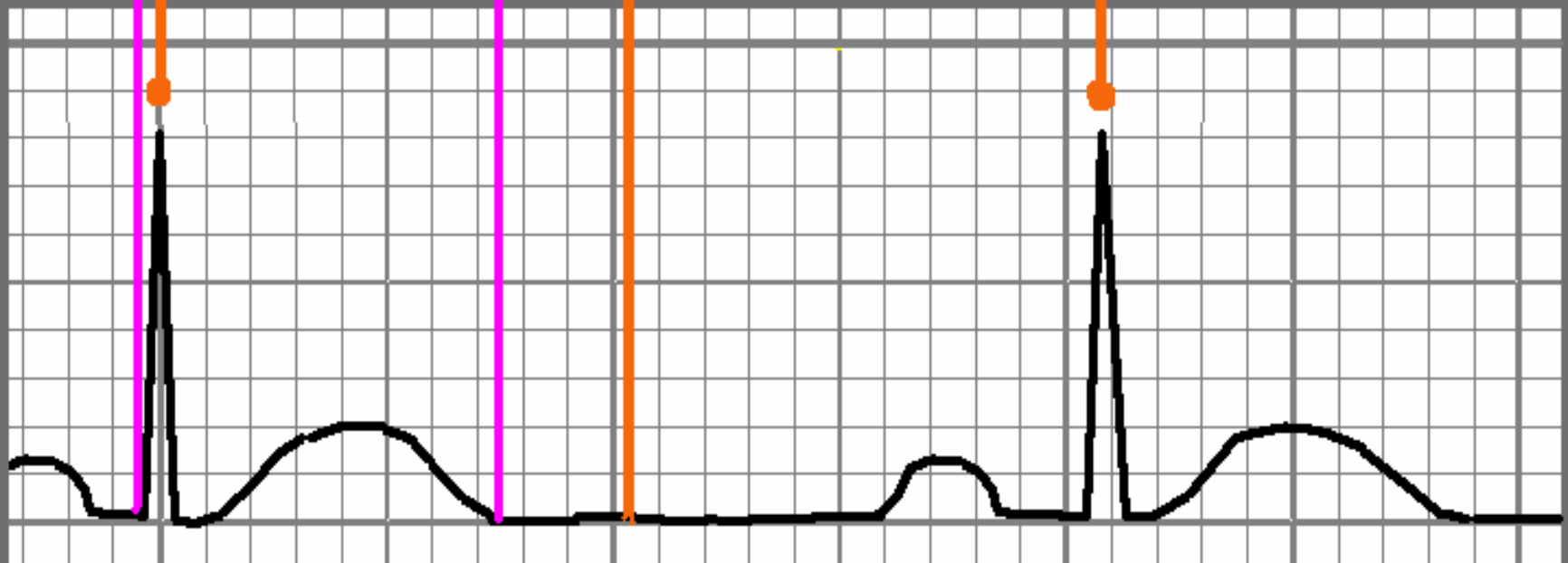
The Q - T Interval  
should be LESS THAN  $\frac{1}{2}$  the

R - R Interval

OK

TOO LONG

GOOD



The Q - T Interval  
should be LESS THAN  $\frac{1}{2}$  the  
R - R Interval



If the patient “fails” the  
“Quick Peek QT Interval”  
test,  
or if “in doubt” . . . .



GET A 12 LEAD ECG, if at all possible, to  
determine the patient’s **QTc Interval**

# Prolonged QT Interval

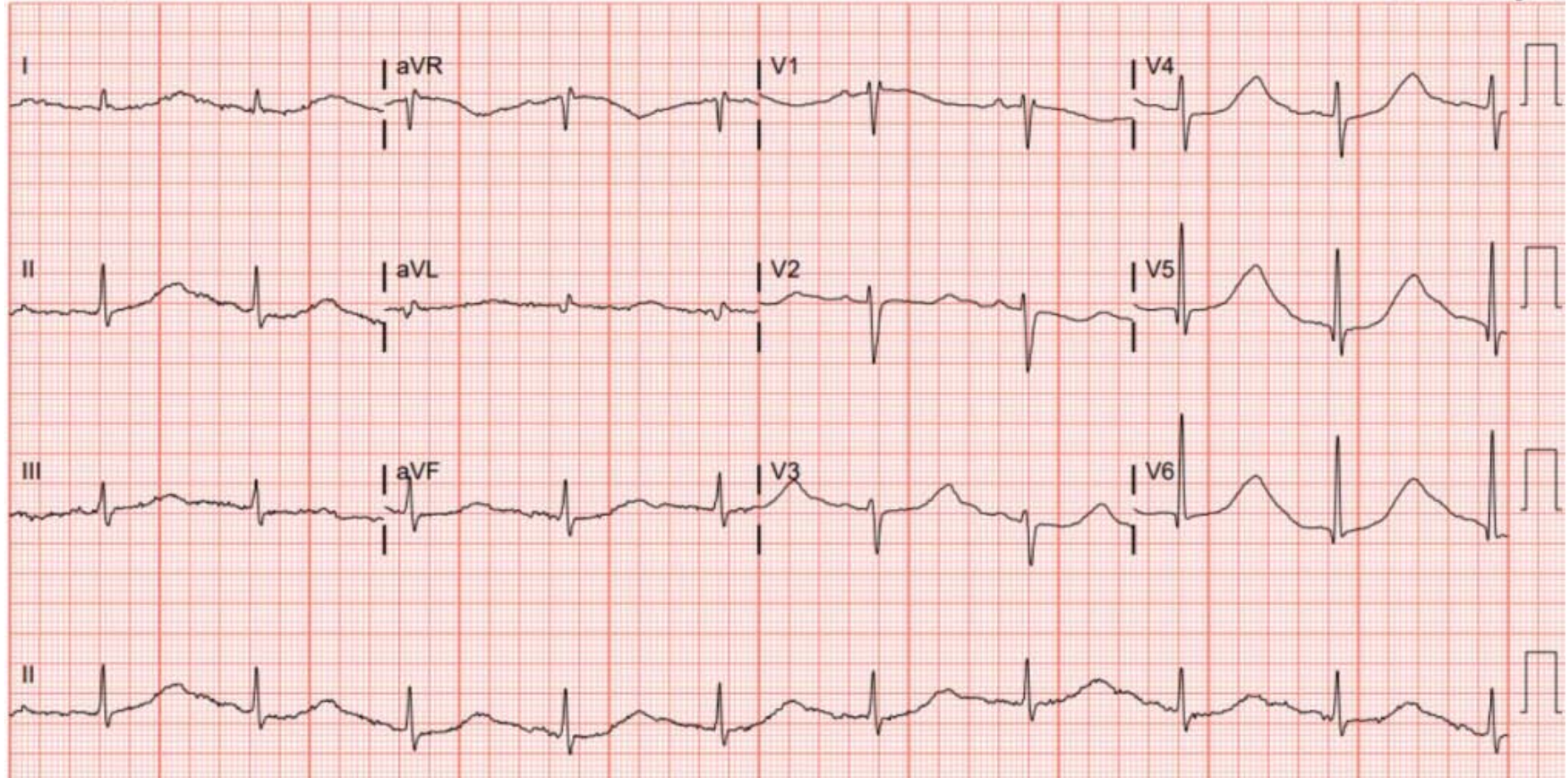
- **QTc 500 – 520** may be due to oral antiarrhythmics (sotalol, amiodarone, etc)
- **QTc above 500**: NOT ADVISABLE to administer any QT prolonging meds
  - Check electrolytes (especially K, Mg, Ca)
- **QTc 550** and above: advise immediate discontinuance of all QT prolonging meds
- **QTc 600+ ANTICIPATE Torsades de Pointes (TdP)**

Rate	58	Sinus rhythm
PR	185	IVCD, consider atypical RBBB
QRSd	126	Baseline wander in lead(s) V2,V3,V4,V6
QT	668	COMPARED TO ECG 07/22/2020 16:56:59
QTc	657	SINUS RHYTHM NOW PRESENT
--Axis--		
P	107	
QRS	61	
T	45	

Req Provider: Rafael Santiago-A

- Abnormal ECG -

Unconfirmed Diagnosis

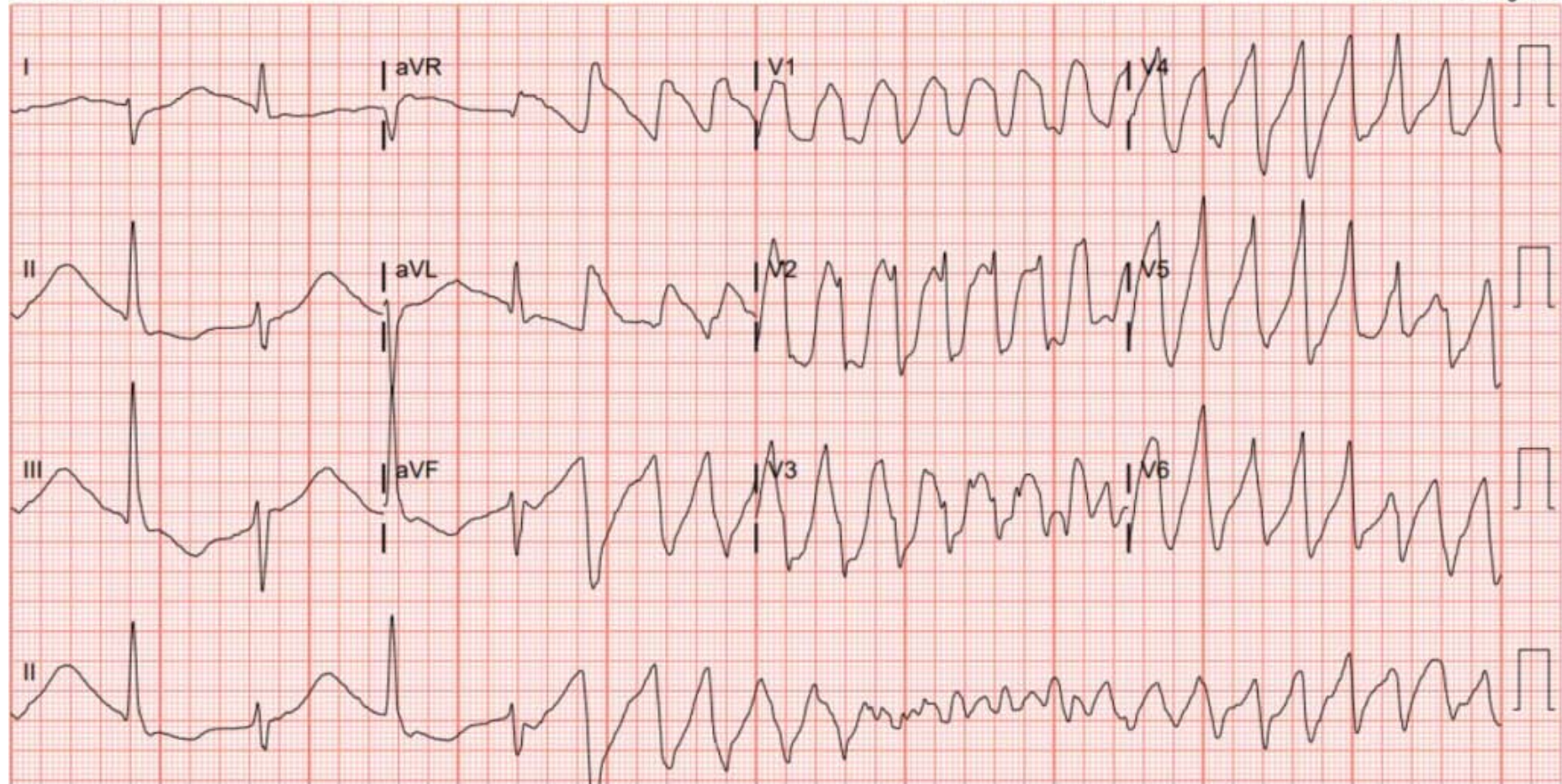


Rate	156	Atrial fibrillation
PR		Ventricular tachycardia, unsustained
QRSd	138	RBBB and LPFB
QT	456	Repol abnrm suggests ischemia, diffuse leads
<b>QTc</b>	<b>735</b>	Baseline wander in lead(s) II,III,aVR,aVF,V1,V2,V3,V4
--Axis--		COMPARED TO ECG 07/22/2020 15:32:52
P		ATRIAL FIBRILLATION NOW PRESENT
QRS	102	VENTRICULAR TACHYCARDIA NOW PRESENT
T	185	LEFT POSTERIOR FASCICULAR BLOCK NOW PRESENT
		RIGHT BUNDLE-BRANCH BLOCK NOW PRESENT
		POSSIBLE ISCHEMIA NOW PRESENT
		PROLONGED QT INTERVAL NO LONGER PRESENT

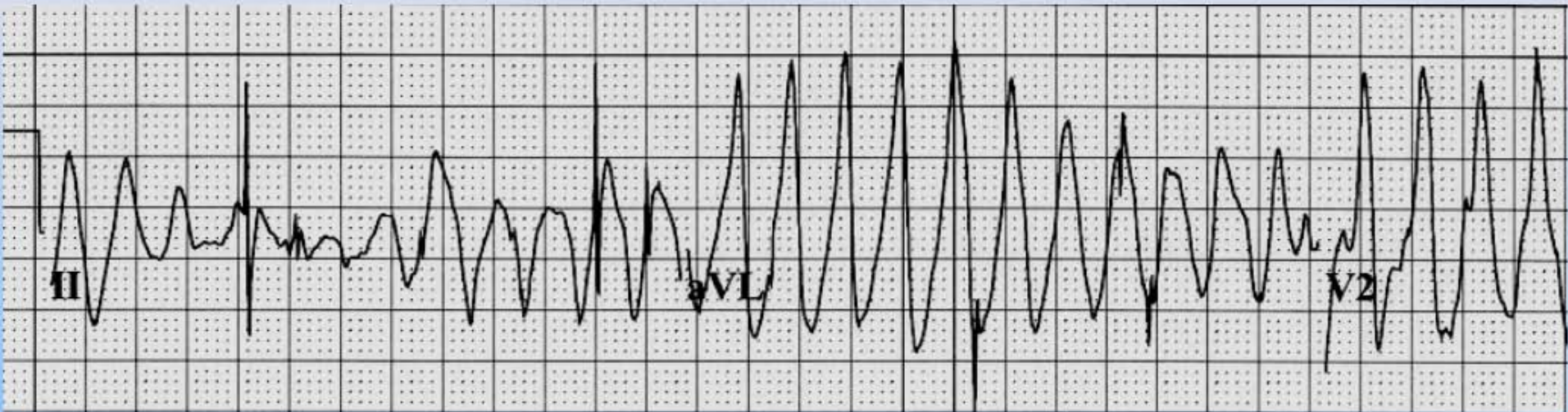
Req Provider: Rafael Santiago-App

- Abnormal ECG -

Unconfirmed Diagnosis



# Dysrhythmia Associated with Mortality, Triggered by LQTS: *Torsades de Pointes*



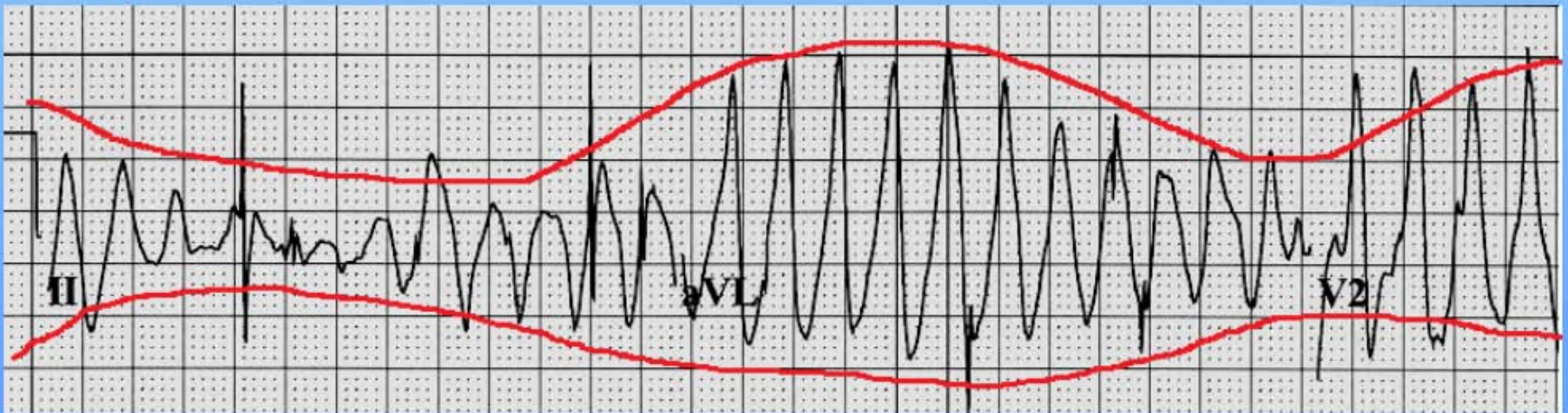
## Torsades de Pointes (TdP) – **HEMODYNAMICS:**

- **Decreased – to – NO Cardiac Output**
- **Often patient PULSELESS during episode**
- **Patients often report SYNCOPÉ when TdP self-terminates.**
- **May DETERIORATE into VENTRICULAR FIBRILLATION and CARDIAC ARREST. (“Sudden Death”)**

# ECG Characteristics of TdP: The QRS Pattern of *Torsades de Pointes* resembles . . . . .



*a piece of Twisted Ribbon !*





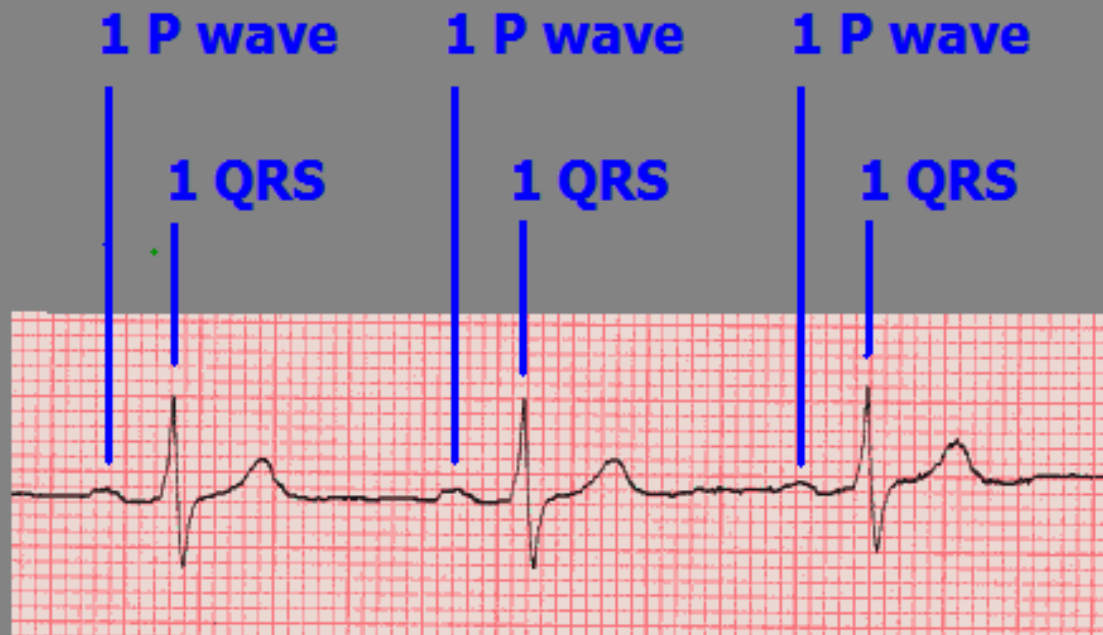
# ESTABLISH YOUR ROUTINE ECG EVALUATION . . . . .

- RATE
- RHYTHM
- INTERVALS
-   P:QRS RATIO

# DETERMINE P : QRS RATIO



**SIMPLY STATED, SHOULD ALWAYS BE 1 : 1**



# **P : QRS RATIO**

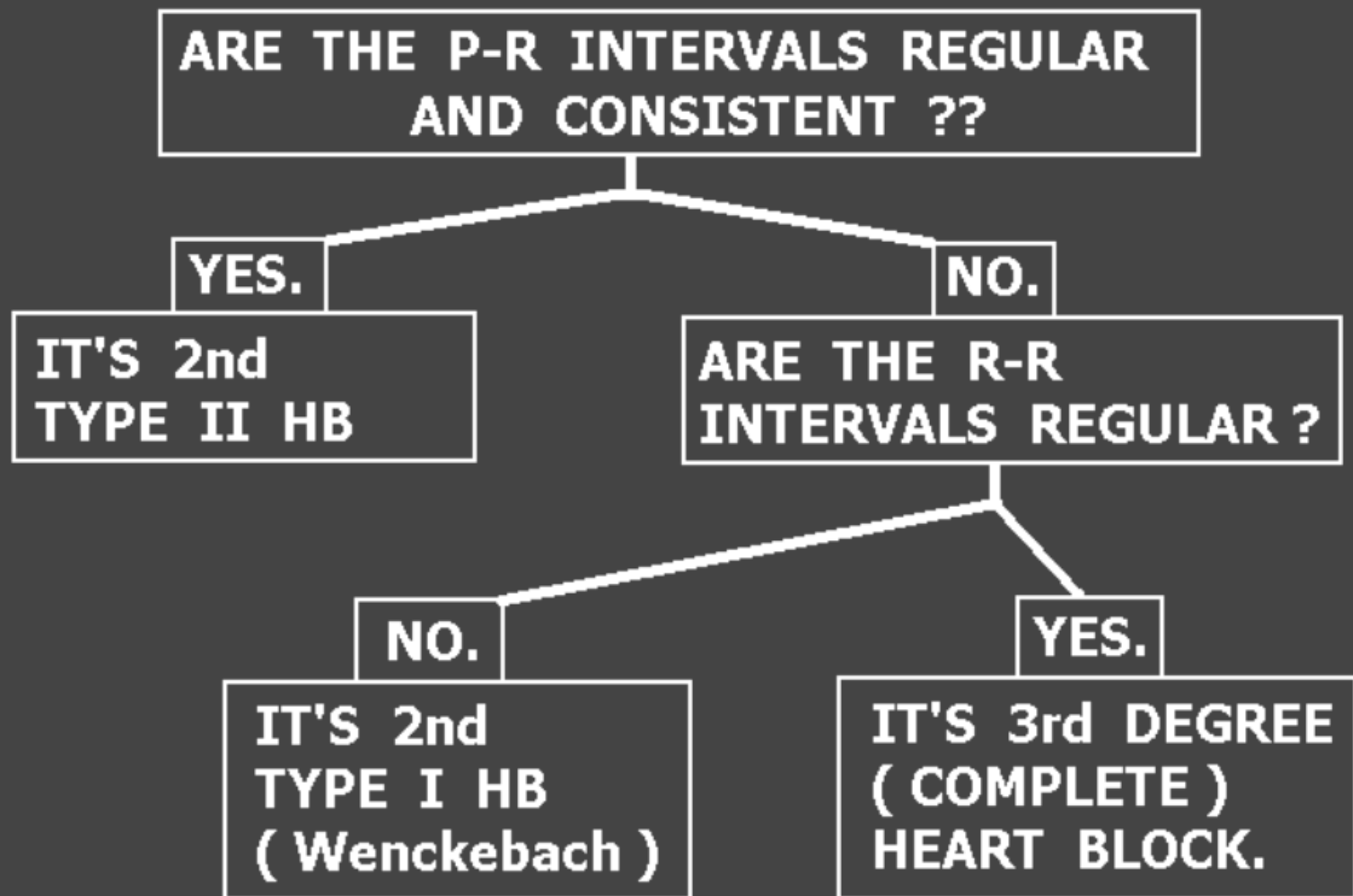
**IF GREATER THAN 1 : 1**

**THINK:**

- **2° HEART BLOCK**  
( TYPE 1 or 2 )
- **3° HEART BLOCK**
- **ATRIAL FLUTTER**  
( SAW-TOOTHED "F" WAVES )

# DIAGNOSING 2nd and 3rd DEGREE HEART BLOCK

**MORE P-WAVES THAN QRS COMPLEXES PRESENT.**



# LET'S TEST THE PROCEDURE . . .

1



2



3

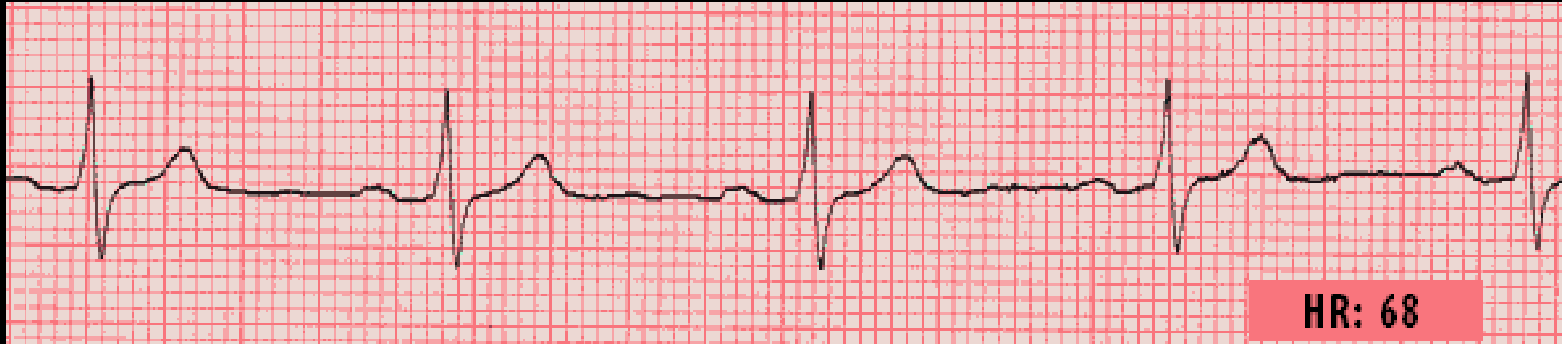




# ESTABLISH YOUR ROUTINE ECG EVALUATION . . . . .

- RATE
- RHYTHM
- INTERVALS
- P:QRS RATIO

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE \_\_\_\_\_

RHYTHM \_\_\_\_\_

P-R INTERVAL \_\_\_\_\_

P: QRS RATIO \_\_\_\_\_

QRS INTERVAL \_\_\_\_\_

## POTENTIAL PROBLEM(S):

# THIS RHYTHM IS: NORMAL SINUS RHYTHM



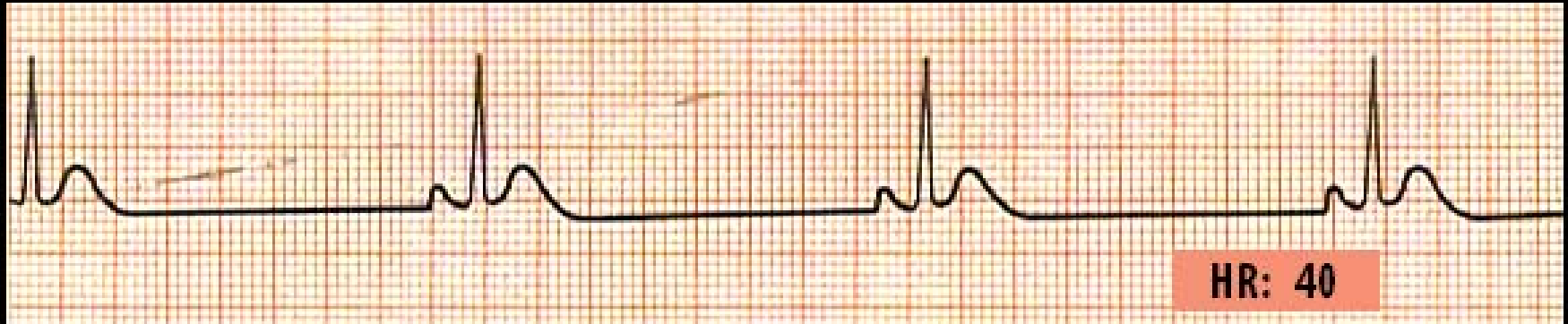
HR: 68

**MAIN IDENTIFICATION CHARACTERISTIC(S): PERFECTLY NORMAL IN EVERY WAY!**

**RATE** ----- **BETWEEN 60 - 100**  
**RHYTHM** ----- **REGULAR**  
**P-R INTERVAL** ----- **120 - 200 ms (.12 - .20)**  
**P:QRS RATIO** ----- **1:1**  
**QRS INTERVAL** ----- **NORMAL (LESS THAN 120 ms)**

**POTENTIAL PROBLEM(S): NONE!**

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE \_\_\_\_\_

RHYTHM \_\_\_\_\_

P-R INTERVAL \_\_\_\_\_

P: QRS RATIO \_\_\_\_\_

QRS INTERVAL \_\_\_\_\_

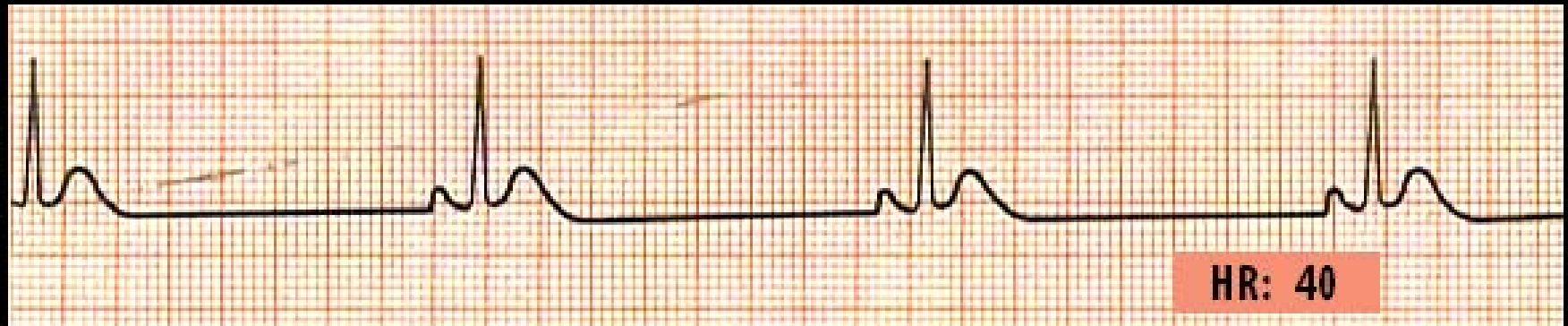
# THIS RHYTHM IS: SINUS BRADYCARDIA



MAIN IDENTIFICATION CHARACTERISTIC(S): **HEART RATE IS LESS THAN NORMAL.**

RATE	LESS THAN 60
RHYTHM	REGULAR
P-R INTERVAL	NORMAL (120 - 200 ms)
P:QRS RATIO	1:1
QRS INTERVAL	NORMAL (< 120 ms)

# THIS RHYTHM IS: SINUS BRADYCARDIA



MAIN IDENTIFICATION CHARACTERISTIC(S): **HEART RATE IS LESS THAN NORMAL.**

## POTENTIAL PROBLEM(S):

- ↓ CARDIAC OUTPUT
- HYPOTENSION
- SHOCK ( INADEQUATE TISSUE PERFUSION )

# THIS RHYTHM IS: SINUS BRADYCARDIA



## TREATMENT / INTERVENTION(S):



**FIRST, ASSESS the PATIENT to determine if the patient is:**

**- STABLE**

**or**

**- UNSTABLE**

**(signs of SHOCK / HYPOPERFUSION)**

# THIS RHYTHM IS: SINUS BRADYCARDIA



## WE MUST CONSIDER UNDERLYING CAUSES:

- INCREASED VAGAL TONE →
- BLOCKED SA NODAL ARTERY →  
(INFERIOR WALL MI)
- ELECTROLYTE IMBAL. (K+) →
- HYPOTHERMIA →
- ORGANOPHOSPHATE POISONING →
- ATHLETIC METABOLISM →  
(excellent health!)

## AND TREAT THEM:

- ATROPINE
- CARDIAC CATH - PTCA / STENT
- THROMBOLYTICS
- CORRECT ELECTROLYTES
- WARM PATIENT
- ATROPINE
- COMPLIMENT PATIENT!

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: WANDERING ATRIAL PACEMAKER



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

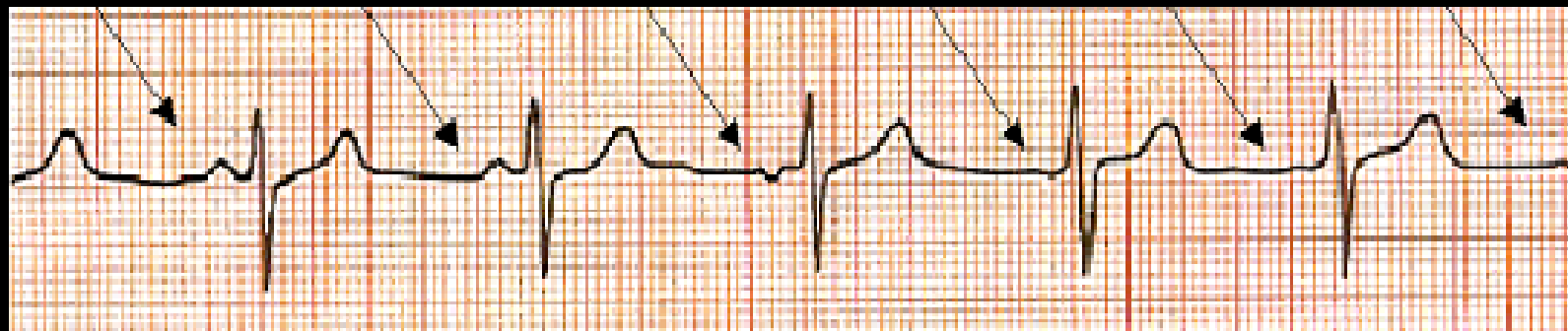
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

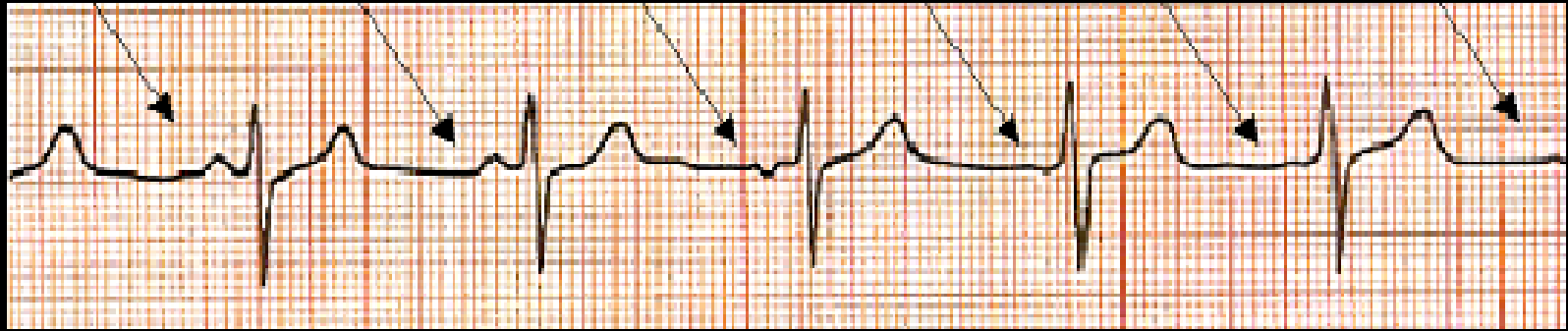
# THIS RHYTHM IS: WANDERING ATRIAL PACEMAKER



MAIN IDENTIFICATION CHARACTERISTIC(S): **P WAVES ARE OF DIFFERENT SIZES, DEFLECTIONS, and P-R INTERVALS SLIGHTLY VARY**

RATE -----	NORMAL
RHYTHM -----	NORMAL
P-R INTERVAL -----	<b>SLIGHT VARIATION</b>
P:QRS RATIO -----	1:1
QRS INTERVAL -----	NORMAL (unless BBB)

# THIS RHYTHM IS: WANDERING ATRIAL PACEMAKER

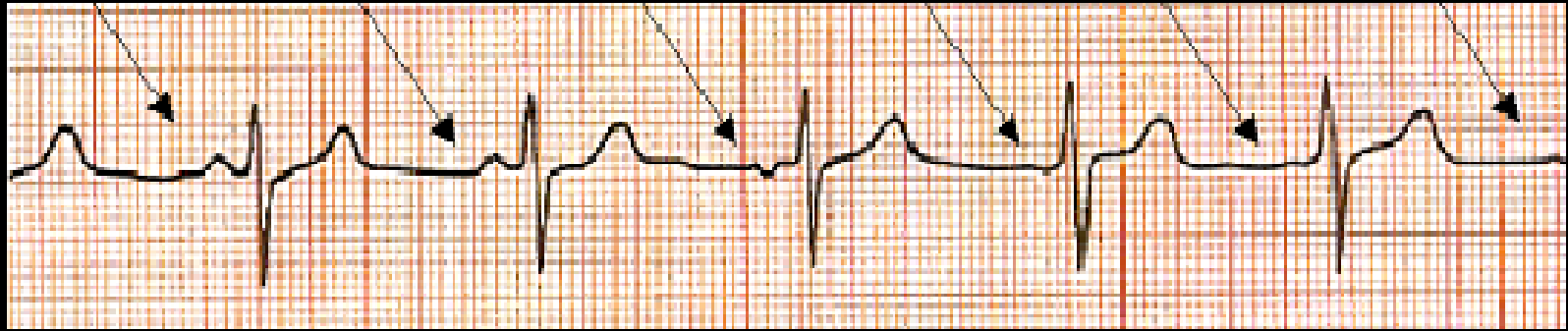


**MAIN IDENTIFICATION CHARACTERISTIC(S): P WAVES ARE OF DIFFERENT SIZES, DEFLECTIONS, and P - R INTERVALS SLIGHTLY VARY**

## POTENTIAL PROBLEM(S) :

- **USUALLY NONE.**
- **THIS RHYTHM IS SEEN MOST FREQUENTLY IN HEALTHY YOUNG CHILDREN**

# THIS RHYTHM IS: WANDERING ATRIAL PACEMAKER



**MAIN IDENTIFICATION CHARACTERISTIC(S): P WAVES ARE OF DIFFERENT SIZES, DEFLECTIONS, and P - R INTERVALS SLIGHTLY VARY**

## TREATMENT / INTERVENTIONS :

- **USUALLY NONE NEEDED.**
- **PERFORM THOROUGH HISTORY and PHYSICAL TO RULE OUT UNDERLYING PROBLEMS.**
- **MONITOR PATIENT.**

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE \_\_\_\_\_

RHYTHM \_\_\_\_\_

P-R INTERVAL \_\_\_\_\_

P: QRS RATIO \_\_\_\_\_

QRS INTERVAL \_\_\_\_\_

# THIS RHYTHM IS: FIRST DEGREE HEART BLOCK



MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

RHYTHM -----

P-R INTERVAL -----

P: QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: FIRST DEGREE HEART BLOCK



MAIN IDENTIFICATION CHARACTERISTIC(S): **P-R INTERVAL TOO LONG -  
(GREATER THAN 200 mSEC.)**

RATE -----	NORMAL
RHYTHM -----	REGULAR
P-R INTERVAL -----	<b>&gt; 200 mSEC.</b>
P:QRS RATIO -----	1:1
QRS INTERVAL -----	NORMAL

# THIS RHYTHM IS: FIRST DEGREE HEART BLOCK



MAIN IDENTIFICATION CHARACTERISTIC(S): **P-R INTERVAL TOO LONG -  
(GREATER THAN 200 mSEC.)**

## POTENTIAL PROBLEMS:

- HR MAY BE BRADYCARDIC ( $< 60$ )
- MAY PROGRESS TO HIGHER GRADE HB ( $2^{\circ}$ ,  $3^{\circ}$ ) with SLOWER VENTRICULAR RATE

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE \_\_\_\_\_

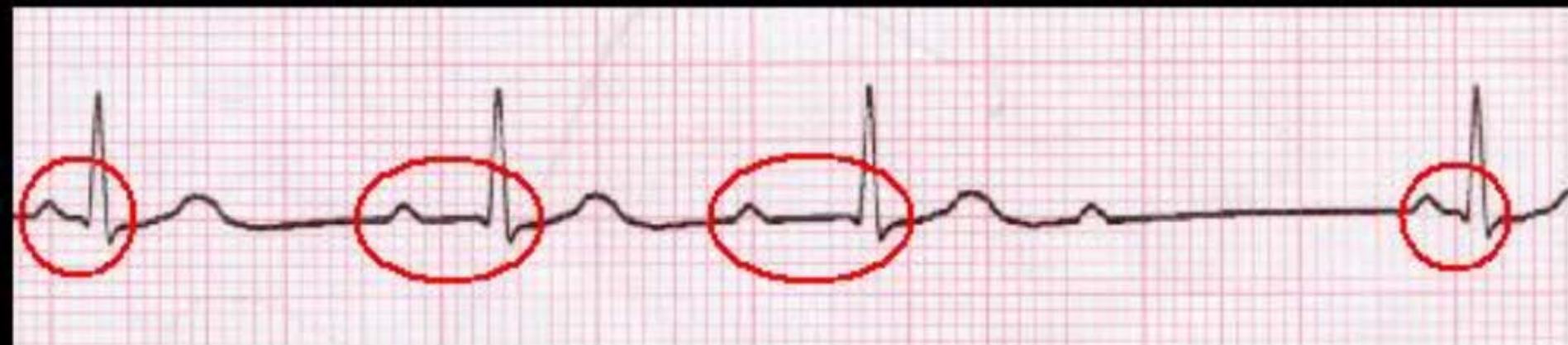
RHYTHM \_\_\_\_\_

P-R INTERVAL \_\_\_\_\_

P:QRS RATIO \_\_\_\_\_

QRS INTERVAL \_\_\_\_\_

# WHEN YOU SEE "EXTRA P WAVES" . . . .



## STEP 1 EVALUATE P - R RELATIONSHIP

### DIAGNOSING 2nd and 3rd DEGREE HEART BLOCK

MORE P-WAVES THAN QRS COMPLEXES PRESENT.

ARE THE P-R INTERVALS REGULAR AND CONSISTENT ??

YES.

IT'S 2nd  
TYPE II HB

NO.

ARE THE R-R  
INTERVALS REGULAR ?

NO.

IT'S 2nd  
TYPE I HB  
( Wenckebach )

YES.

IT'S 3rd DEGREE  
( COMPLETE )  
HEART BLOCK.

# WHEN YOU SEE "EXTRA P WAVES" . . . .



DIAGNOSING 2nd and 3rd DEGREE HEART BLOCK  
MORE P-WAVES THAN QRS COMPLEXES PRESENT.

**STEP 1**

EVALUATE P - R RELATIONSHIP

ARE THE P-R INTERVALS REGULAR AND CONSISTENT ??

YES.

IT'S 2nd TYPE II HB

NO.

ARE THE R-R INTERVALS REGULAR?

NO.

IT'S 2nd TYPE I HB (Wenckebach)

YES.

IT'S 3rd DEGREE (COMPLETE) HEART BLOCK.

**STEP 2**

EVALUATE R - R INTERVALS

# THIS RHYTHM IS: 2nd<sup>o</sup> TYPE I HB (Wenckebach)



MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE \_\_\_\_\_

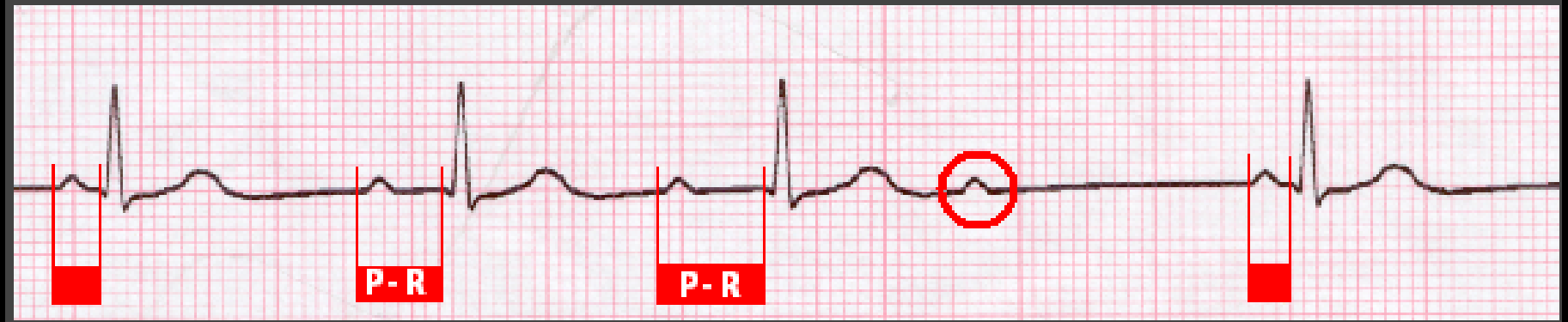
RHYTHM \_\_\_\_\_

P-R INTERVAL \_\_\_\_\_

P:QRS RATIO \_\_\_\_\_

QRS INTERVAL \_\_\_\_\_

# THIS RHYTHM IS: 2<sup>nd</sup> ° TYPE I HB (Wenckebach)



MAIN IDENTIFICATION CHARACTERISTIC(S): **P-R INTERVAL GETS PROGRESSIVELY LONGER UNTIL IT DROPS A QRS – THEN CYCLE REPEATS**

RATE \_\_\_\_\_

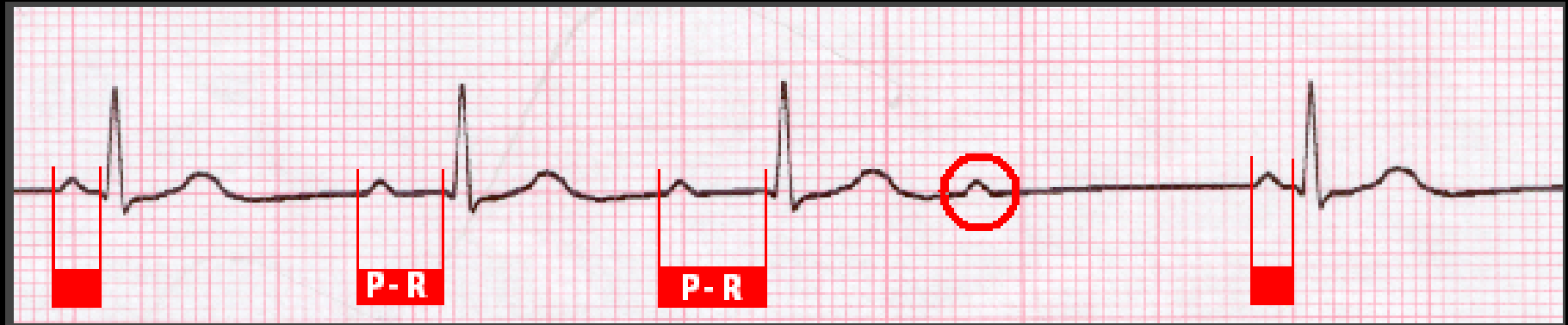
RHYTHM \_\_\_\_\_

P-R INTERVAL \_\_\_\_\_

P:QRS RATIO \_\_\_\_\_

QRS INTERVAL \_\_\_\_\_

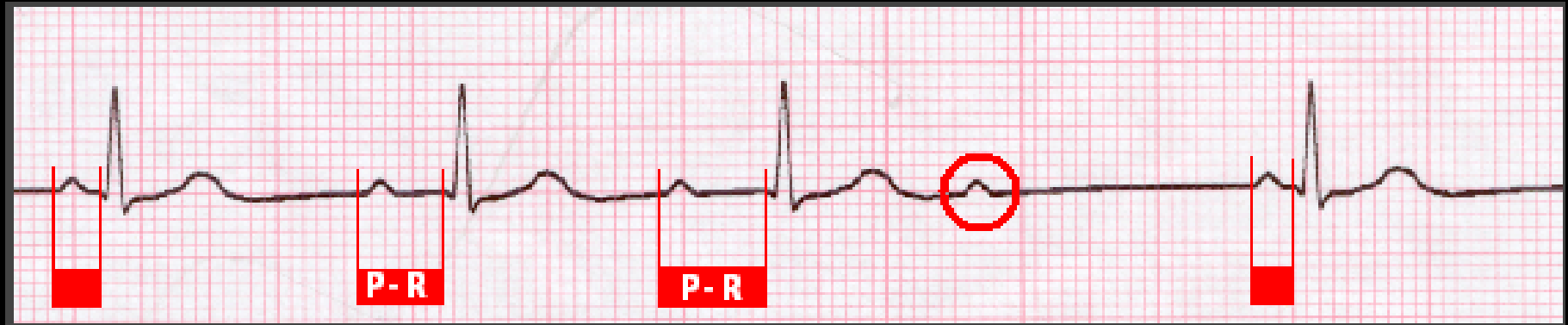
# THIS RHYTHM IS: 2<sup>nd</sup> ° TYPE I HB (Wenckebach)



**MAIN IDENTIFICATION CHARACTERISTIC(S): P-R INTERVAL GETS PROGRESSIVELY LONGER UNTIL IT DROPS A QRS – THEN CYCLE REPEATS**

RATE	NORMAL or BRADYCARDIC
RHYTHM	REGULARLY IRREGULAR
P-R INTERVAL	VARIABLE (regularly irregular)
P:QRS RATIO	VARIABLE (usually 1:1 and 2:1)
QRS INTERVAL	NORMAL

# THIS RHYTHM IS: 2<sup>nd</sup> ° TYPE I HB (Wenckebach)



MAIN IDENTIFICATION CHARACTERISTIC(S): **P-R INTERVAL GETS PROGRESSIVELY LONGER UNTIL IT DROPS A QRS – THEN CYCLE REPEATS**

## POTENTIAL PROBLEMS:

- HR MAY BE BRADYCARDIC (< 60)
- MAY PROGRESS TO HIGHER GRADE HB ( 2<sup>o</sup> type II, 3<sup>o</sup> )  
with SLOWER VENTRICULAR RATE
- PT MAY BE SYMPTOMATIC (SHOCK) FROM  
↓ CARDIAC OUTPUT

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

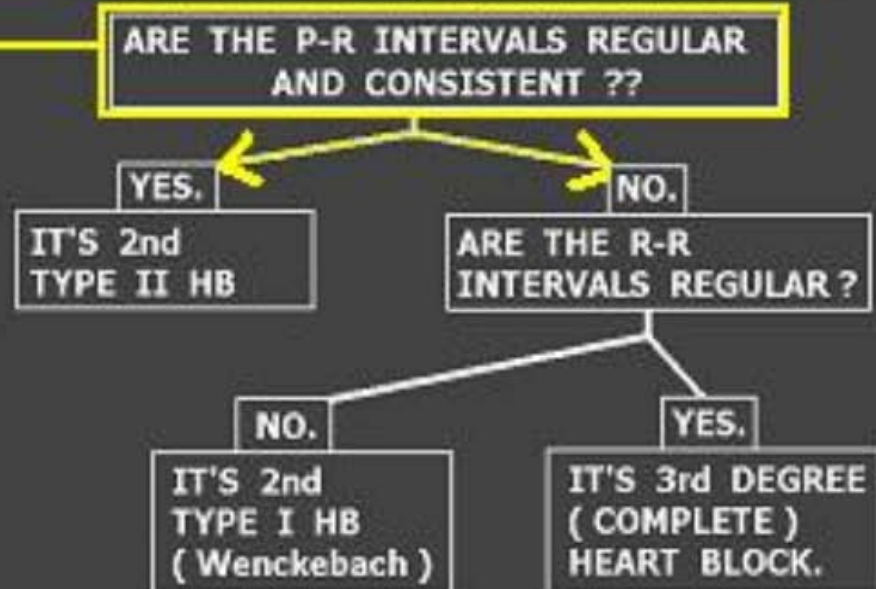
- RATE \_\_\_\_\_
- RHYTHM \_\_\_\_\_
- P-R INTERVAL \_\_\_\_\_
- P:QRS RATIO \_\_\_\_\_
- QRS INTERVAL \_\_\_\_\_

# WHEN YOU SEE "EXTRA P WAVES" . . . .



## DIAGNOSING 2nd and 3rd DEGREE HEART BLOCK MORE P-WAVES THAN QRS COMPLEXES PRESENT.

**STEP 1**  
EVALUATE P - R RELATIONSHIP



# WHEN YOU SEE "EXTRA P WAVES" . . . .



## DIAGNOSING 2nd and 3rd DEGREE HEART BLOCK

MORE P-WAVES THAN QRS COMPLEXES PRESENT.

**STEP 1**  
EVALUATE P - R RELATIONSHIP

ARE THE P-R INTERVALS REGULAR AND CONSISTENT ??

YES.

IT'S 2nd  
TYPE II HB

NO.

ARE THE R-R  
INTERVALS REGULAR ?

NO.

IT'S 2nd  
TYPE I HB  
( Wenckebach )

YES.

IT'S 3rd DEGREE  
( COMPLETE )  
HEART BLOCK.

# THIS RHYTHM IS: 2<sup>nd</sup>° TYPE II HEART BLOCK



MAIN IDENTIFICATION CHARACTERISTIC(S): **MORE THAN ONE P WAVE FOR EACH QRS – BUT EVERY QRS HAS A NORMAL, CONSISTENT P-R INTERVAL**

RATE ----- USUALLY BRADYCARDIC  
RHYTHM ----- USUALLY REGULAR (can be irregular)  
P-R INTERVAL ----- **NORMAL and CONSISTENT**  
P:QRS RATIO ----- **≥ 2:1**  
QRS INTERVAL ----- NORMAL

# THIS RHYTHM IS: 2<sup>nd</sup>° TYPE II HEART BLOCK



MAIN IDENTIFICATION CHARACTERISTIC(S): **MORE THAN ONE P WAVE FOR EACH QRS – BUT EVERY QRS HAS A NORMAL, CONSISTENT P-R INTERVAL**

RATE ----- USUALLY BRADYCARDIC  
RHYTHM ----- USUALLY REGULAR (can be irregular)  
P-R INTERVAL ----- **NORMAL and CONSISTENT**  
P:QRS RATIO ----- **≥ 2:1**  
QRS INTERVAL ----- NORMAL

# THIS RHYTHM IS: 2<sup>nd</sup> ° TYPE II HEART BLOCK

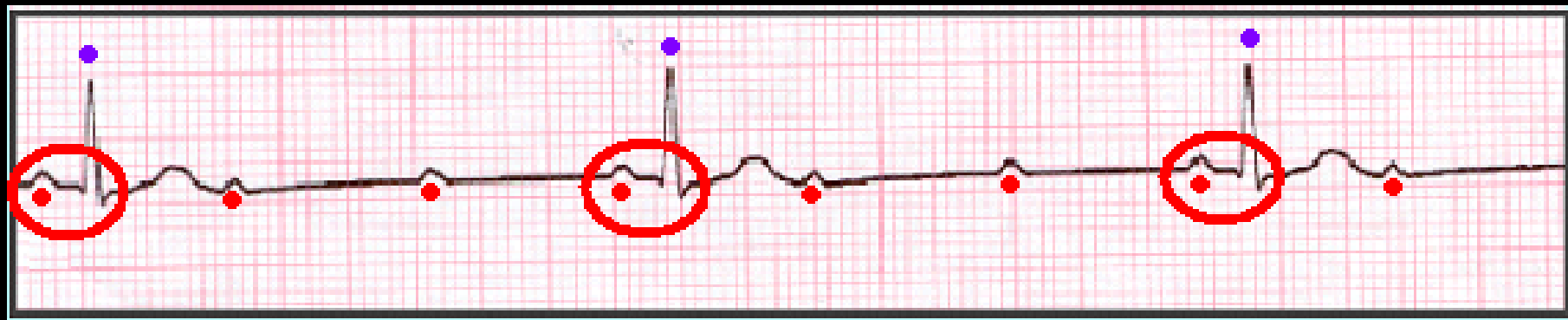


MAIN IDENTIFICATION CHARACTERISTIC(S): **MORE THAN ONE P WAVE FOR EACH QRS – BUT EVERY QRS HAS A NORMAL, CONSISTENT P -R INTERVAL**

## POTENTIAL PROBLEMS:

- PT MAY BE SYMPTOMATIC (SHOCK) FROM ↓ CARDIAC OUTPUT
- BLOCKAGE MAY ADVANCE TO VENTRICULAR STANDSTILL (ADAMS - STOKES SYNDROME) AND CARDIAC ARREST
- MAY PROGRESS TO COMPLETE (3<sup>rd</sup> °) HEART BLOCK

# THIS RHYTHM IS: 2<sup>nd</sup> ° TYPE II HEART BLOCK



MAIN IDENTIFICATION CHARACTERISTIC(S): **MORE THAN ONE P WAVE FOR EACH QRS – BUT EVERY QRS HAS A NORMAL, CONSISTENT P-R INTERVAL**

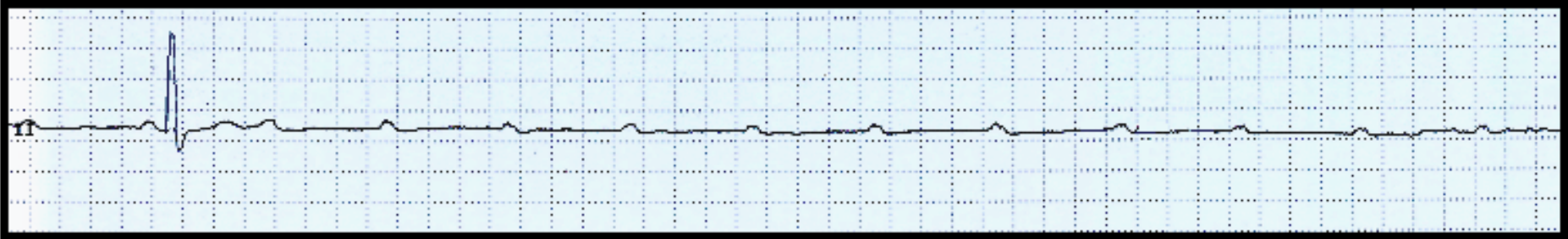


**ADAMS - STOKES SYNDROME is essentially spontaneous CARDIAC ARREST -- characterized by episodes of ASYSTOLE, VENTRICULAR STANDSTILL and V-FIB. In this regard, 2<sup>nd</sup> ° TYPE II HB can be more dangerous than 3<sup>rd</sup> ° HB (at least 3<sup>rd</sup> ° Heart Block has an ESCAPE RHYTHM)**





## ADAMS - STOKES SYNDROME



### CASE HISTORY:

72 y/o male with history of SYNCOPES OF UNKNOWN ORIGIN. While undergoing Cardiac Catheterization (Left Heart Cath), pt went from NSR rate 76 - 80 to **2nd degree TYPE II HEART BLOCK**, which quickly deteriorated into **VENTRICULAR STANDSTILL**.

**TX: CPR, Atropine, Transvenous Pacemaker, followed by Permanent Pacemaker Implantation. Patient experienced full recovery, was discharged.**

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE \_\_\_\_\_

RHYTHM \_\_\_\_\_

P-R INTERVAL \_\_\_\_\_

P:QRS RATIO \_\_\_\_\_

QRS INTERVAL \_\_\_\_\_

# THIS RHYTHM IS:

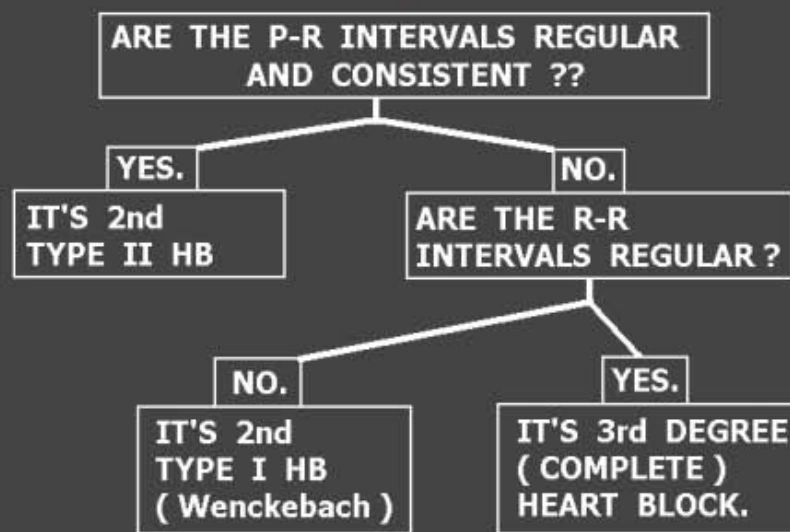


## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----  
RHYTHM -----  
P-R INTERVAL -----  
P: QRS RATIO -----  
QRS INTERVAL -----

### DIAGNOSING 2nd and 3rd DEGREE HEART BLOCK

MORE P-WAVES THAN QRS COMPLEXES PRESENT.



**THIS RHYTHM IS: 3rd<sup>o</sup> HB  $\bar{c}$  JUNCTIONAL ESCAPE**



**MAIN IDENTIFICATION CHARACTERISTIC(S):**

**RATE** \_\_\_\_\_

**RHYTHM** \_\_\_\_\_

**P-R INTERVAL** \_\_\_\_\_

**P:QRS RATIO** \_\_\_\_\_

**QRS INTERVAL** \_\_\_\_\_

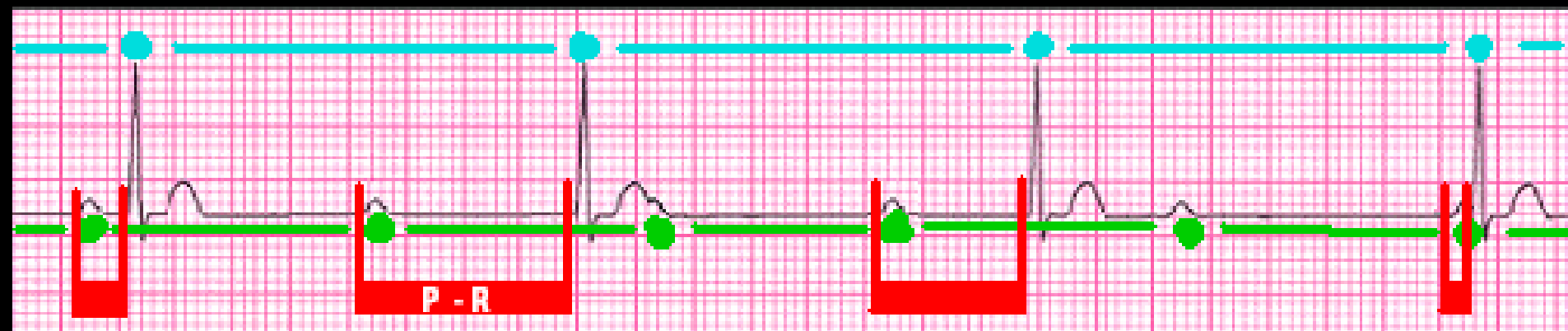
# THIS RHYTHM IS: 3rd<sup>o</sup> HB $\bar{c}$ JUNCTIONAL ESCAPE



**MAIN IDENTIFICATION CHARACTERISTIC(S): P - R INTERVAL INCOSISTENT, P - P INTERVALS REGULAR, R - R INTERVALS REGULAR -- NO RELATIONSHIP BETWEEN P WAVES AND QRS COMPLEXES.**

RATE	USUALLY BRADYCARDIC (40 -60 JUNCTIONAL RATE)
RHYTHM	REGULAR
P-R INTERVAL	INCONSISTENT (irregularly irregular)
P:QRS RATIO	VARIES - USUALLY > 2:1
QRS INTERVAL	NORMAL (< 120 ms) UNLESS PT HAS BUNDLE BRANCH BLOCK

# THIS RHYTHM IS: 3rd<sup>o</sup> HB $\bar{c}$ JUNCTIONAL ESCAPE



**MAIN IDENTIFICATION CHARACTERISTIC(S): P - R INTERVAL INCOSISTENT, P - P INTERVALS REGULAR, R - R INTERVALS REGULAR -- NO RELATIONSHIP BETWEEN P WAVES AND QRS COMPLEXES.**

## POTENTIAL PROBLEMS:

- HYPOTENSION and SHOCK due to ↓ HEART RATE and ↓ CARDIAC OUTPUT

# FAILURE AT AV NODE LEVEL

ESCAPE RHYTHM ORIGINATES JUST BELOW

RIGHT BUNDLE BRANCH

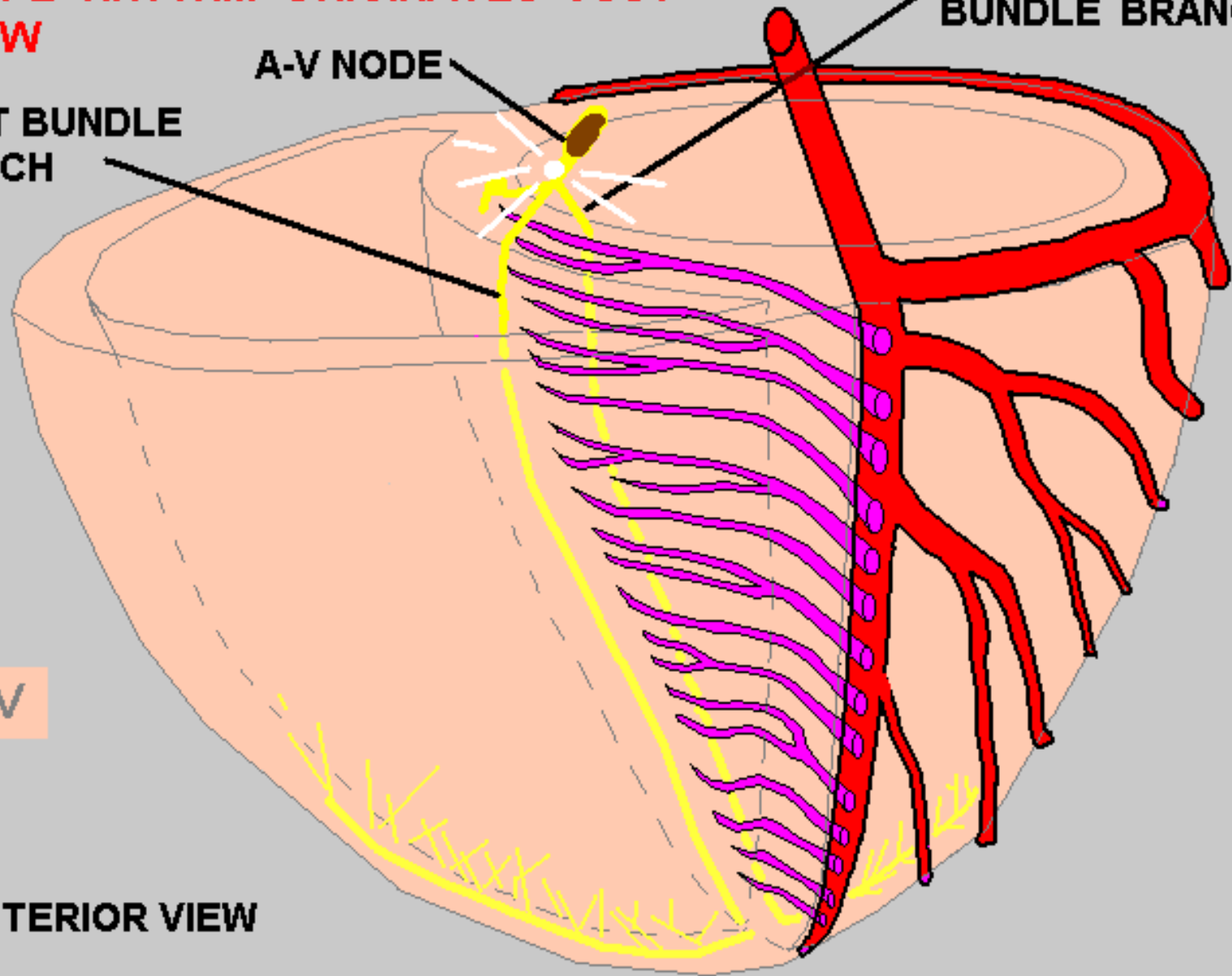
A-V NODE

LEFT ANTERIOR BUNDLE BRANCH

RV

LV

ANTERIOR VIEW



# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE \_\_\_\_\_

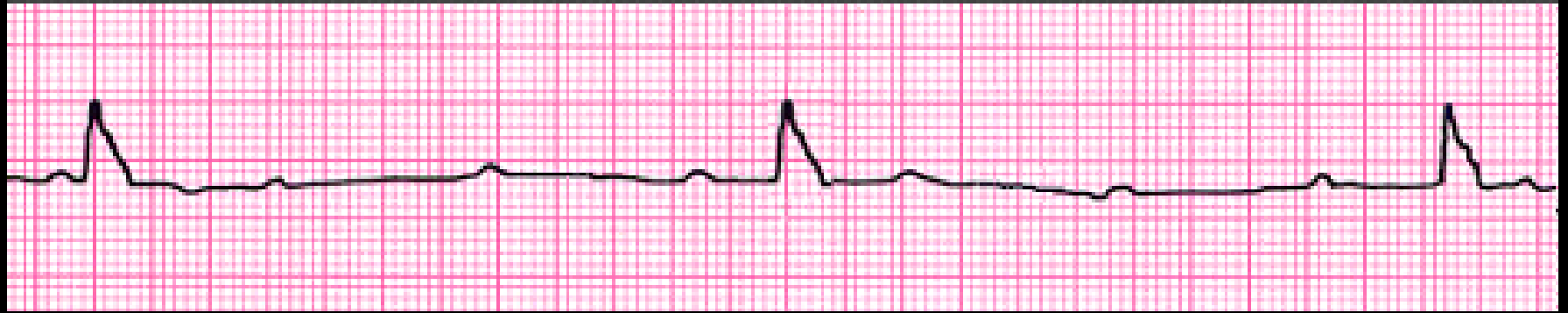
RHYTHM \_\_\_\_\_

P-R INTERVAL \_\_\_\_\_

P:QRS RATIO \_\_\_\_\_

QRS INTERVAL \_\_\_\_\_

# THIS RHYTHM IS: 3rd<sup>o</sup> HB $\bar{c}$ IDIOVENTRICULAR ESCAPE



MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

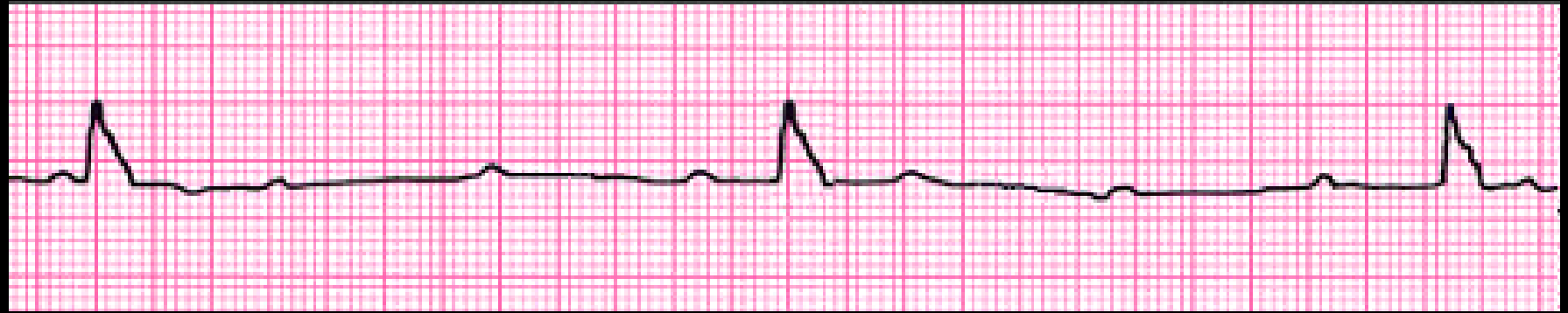
RHYTHM -----

P-R INTERVAL ----

P:QRS RATIO ----

QRS INTERVAL ----

# THIS RHYTHM IS: 3<sup>rd</sup>° HB $\bar{c}$ IDIOVENTRICULAR ESCAPE



MAIN IDENTIFICATION CHARACTERISTIC(S): **P - R INTERVALS INCONSISTENT**  
**P - P INTERVALS REGULAR, R - R INTERVALS REGULAR. NO**  
**RELATIONSHIP BETWEEN P WAVES AND QRS COMPLEXES. QRS**  
**COMPLEXES are WIDER THAN 120ms, AND OF SLOW VENTRICULAR**  
**RATE ( usually < 40 )**

RATE ----- USUALLY BRADYCARDIC ( < 40 VENTRICULAR RATE )

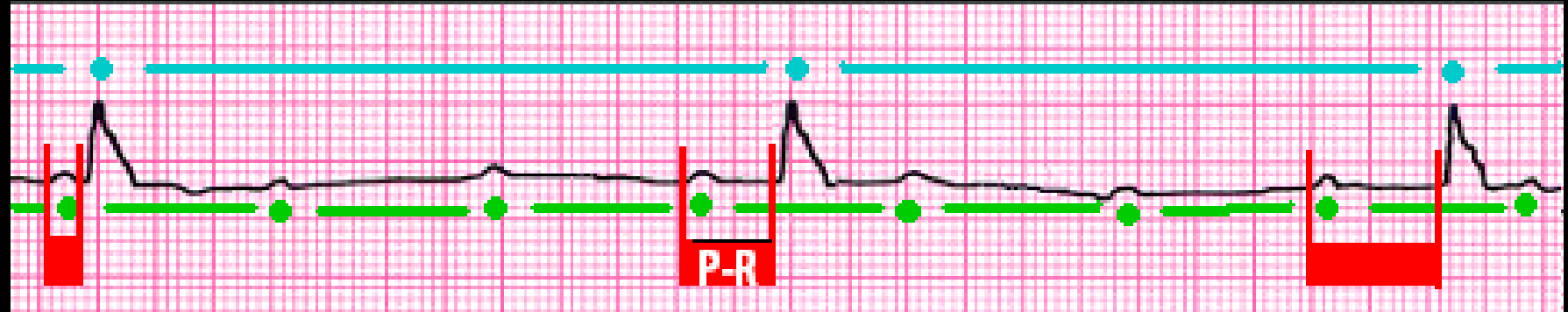
RHYTHM ----- REGULAR

P-R INTERVAL ---- **INCONSISTENT ( irregularly irregular )**

P:QRS RATIO ---- **VARIES - USUALLY > 2 : 1**

QRS INTERVAL ---- **WIDER THAN 120 ms**

# THIS RHYTHM IS: 3rd<sup>o</sup> HB $\bar{c}$ IDIOVENTRICULAR ESCAPE



MAIN IDENTIFICATION CHARACTERISTIC(S): **P - R INTERVALS INCONSISTENT**  
**P - P INTERVALS REGULAR, R - R INTERVALS REGULAR. NO**  
**RELATIONSHIP BETWEEN P WAVES AND QRS COMPLEXES. QRS**  
**COMPLEXES are WIDER THAN 120ms, AND OF SLOW VENTRICULAR**  
**RATE ( usually < 40 )**

RATE ----- USUALLY BRADYCARDIC ( < 40 VENTRICULAR RATE )

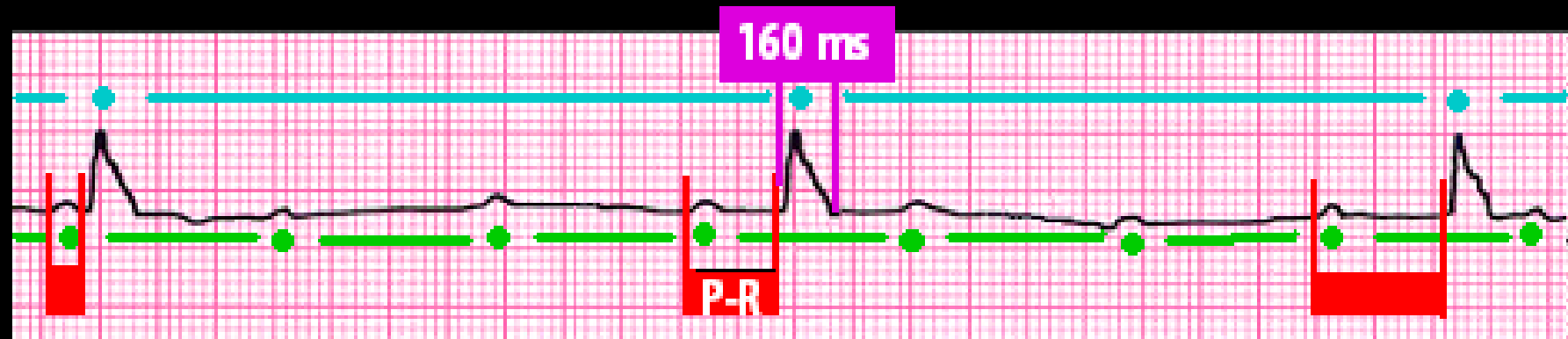
RHYTHM ----- REGULAR

P-R INTERVAL ---- INCONSISTENT ( irregularly irregular )

P:QRS RATIO ---- VARIES - USUALLY > 2 : 1

QRS INTERVAL ---- WIDER THAN 120 ms

# THIS RHYTHM IS: 3rd<sup>o</sup> HB $\bar{c}$ IDIOVENTRICULAR ESCAPE



MAIN IDENTIFICATION CHARACTERISTIC(S): **P - R INTERVALS INCONSISTENT**  
**P - P INTERVALS REGULAR, R - R INTERVALS REGULAR. NO**  
**RELATIONSHIP BETWEEN P WAVES AND QRS COMPLEXES. QRS**  
**COMPLEXES are WIDER THAN 120ms, AND OF SLOW VENTRICULAR**  
**RATE ( usually < 40 )**

RATE ----- USUALLY BRADYCARDIC ( < 40 VENTRICULAR RATE )

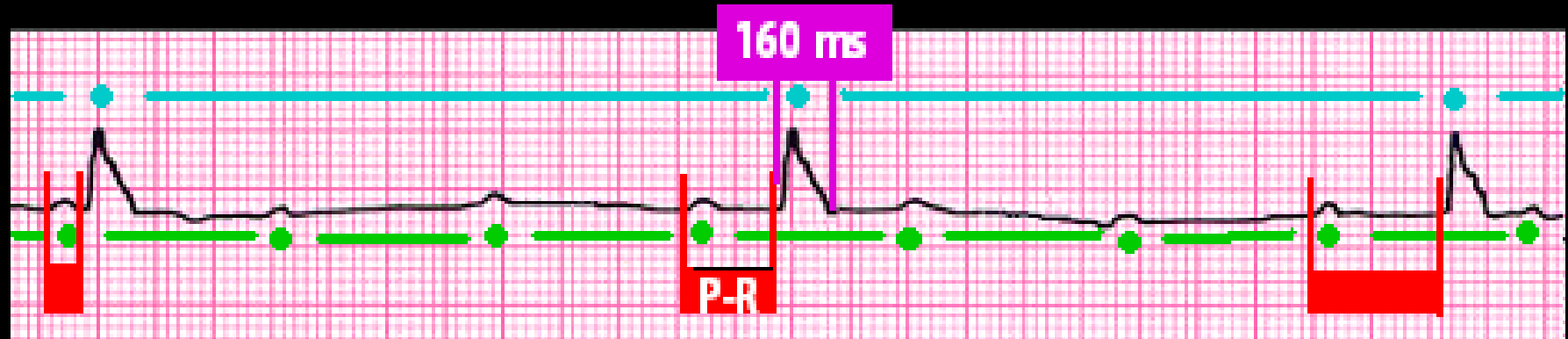
RHYTHM ----- REGULAR

P-R INTERVAL ---- INCONSISTENT ( irregularly irregular )

P:QRS RATIO ---- VARIES - USUALLY > 2 : 1

QRS INTERVAL ---- WIDER THAN 120 ms

# THIS RHYTHM IS: 3rd<sup>o</sup> HB $\bar{c}$ IDIOVENTRICULAR ESCAPE



MAIN IDENTIFICATION CHARACTERISTIC(S): **P - R INTERVALS INCONSISTENT**  
**P - P INTERVALS REGULAR, R - R INTERVALS REGULAR. NO**  
**RELATIONSHIP BETWEEN P WAVES AND QRS COMPLEXES. QRS**  
**COMPLEXES are WIDER THAN 120ms, AND RATE (usually < 40)**

## POTENTIAL PROBLEMS:

**HYPOTENSION and SHOCK due to ↓ HEART RATE and**  
**↓ CARDIAC OUTPUT**

SEP-2006

ST. JOSEPH'S HOSPITAL

95 yr  
Female Caucasian

Vent. rate	18	BPM
PR interval	*	ms
QRS duration	226	ms
QT/QTc	706/385	ms
P-R-T axes	* -79	80

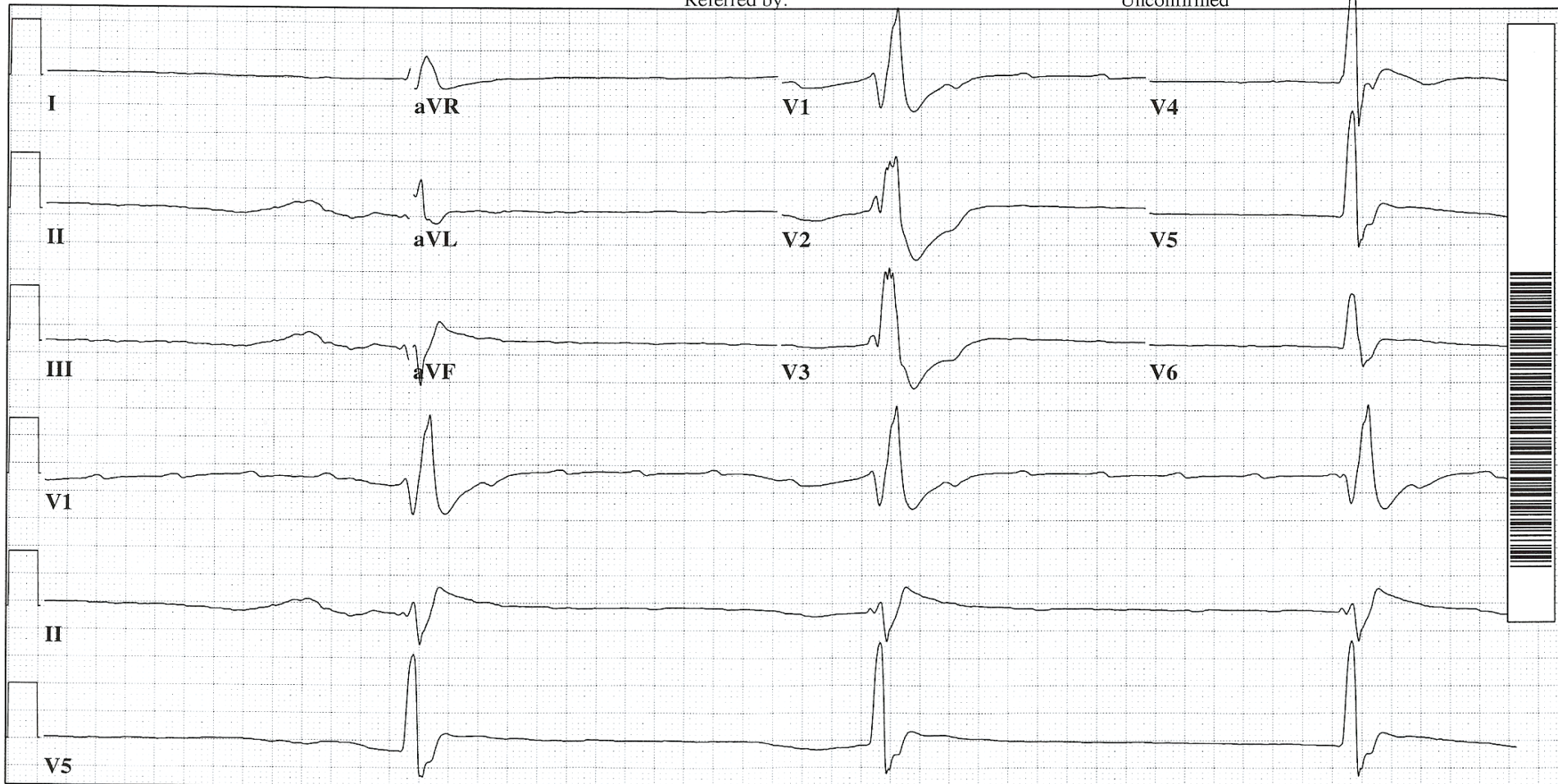
\*\*\* Less than 4 QRS complexes detected, no interpretation possible  
When compared with ECG of 30-DEC-2005 18:36,  
Current undetermined rhythm precludes rhythm comparison, needs review

Loc:3 Option:23

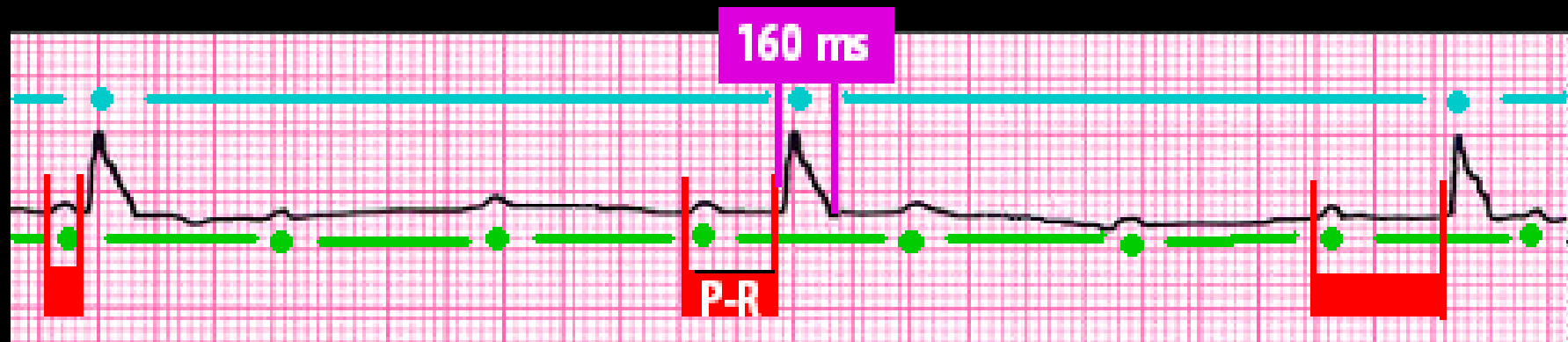
Technician:

Referred by:

Unconfirmed



# THIS RHYTHM IS: 3rd<sup>o</sup> HB $\bar{c}$ IDIOVENTRICULAR ESCAPE



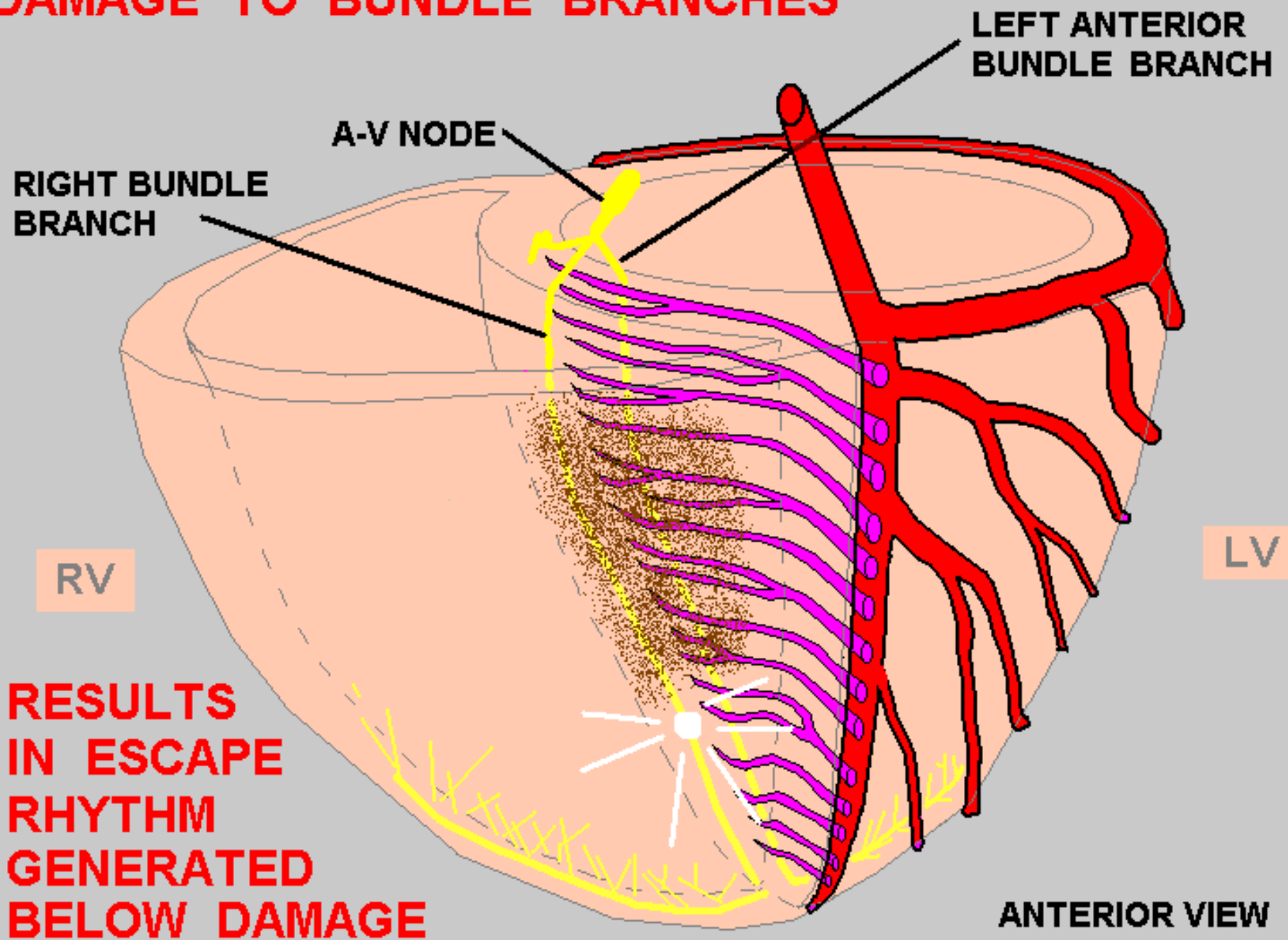
MAIN IDENTIFICATION CHARACTERISTIC(S): **P - R INTERVALS INCONSISTENT**  
**P - P INTERVALS REGULAR, R - R INTERVALS REGULAR. NO**  
**RELATIONSHIP BETWEEN P WAVES AND QRS COMPLEXES. QRS**  
**COMPLEXES are WIDER THAN 120ms, AND RATE (usually < 40)**



**Tx NOTE:**

**PRIMARY EMERGENT TREATMENT**  
**IS TRANSCUTANEOUS PACEMAKER.**  
**- ATROPINE MOST LIKELY WILL**  
**NOT WORK (DUE TO INFRA-HISIAN BLOCK)**

# DAMAGE TO BUNDLE BRANCHES



LEFT ANTERIOR BUNDLE BRANCH

A-V NODE

RIGHT BUNDLE BRANCH

RV

LV

RESULTS IN ESCAPE RHYTHM GENERATED BELOW DAMAGE

ANTERIOR VIEW



???

# CAUSES of HEART BLOCK

## THINK:

- **ISCHEMIA / INFARCTION**
  - AV NODE** INFERIOR WALL (RCA or CIRCUMFLEX LESIONS)
  - HIS / BUNDLE BRANCHES** ANTERIOR WALL (LAD LESIONS)
- **⊖ DROMOTROPIC MEDS** DIGITALIS / BETA & Ca<sup>++</sup> CH BLOCKERS
- **INFILTRATIVE DISEASE** AMYLOIDOSIS / HEMOCHROMATOSIS
- **INFLAMMATORY DISEASE** PERICARDITIS / MYOCARDITIS / RHEUMATIC DISORDERS
- **LEV'S DISEASE** LENEGRE'S SYNDROME
- **AORTIC / MITRAL ANNULAR CALCIFICATION**





## **SINUS ARREST.**

Causes: SA Nodal disease, Increased vagal tone,  
SA Node ischemia / MI

Hemodynamic Concerns: Patient may experience syncope,  
cardiac arrest

Treatment: Atropine, CPR, Pacemaker

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: ATRIAL FIBRILLATION



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: ATRIAL FIBRILLATION



MAIN IDENTIFICATION CHARACTERISTIC(S): **IRREGULARLY IRREGULAR R-R INTERVALS, NO DISCERNABLE P WAVES, FIBRILLATORY BASE-LINE.**

RATE -----	BRADY, NORMAL, or TACHY
RHYTHM -----	<b>IRREGULARLY IRREGULAR</b>
P-R INTERVAL -----	<b>NOT DISCERNABLE</b>
P:QRS RATIO -----	<b>NOT DISCERNABLE</b>
QRS INTERVAL -----	NORMAL, (unless BBB present)

# THIS RHYTHM IS: ATRIAL FIBRILLATION

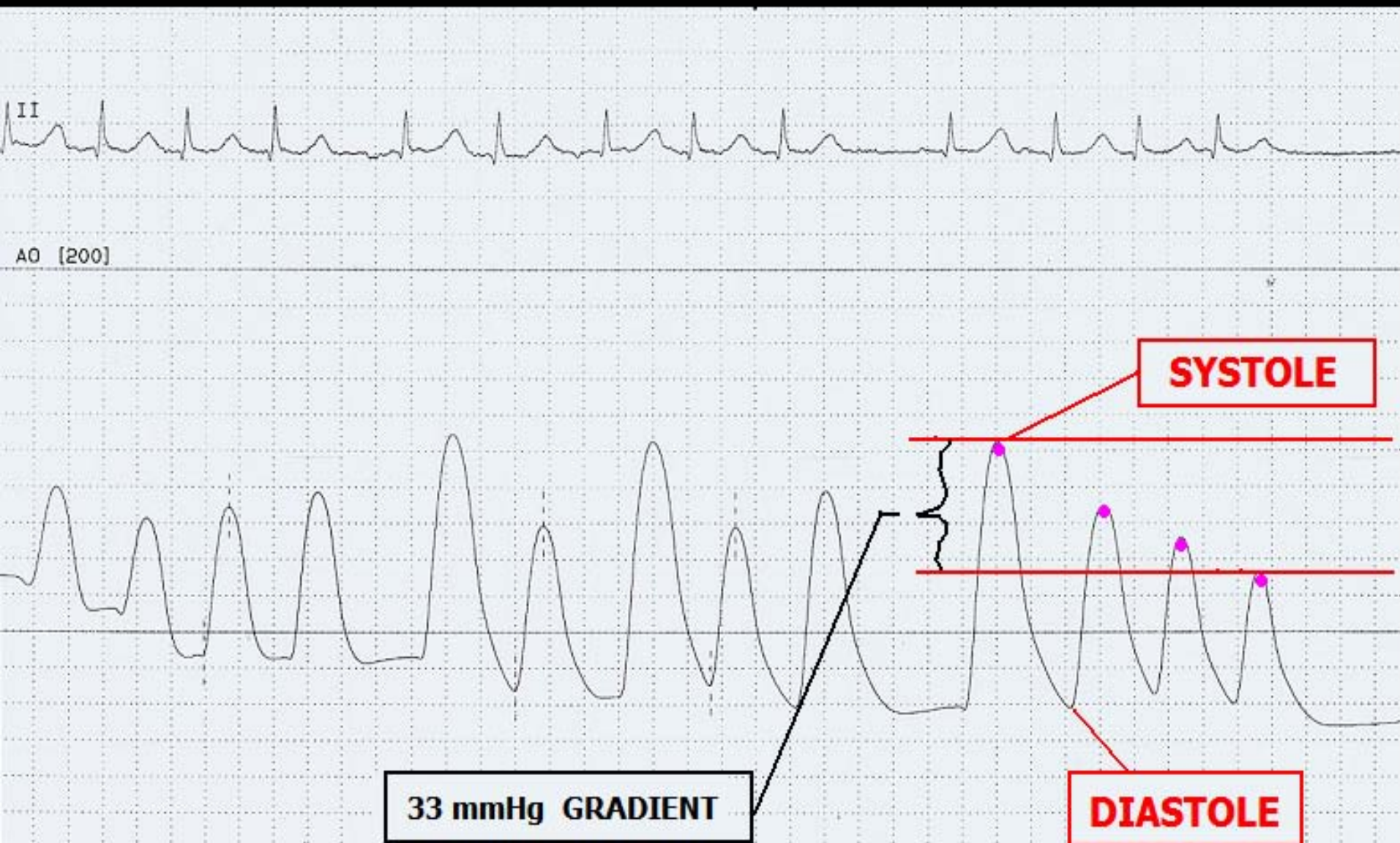


MAIN IDENTIFICATION CHARACTERISTIC(S): **IRREGULARLY IRREGULAR R-R INTERVALS, NO DISCERNABLE P WAVES, FIBRILLATORY BASE-LINE.**  
**VARYING SYSTOLIC BLOOD PRESSURE WITH EACH HEART BEAT**

RATE -----	BRADY, NORMAL, or TACHY
RHYTHM -----	<b>IRREGULARLY IRREGULAR</b>
P-R INTERVAL -----	<b>NOT DISCERNABLE</b>
P:QRS RATIO -----	<b>NOT DISCERNABLE</b>
QRS INTERVAL -----	NORMAL, (unless BBB present)

# The effects of ATRIAL FIBRILLATION on BLOOD PRESSURE

... THIS MEANS YOU MAY OBSERVE FLUCTUATIONS IN THE PATIENT'S PULSE !



# THIS RHYTHM IS: ATRIAL FIBRILLATION



MAIN IDENTIFICATION CHARACTERISTIC(S): **IRREGULARLY IRREGULAR R-R INTERVALS, NO DISCERNABLE P WAVES, FIBRILLATORY BASE-LINE.**

## POTENTIAL PROBLEMS:

- VENTRICULAR RATE CAN BECOME TOO SLOW or TOO FAST
- WITHOUT THE "ATRIAL KICK," CARDIAC OUTPUT DROPS 10-20%
- THROMBUS FORMATION MAY OCCUR IN THE LEFT ATRIAL APPENDAGE, PUTTING PATIENT AT HIGH RISK FOR CVA

# THIS RHYTHM IS: ATRIAL FIBRILLATION



MAIN IDENTIFICATION CHARACTERISTIC(S): **IRREGULARLY IRREGULAR R-R INTERVALS, NO DISCERNABLE P WAVES, FIBRILLATORY BASE-LINE.**

## TREATMENT / INTERVENTIONS:

- **NEED FOR EMERGENCY INTERVENTION FOR A-FIB IS BASED ON PATIENT'S VENTRICULAR RATE:**

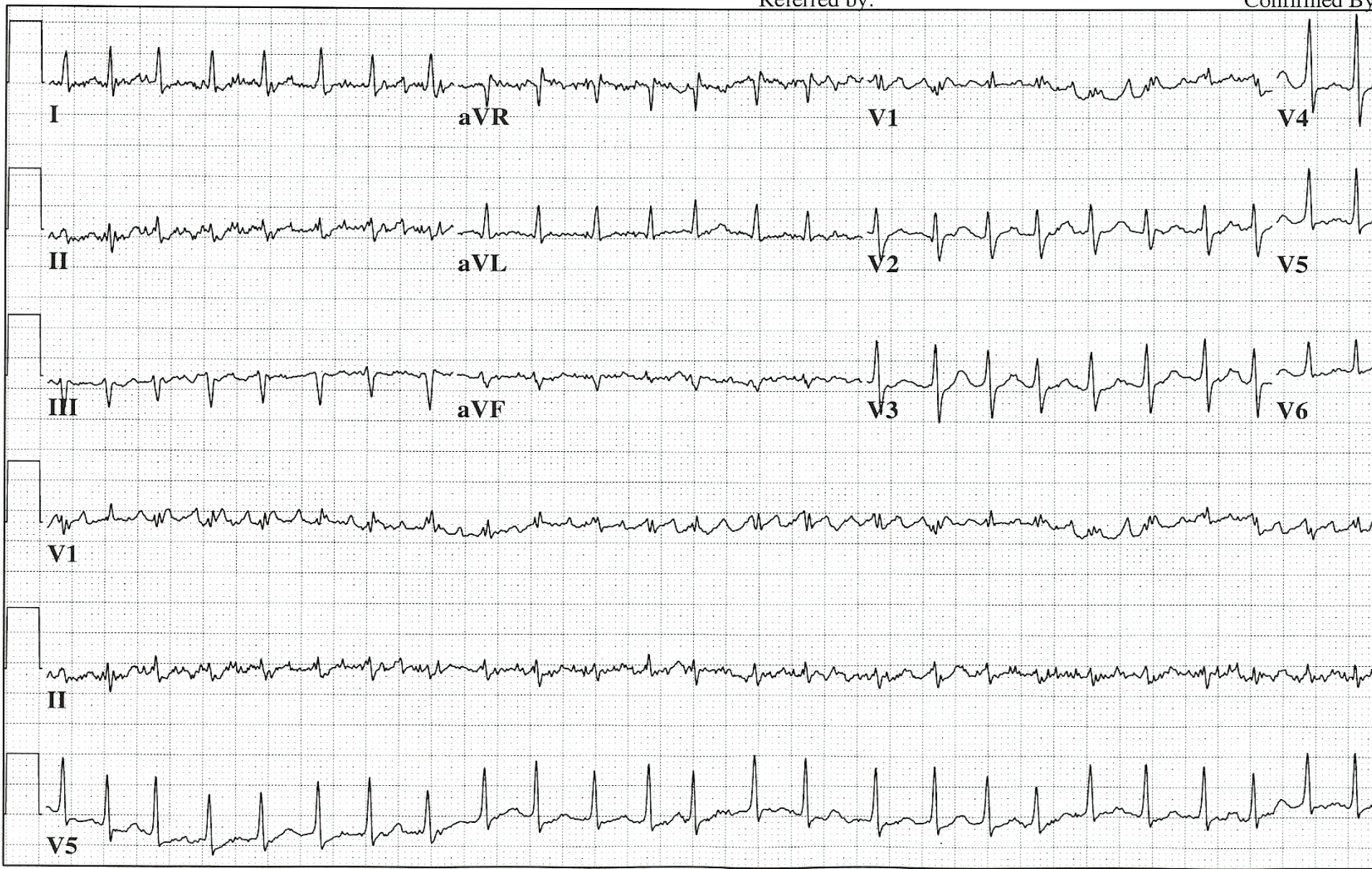
☞ **TOO SLOW - SYMPTOMATIC BRADYCARDIA ALGORITHM**

☞ **TOO FAST - TACHYCARDIA ALGORITHM**

Adrial fibrillation has replaced Sinus rhythm  
Vent. rate has increased BY 109 BPM ...

Referred by:

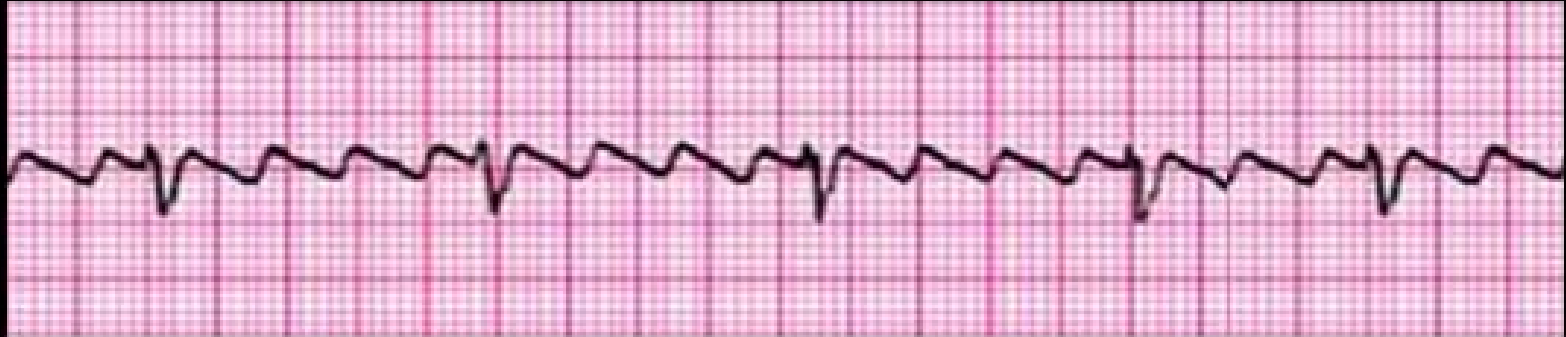
Confirmed By:



25mm/s 10mm/mV 40Hz 005C 12SL 235 CID: 2

EID:10 ED

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

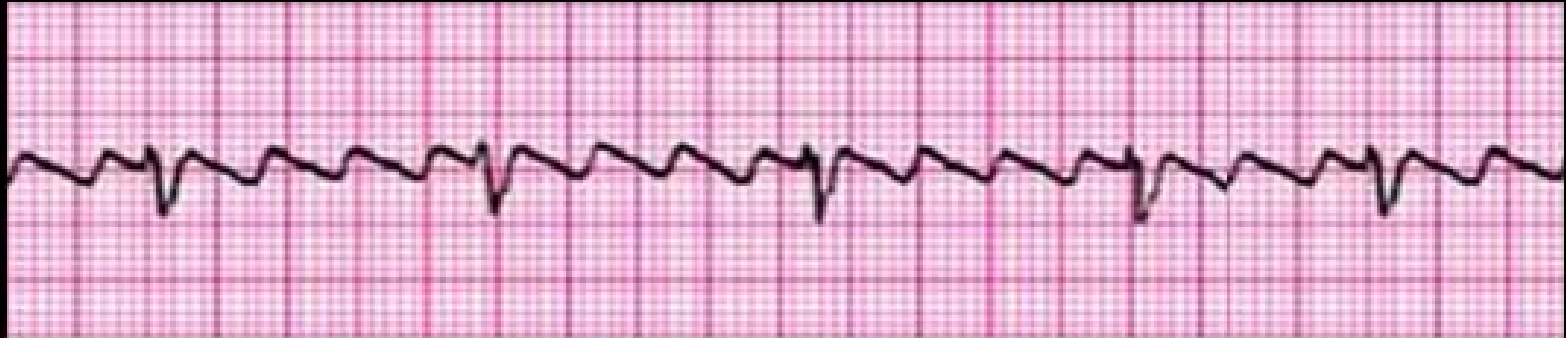
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: ATRIAL FLUTTER



MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

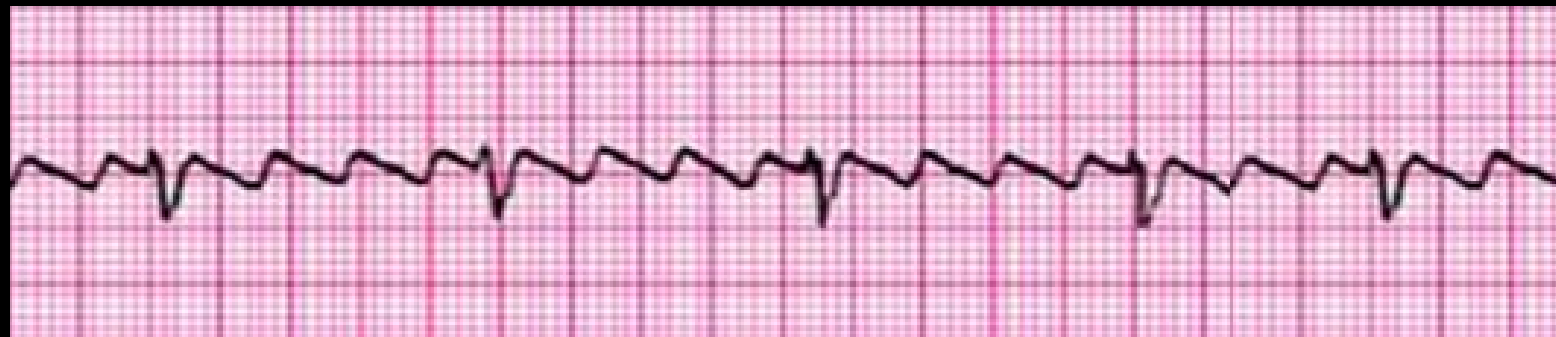
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: ATRIAL FLUTTER



MAIN IDENTIFICATION CHARACTERISTIC(S): **RAPID RATE "SAW-TOOTHED" FLUTTER WAVES (F-WAVES)**

RATE ----- **ATRIAL : 200 - 300, VENT: BRADY, NORMAL or TACHY**  
RHYTHM ----- **REGULAR or IRREGULAR**  
P-R INTERVAL ----- **USUALLY NORMAL, CONSISTENT**  
P:QRS RATIO ----- **VARIES (usually 3:1, 4:1, or 5:1)**  
QRS INTERVAL ----- **NORMAL (unless BBB present)**

# THIS RHYTHM IS: ATRIAL FLUTTER

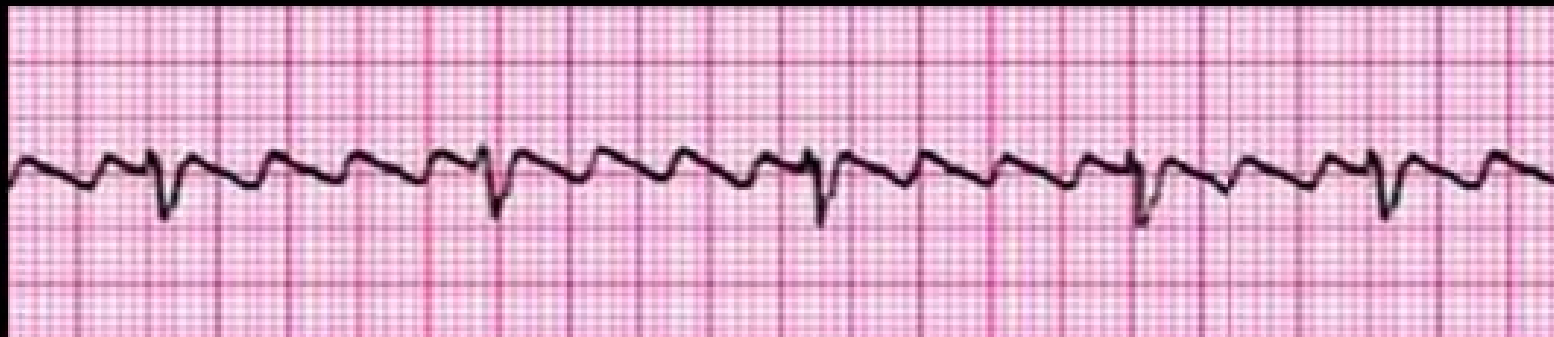


MAIN IDENTIFICATION CHARACTERISTIC(S): **RAPID RATE "SAW - TOOTHED" FLUTTER WAVES (F - WAVES)**

## POTENTIAL PROBLEM(S):

- **VENTRICULAR RATE CAN BE TOO RAPID or TOO SLOW RESULTING IN ↓ CARDIAC OUTPUT and SHOCK**
- **A-FLUTTER OFTEN IS INTERMITTENT WITH A-FIB -- THEREFORE A-FIB PRECAUTIONS APPLY (THROMBUS RISKS)**

# THIS RHYTHM IS: ATRIAL FLUTTER



MAIN IDENTIFICATION CHARACTERISTIC(S): **RAPID RATE "SAW-TOOTHED" FLUTTER WAVES (F-WAVES)**

## TREATMENT / INTERVENTIONS:

- **NEED FOR EMERGENCY INTERVENTION IS BASED ON PATIENT'S VENTRICULAR RATE:**

☞ **TOO SLOW - SYMPTOMATIC BRADYCARDIA ALGORITHM**

☞ **TOO FAST - TACHYCARDIA ALGORITHM**

68 yr  
Male Hispanic  
Room: VAM  
Loc: 3 Option: 23

Vent. rate 85 BPM  
PR interval \* ms  
QRS duration 100 ms  
QT/QTc 342/406 ms  
P-R-T axes \* 58 46

\*\*\*UNEDITED COPY: REPORT IS COMPUTER GENERATED ONLY, WITHOUT PHYSICIAN INTERPRETATION\*\*.  
Atrial fibrillation  
Voltage criteria for left ventricular hypertrophy  
Abnormal ECG  
When compared with ECG of 19-NOV-2006 07:39,  
No significant change was found

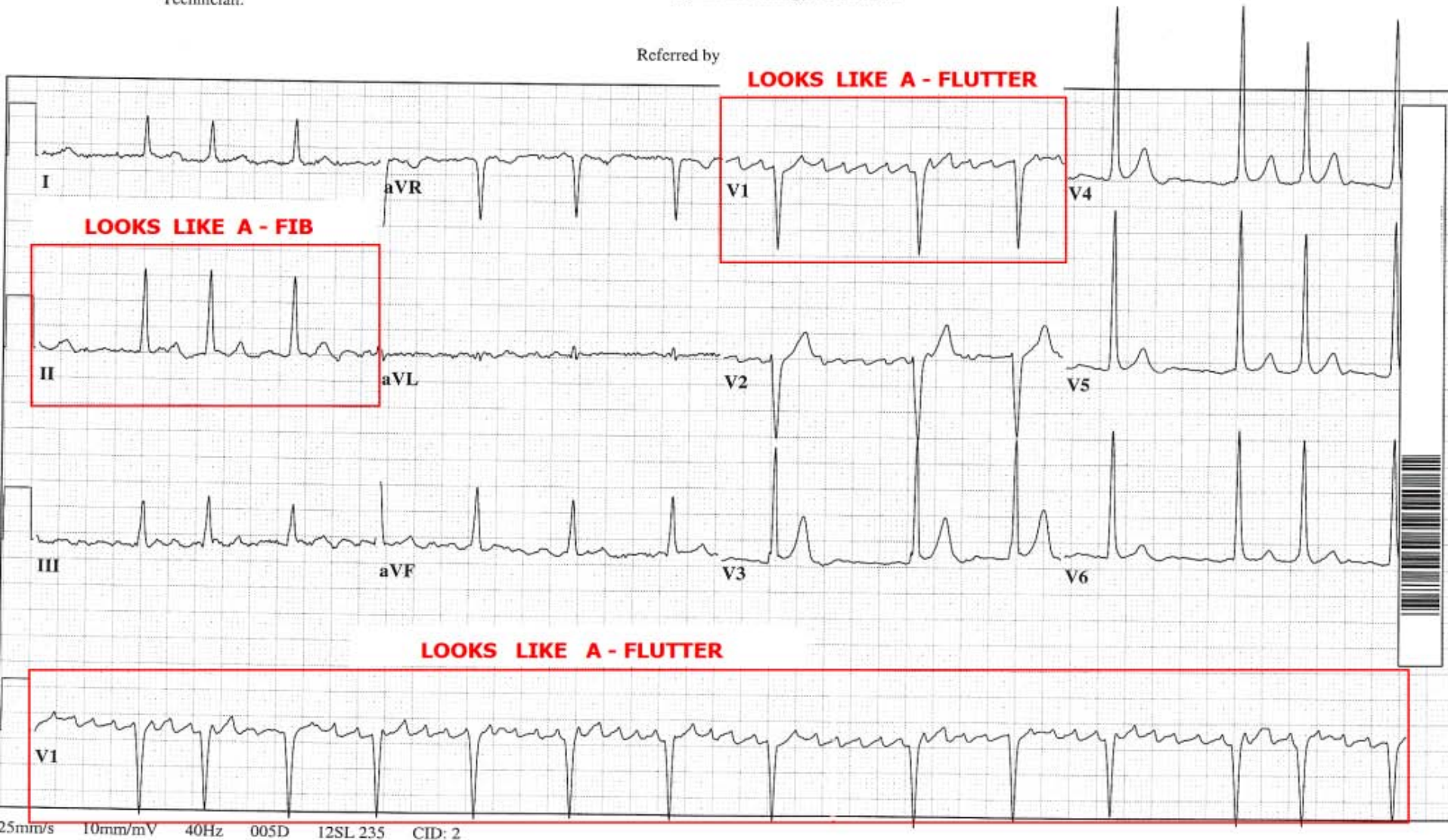
Technician:

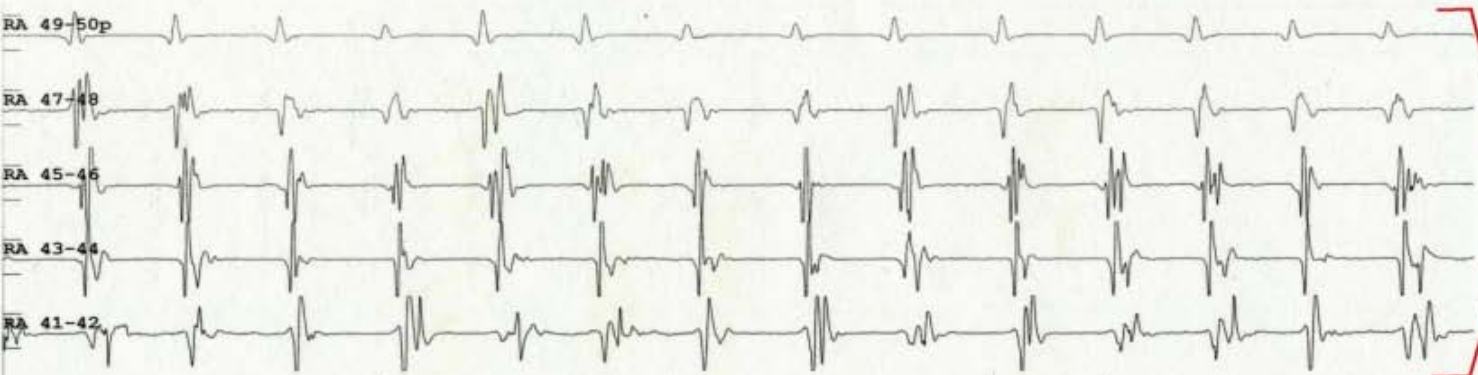
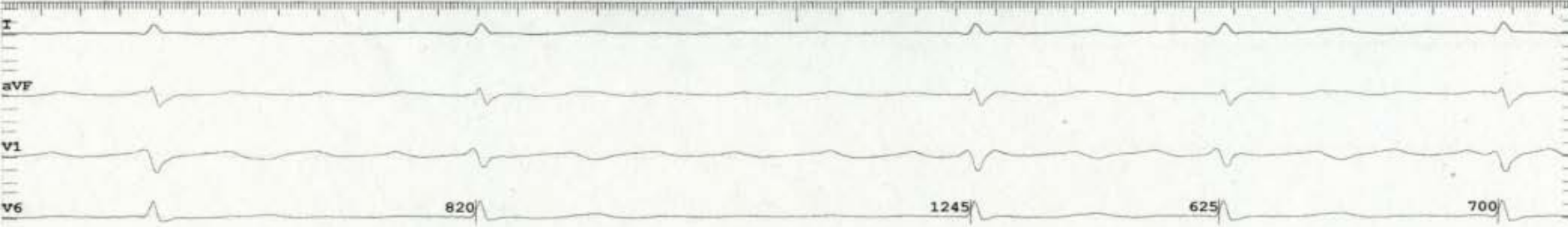
Referred by

**LOOKS LIKE A - FLUTTER**

**LOOKS LIKE A - FIB**

**LOOKS LIKE A - FLUTTER**

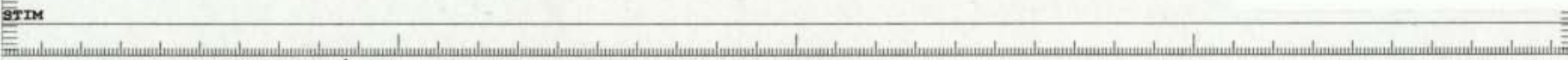




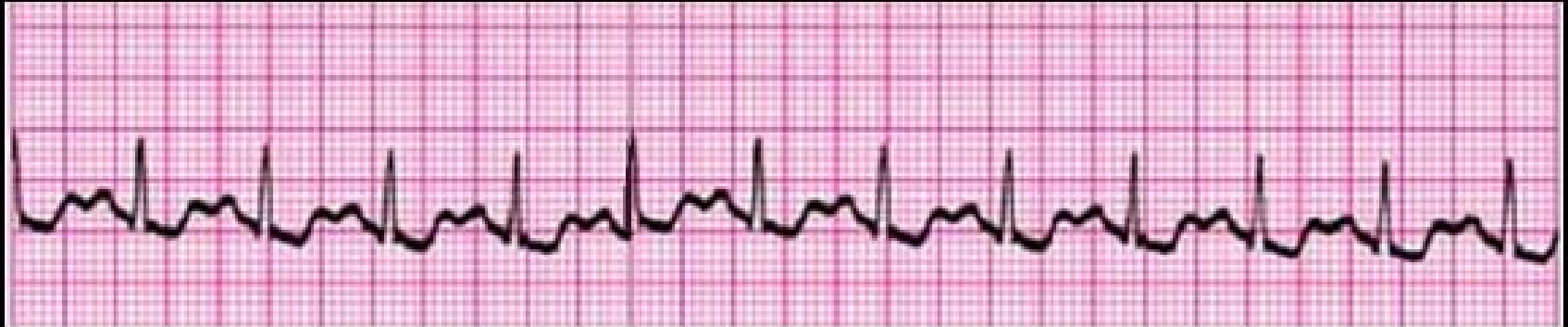
**RIGHT ATRIUM  
in  
ATRIAL  
FLUTTER**



**LEFT ATRIUM  
IN  
ATRIAL  
FIBRILLATION**



# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

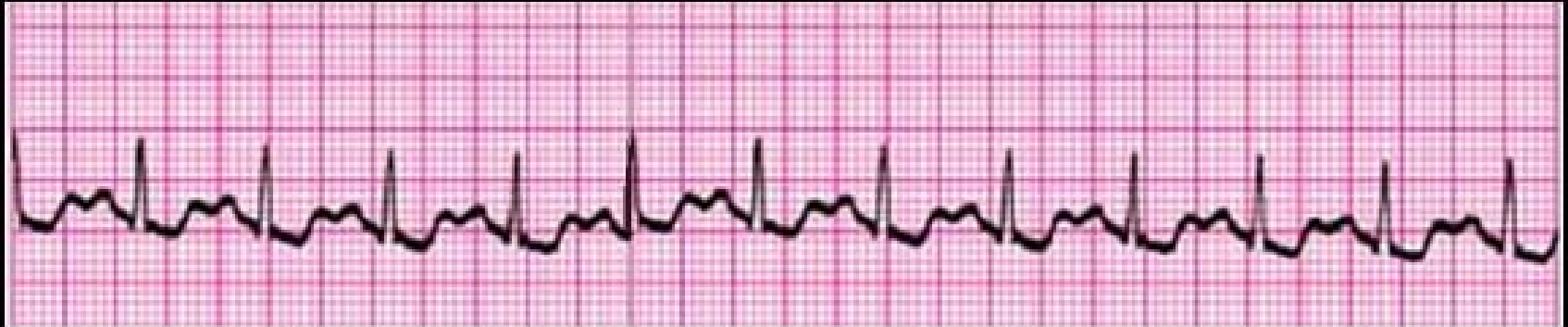
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: SINUS TACHYCARDIA



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

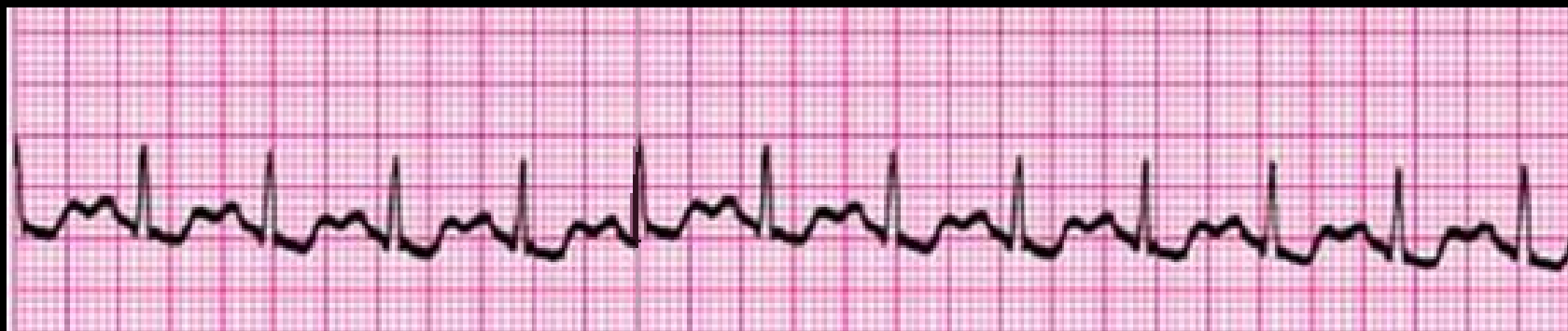
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: SINUS TACHYCARDIA



MAIN IDENTIFICATION CHARACTERISTIC(S): **SINUS RHYTHM, RATE HIGHER THAN 100. (ACLS guidelines: heart rate 100 - 150 )**

RATE ----- **100 - 150 ( can be > 150 )**

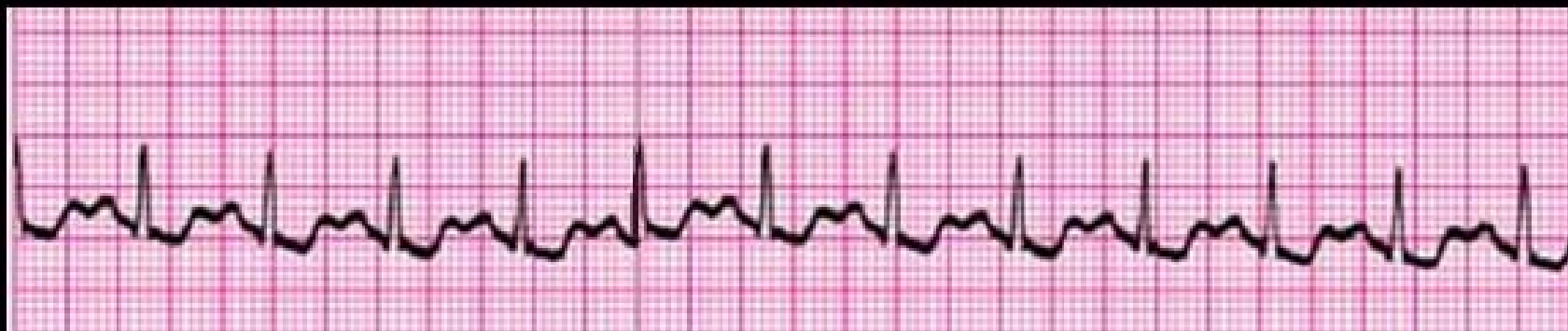
RHYTHM ----- **REGULAR**

P-R INTERVAL ----- **NORMAL ( 120 - 200 ms )**

P:QRS RATIO ----- **1 : 1**

QRS INTERVAL ----- **NORMAL (< 120 ms ), ( unless Bundle Branch Block present )**

# THIS RHYTHM IS: SINUS TACHYCARDIA

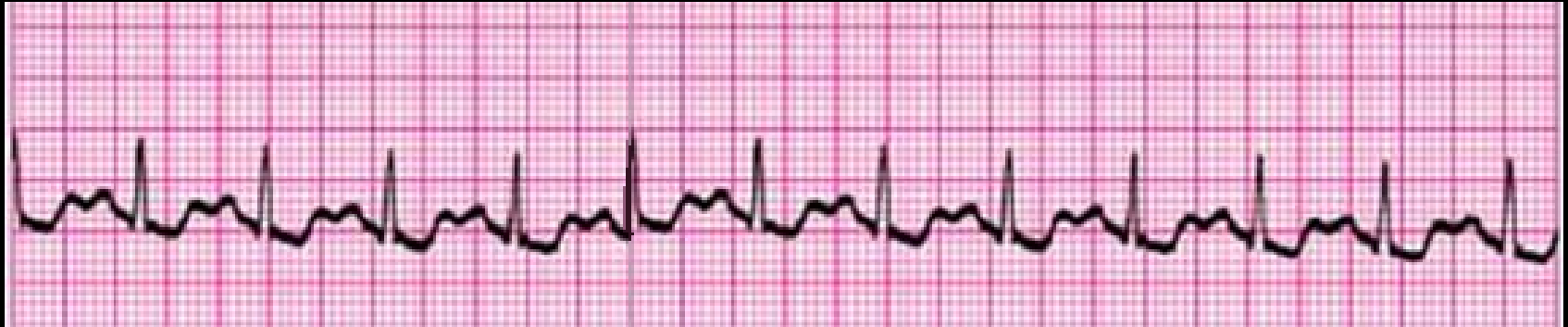


MAIN IDENTIFICATION CHARACTERISTIC(S): **SINUS RHYTHM, RATE HIGHER THAN 100. (ACLS guidelines: heart rate 100 - 150 )**

## POTENTIAL PROBLEMS :

- Usually none, unless pt. has severe underlying disease, such as a LOW EF ( <40 % ).
- IN MOST CASES, the patient's UNDERLYING PROBLEM is the key issue . . . .

# THIS RHYTHM IS: SINUS TACHYCARDIA



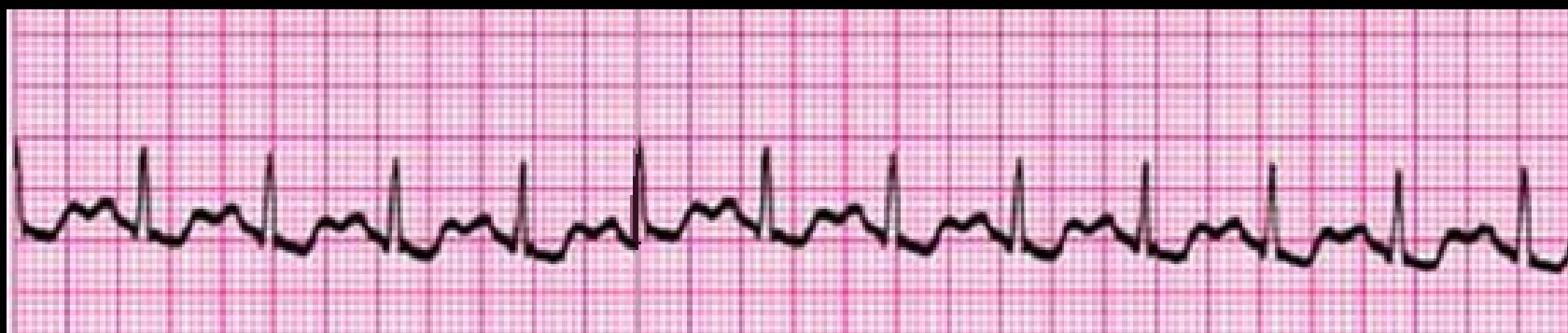
MAIN IDENTIFICATION CHARACTERISTIC(S): **SINUS RHYTHM, RATE HIGHER THAN 100. (ACLS guidelines: heart rate 100 - 150 )**

## TREATMENT / INTERVENTIONS :



**IN MOST CASES, YOU TREAT THE UNDERLYING CAUSE!**

# THIS RHYTHM IS: SINUS TACHYCARDIA



**WE MUST CONSIDER  
UNDERLYING CAUSES:**

**AND TREAT THEM:**

**ANXIETY / FEAR**



**CALM PATIENT**

**HYPOVOLEMIA**

**DEHYDRATION**



**FLUIDS**

**BLOOD LOSS**



**STOP BLEEDING**

**MEDICATION EFFECTS**



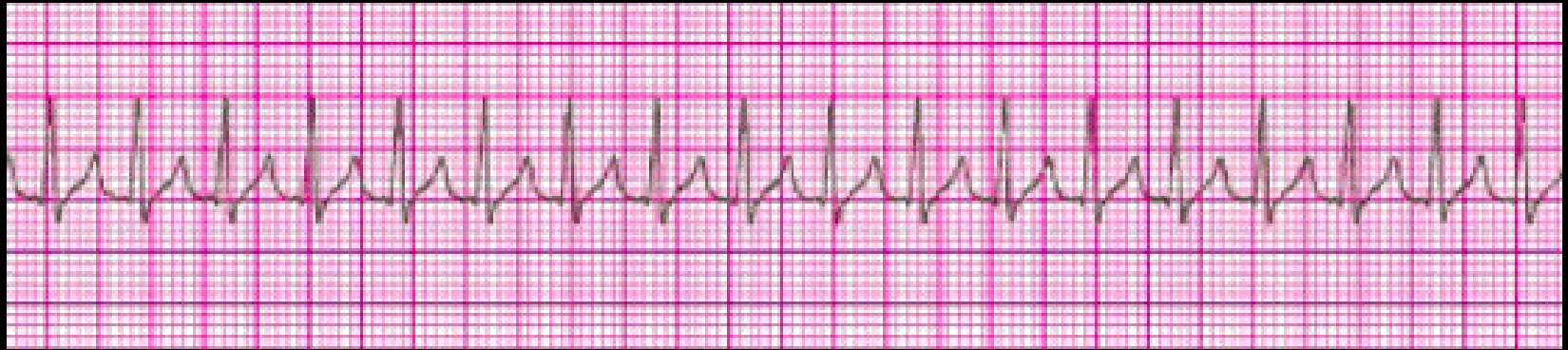
**CONSIDER MEDICAL Tx**

**OTHER ILLNESS**



**IDENTIFY & Tx DISORDER**

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

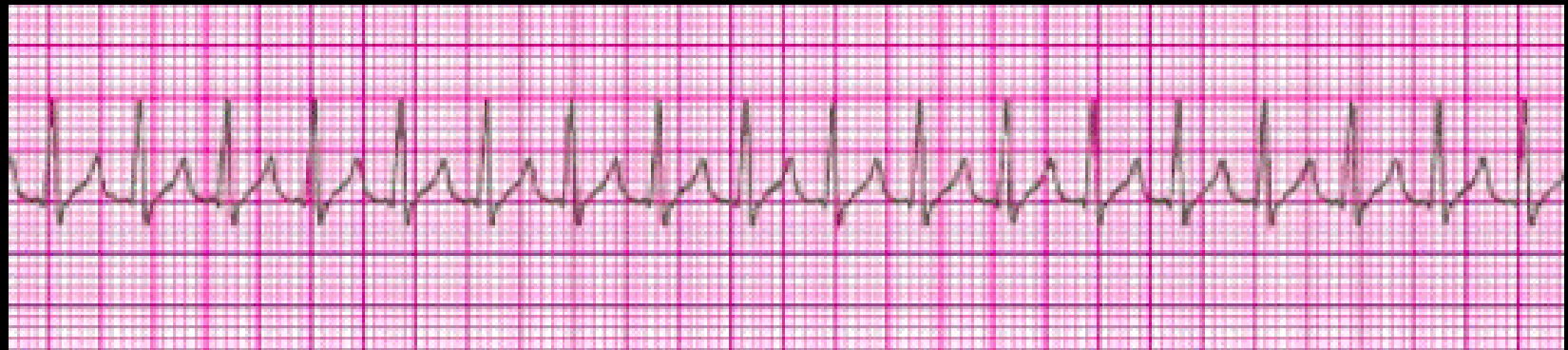
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: SUPRAVENTRICULAR TACHYCARDIA (SVT)



MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

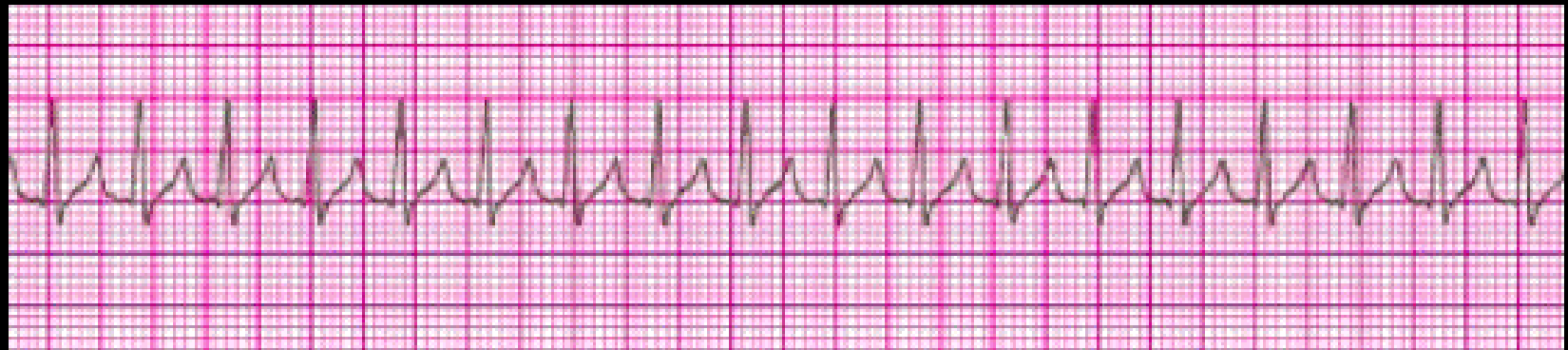
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

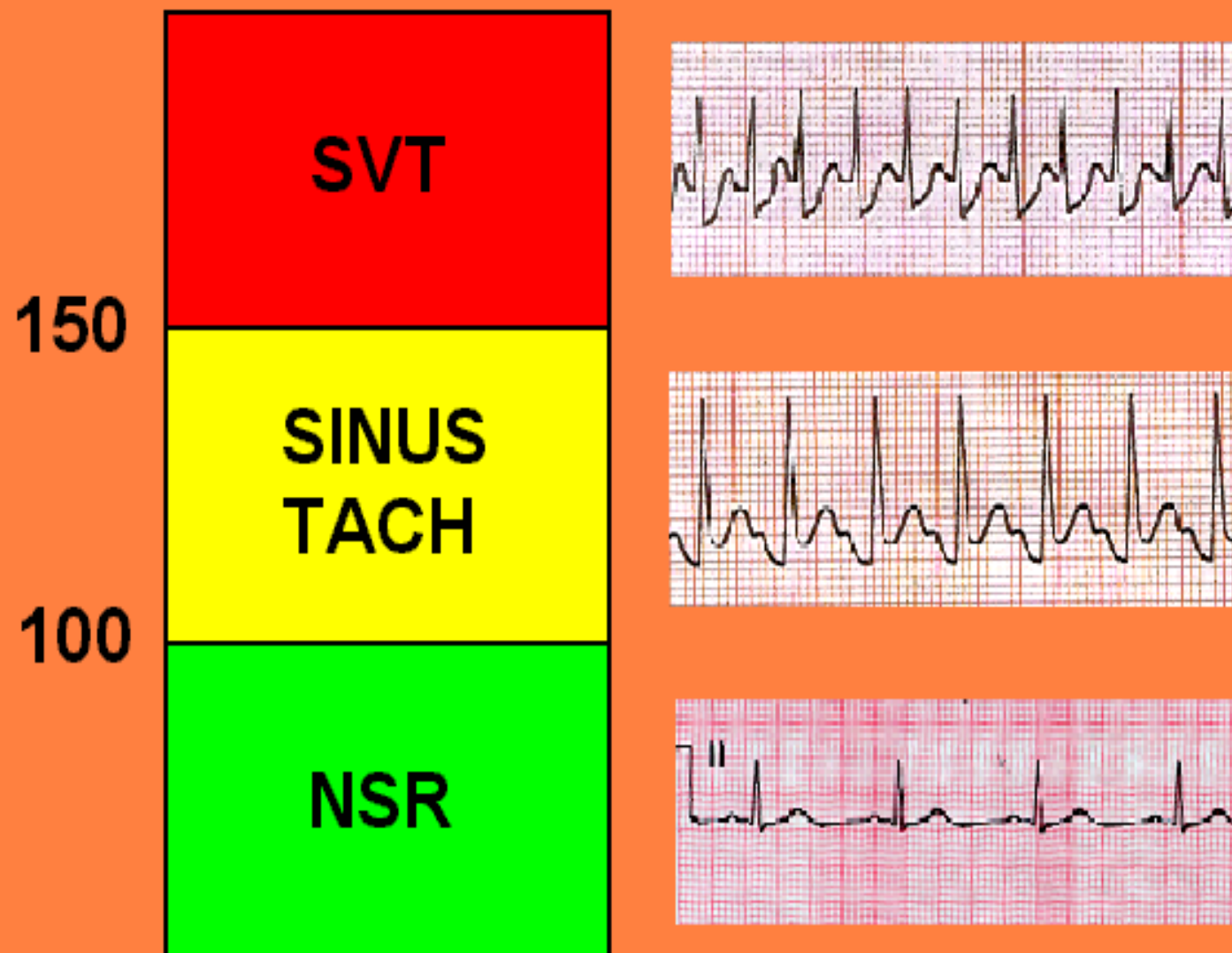
# THIS RHYTHM IS: SUPRAVENTRICULAR TACHYCARDIA (SVT)



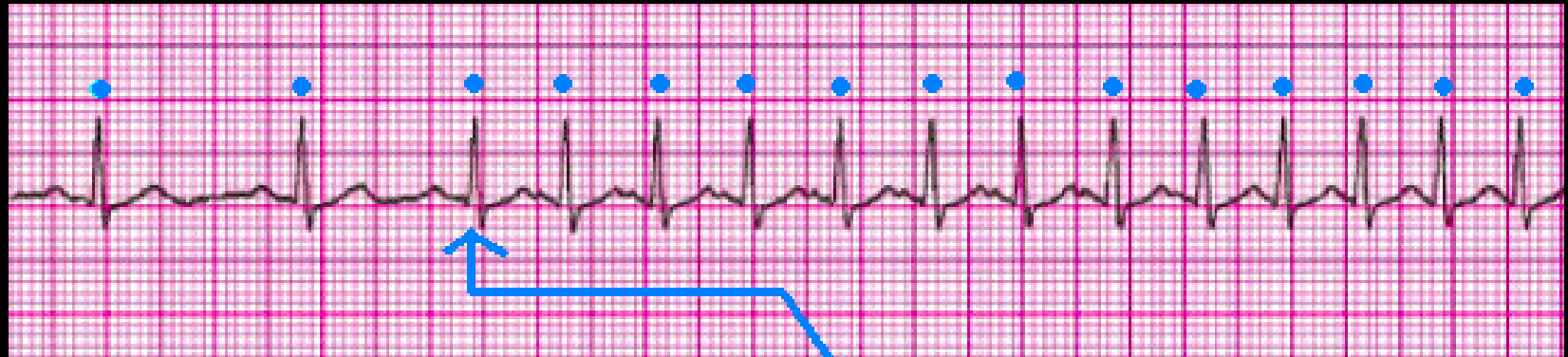
**MAIN IDENTIFICATION CHARACTERISTIC(S): HEART RATE TOO FAST, USUALLY > 150. P WAVES MAY BE "BURIED" IN THE PRECEDING T WAVES. Pt USUALLY C/O "SUDDEN ONSET of HEART RACING," or "PALPITATIONS."**

<b>RATE</b> -----	<b>TACHYCARDIC (usually &gt; 150)</b>
<b>RHYTHM</b> -----	<b>REGULAR</b>
<b>P-R INTERVAL</b> -----	<b>NORMAL or ABNORMAL. MAY BE IMPOSSIBLE TO SEE DUE TO P WAVE BURIED IN T WAVES</b>
<b>P:QRS RATIO</b> -----	<b>1:1</b>
<b>QRS INTERVAL</b> -----	<b>NORMAL</b>

# ACLS TACHYCARDIA GUIDELINES



## RHYTHM CLUES . . . .

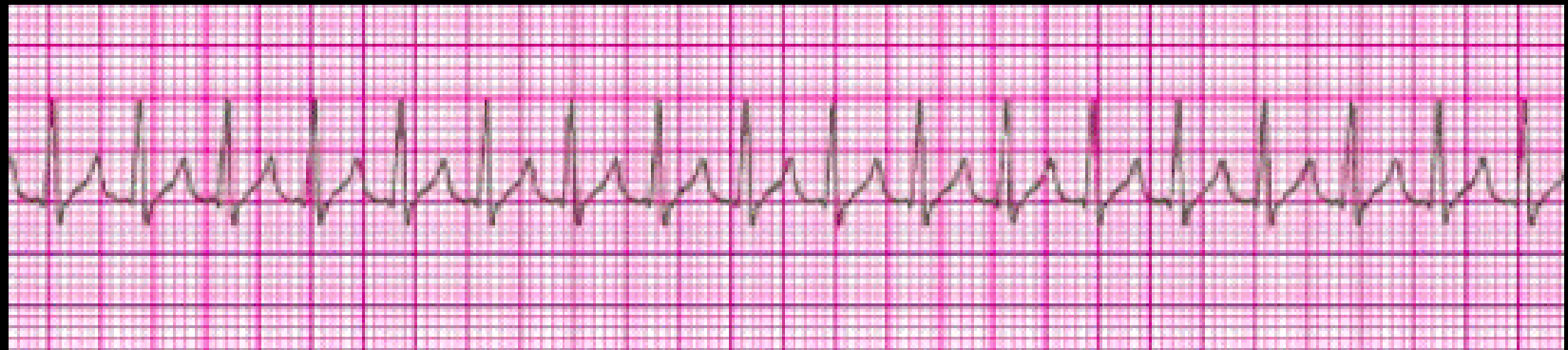


**SUPRAVENTRICULAR TACHYCARDIA**

**SVT is usually PAROXYSMAL -- ie: has a SUDDEN ONSET.**

**SINUS TACHYCARDIA usually has a "ramp - up " and "ramp - down " period -- a gradual change in HEART RATE.**

# THIS RHYTHM IS: SUPRAVENTRICULAR TACHYCARDIA (SVT)

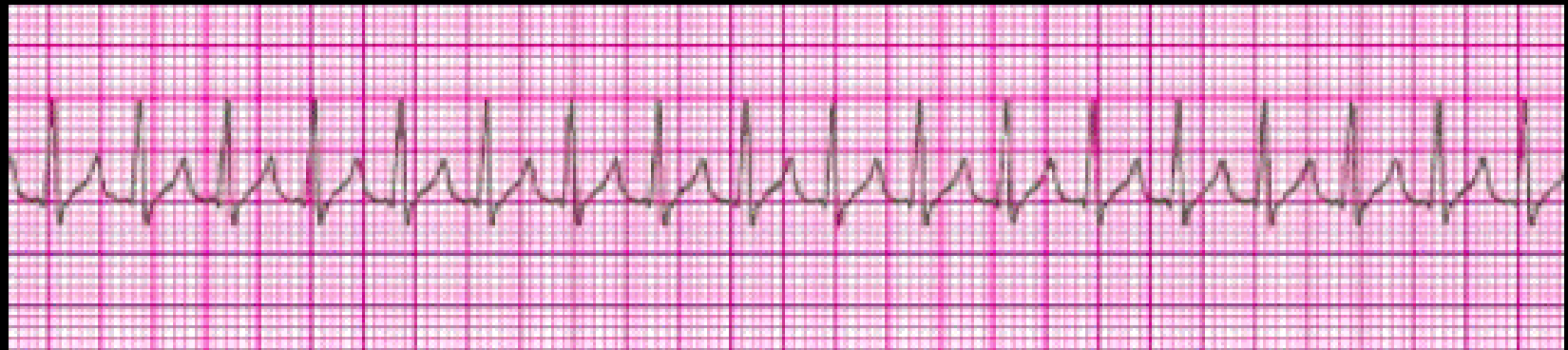


**MAIN IDENTIFICATION CHARACTERISTIC(S): HEART RATE TOO FAST, USUALLY > 150. P WAVES MAY BE "BURIED" IN THE PRECEDING T WAVES. Pt USUALLY C/O "SUDDEN ONSET of HEART RACING," or "PALPITATIONS."**

## POTENTIAL PROBLEMS:

- HEART MAY BE BEATING TOO FAST TO ALLOW ADEQUATE TIME FOR VENTRICULAR FILLING, RESULTING IN ↓ CARDIAC OUTPUT AND POSSIBLE HYPOTENSION AND SHOCK.
- MYOCARDIAL ISCHEMIA (and therefore CHEST PAIN ) IN PATIENTS WITH SIGNIFICANT UNDERLYING HEART DISEASE.

# THIS RHYTHM IS: SUPRAVENTRICULAR TACHYCARDIA (SVT)



**MAIN IDENTIFICATION CHARACTERISTIC(S): HEART RATE TOO FAST, USUALLY > 150. P WAVES MAY BE "BURIED" IN THE PRECEDING T WAVES. Pt USUALLY C/O "SUDDEN ONSET of HEART RACING," or "PALPITATIONS."**

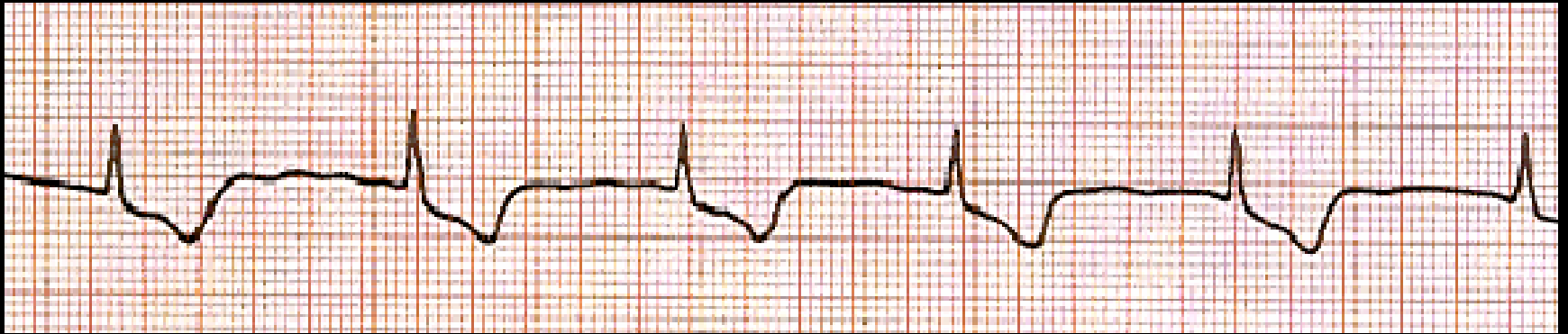
## TREATMENT / INTERVENTIONS:



**BASED ON WHETHER PATIENT IS**

**STABLE or UNSTABLE . . .**

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

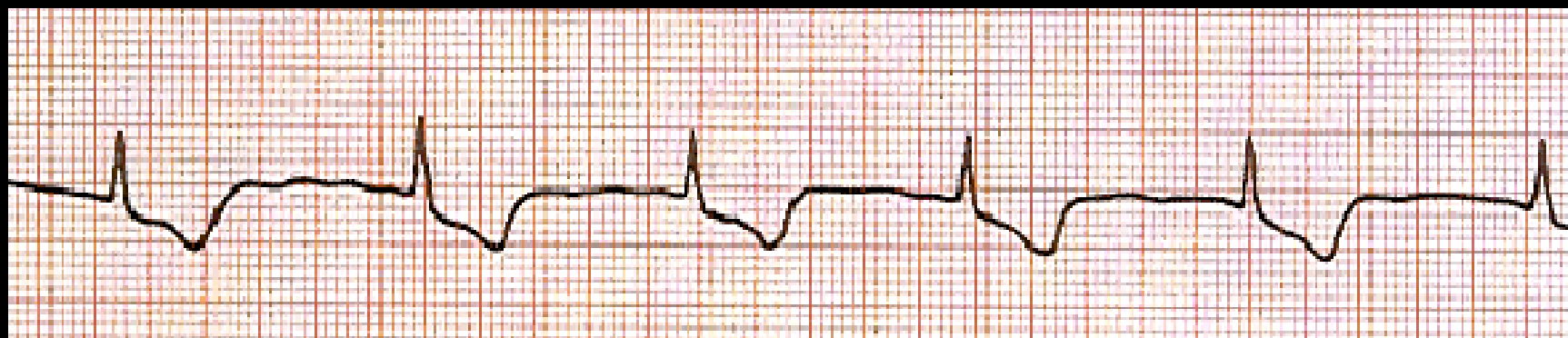
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: JUNCTIONAL RHYTHM



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

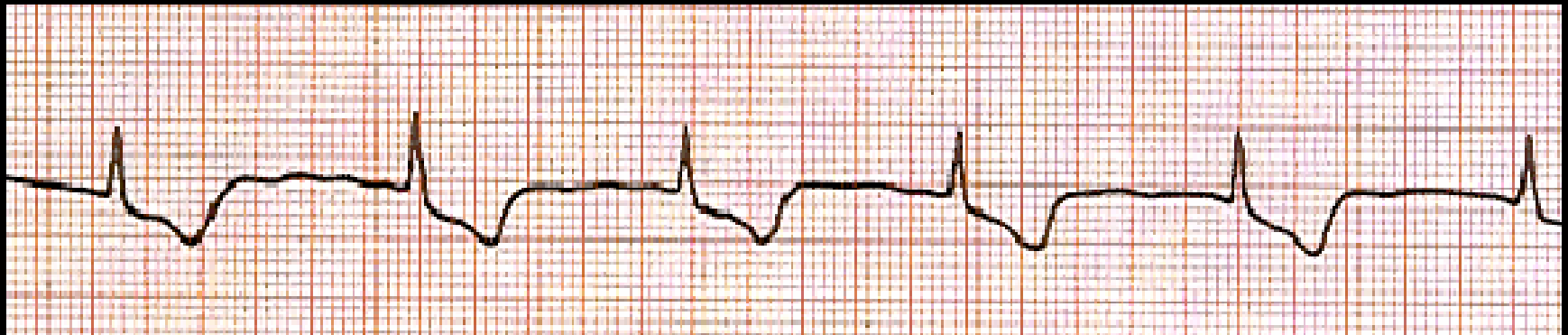
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: JUNCTIONAL RHYTHM



**MAIN IDENTIFICATION CHARACTERISTIC(S): P WAVES ABSENT, or LOCATED JUST AFTER QRS (in S-Tseg) or JUST BEFORE QRS (short P-R). WHEN P wave**

**seen, it is INVERTED (upside-down).**

**- HR USUALLY 40-60**

**RATE ----- 40-60**

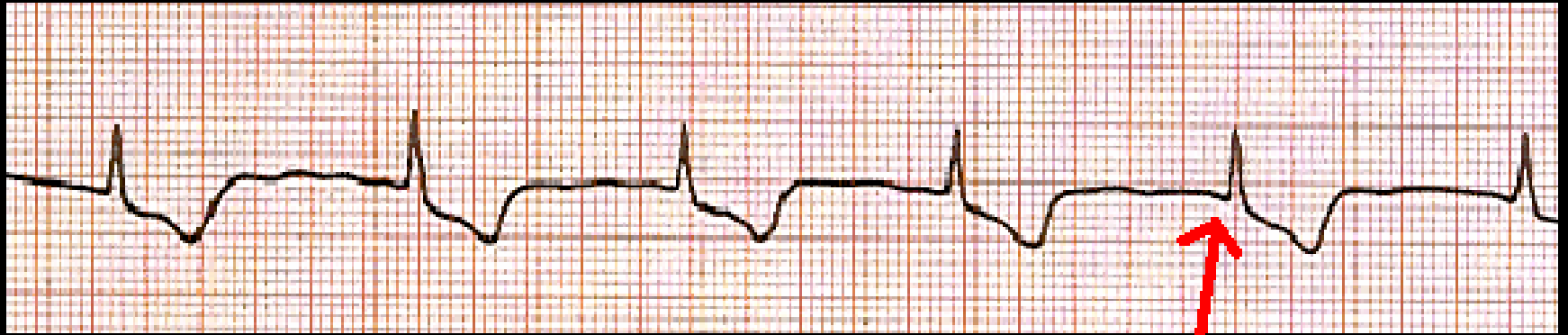
**RHYTHM ----- REGULAR**

**P-R INTERVAL ----- ABSENT or SHORT**

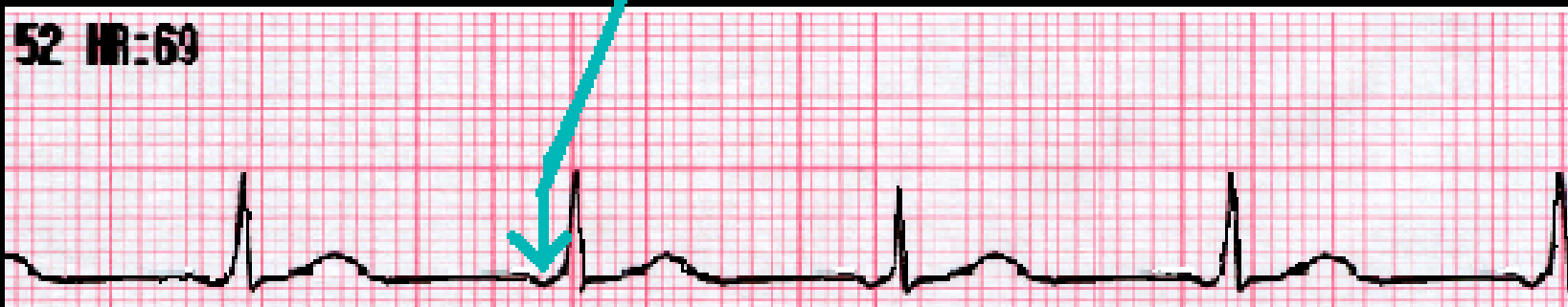
**P:QRS RATIO ----- 1:1**

**QRS INTERVAL ----- NORMAL**

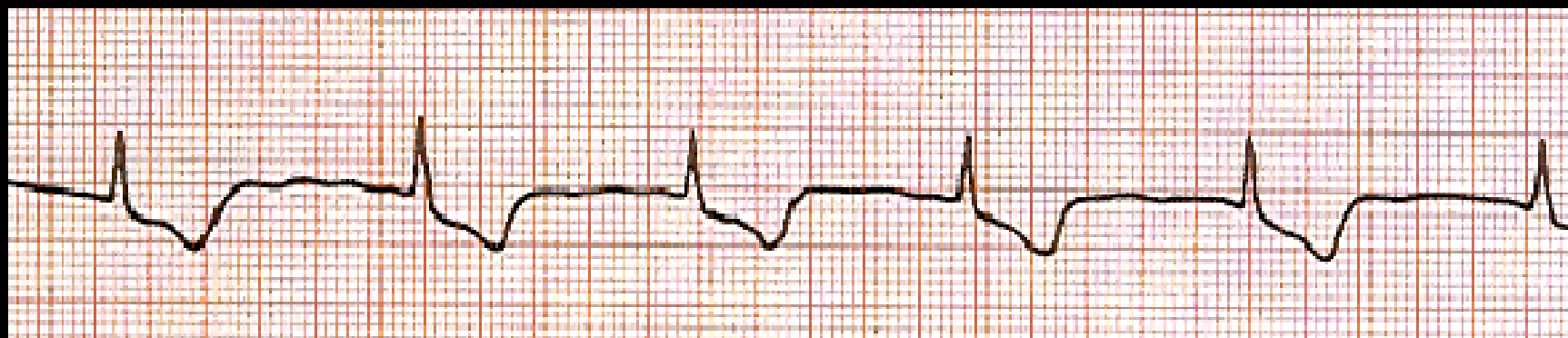
# THIS RHYTHM IS: JUNCTIONAL RHYTHM



MAIN IDENTIFICATION CHARACTERISTIC(S): **P WAVES ABSENT**, or **LOCATED JUST AFTER QRS (in S-Tseg)** or **JUST BEFORE QRS (short P-R)**. WHEN P wave seen, it is **INVERTED (upside-down)**.  
- HR USUALLY 40-60



# THIS RHYTHM IS: JUNCTIONAL RHYTHM

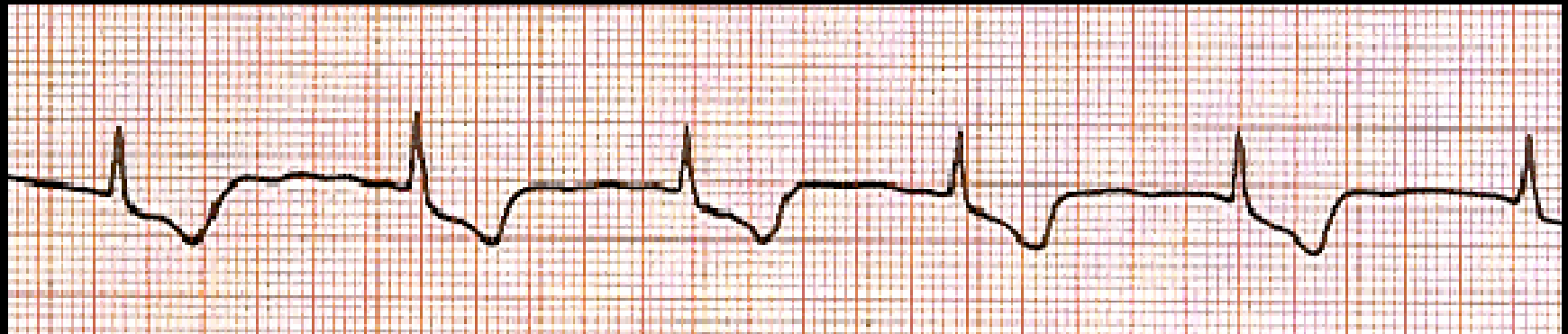


**MAIN IDENTIFICATION CHARACTERISTIC(S): P WAVES ABSENT, or LOCATED JUST AFTER QRS (in S-Tseg) or JUST BEFORE QRS (short P-R). WHEN P wave seen, it is INVERTED (upside-down).**

**- HR USUALLY 40 -60**

**POTENTIAL PROBLEM(S):**

# THIS RHYTHM IS: JUNCTIONAL RHYTHM



**MAIN IDENTIFICATION CHARACTERISTIC(S):** P WAVES ABSENT, or LOCATED JUST AFTER QRS (in S-Tseg) or JUST BEFORE QRS (short P-R). WHEN P wave seen, it is INVERTED (upside-down).  
- HR USUALLY 40 -60

## POTENTIAL PROBLEM(S):

- IF HEART RATE TOO SLOW or FAST, ↓ CARDIAC OUTPUT
- COULD BE INDICATOR OF MORE SERIOUS UNDERLYING CONDITIONS:
  - M.I.
  - ELECTRICAL SYSTEM DISORDERS
  - ELECTROLYTE IMBALANCES, etc

# THIS RHYTHM IS: JUNCTIONAL RHYTHM



**MAIN IDENTIFICATION CHARACTERISTIC(S): P WAVES ABSENT, or LOCATED JUST AFTER QRS (in S-Tseg) or JUST BEFORE QRS (short P-R). WHEN P wave seen, it is INVERTED (upside-down).**  
- HR USUALLY 40 -60

## TREATMENT / INTERVENTION:

- CORRECT HEART RATE, if pt. symptomatic and HR too SLOW or FAST. (atropine, pacemaker - cardioversion, etc)
- FURTHER DIAGNOSTIC STUDIES to determine why SINUS NODE not working !!!

# THIS RHYTHM IS: JUNCTIONAL RHYTHM



## WE MUST CONSIDER UNDERLYING CAUSES:

INCREASED VAGAL TONE →

BLOCKED SA NODAL ARTERY →  
(ACUTE INFERIOR MI ?)

ELECTROLYTE IMBAL. (K+) →

## AND TREAT THEM:

ATROPINE

CARDIAC CATH - PTCA / STENT  
THROMBOLYTICS

CORRECT ELECTROLYTES

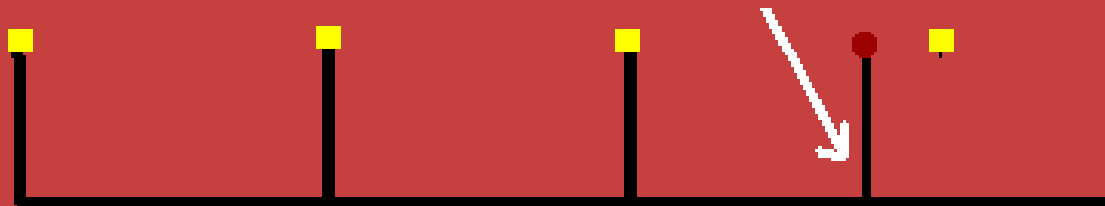
# ECTOPY

- ATRIAL
- JUNCTIONAL
- VENTRICULAR

# CLASSIFICATIONS OF ECTOPY

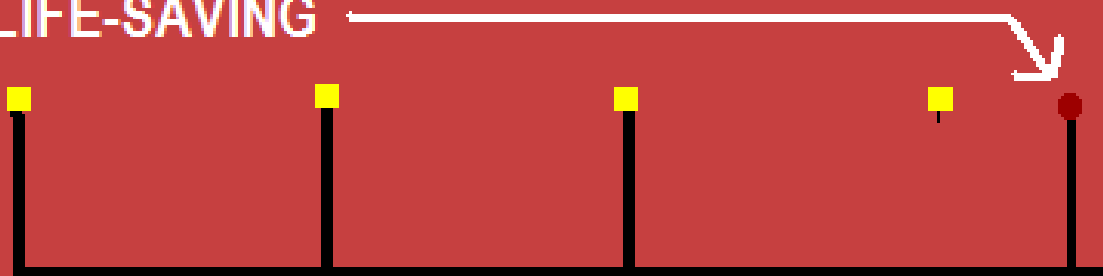
## 1. PREMATURE

THE ECTOPIC BEAT COMES BEFORE THE NEXT REGULARLY EXPECTED BEAT (IT'S EARLY!)



## 2. END-DIASTOLIC, ESCAPE, or COMPENSATORY

THE ECTOPIC BEAT COMES AFTER A REGULAR BEAT FAILS TO HAPPEN. END-DIASTOLIC BEATS MAY BE LIFE-SAVING



# CAUSES OF ECTOPY


---

## 1. PREMATURE

- HYPOXIA
- IRRITABILITY
- CHANGES IN SYMPATHETIC / PARASYMPATHETIC TONE
- DAMAGE TO MYOCARDIUM CAUSING CHANGES IN AUTOMATICITY ( such as from MI / NECROSIS, etc. ).
- MEDICATIONS / SUBSTANCES
- ELECTROLYTES

## 2. END-DIASTOLIC , ESCAPE, or COMPENSATORY

- FAILURE OF SA NODE
- FAILURE OF AV NODE



WHEN THESE FAIL TO PRODUCE OR PROPOGATE AN IMPULSE, ESCAPE FOCI MAY TAKE OVER PACING THE HEART BY PRODUCING END-DIASTOLIC BEATS

# **SIMPLY STATED,**

## **1. PREMATURE BEATS ----**

**BAD**

## **2. END-DIASTOLIC, ESCAPE, or COMPENSATORY ----**

**GOOD**

# SIMPLY STATED,

## 1. PREMATURE BEATS ----

**BAD**



IN SOME CASES WE MUST ELIMINATE PREMATURE BEATS TO PROTECT THE PATIENT

## 2. END-DIASTOLIC or ESCAPE BEATS ----

**GOOD**



ELIMINATION OF END-DIASTOLIC BEATS COULD BE DEADLY

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

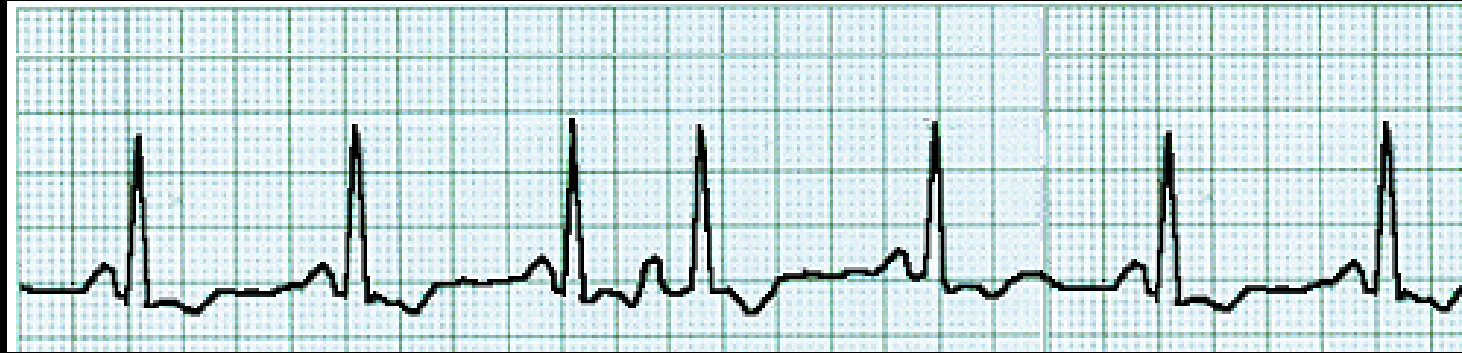
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: NSR with PAC



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

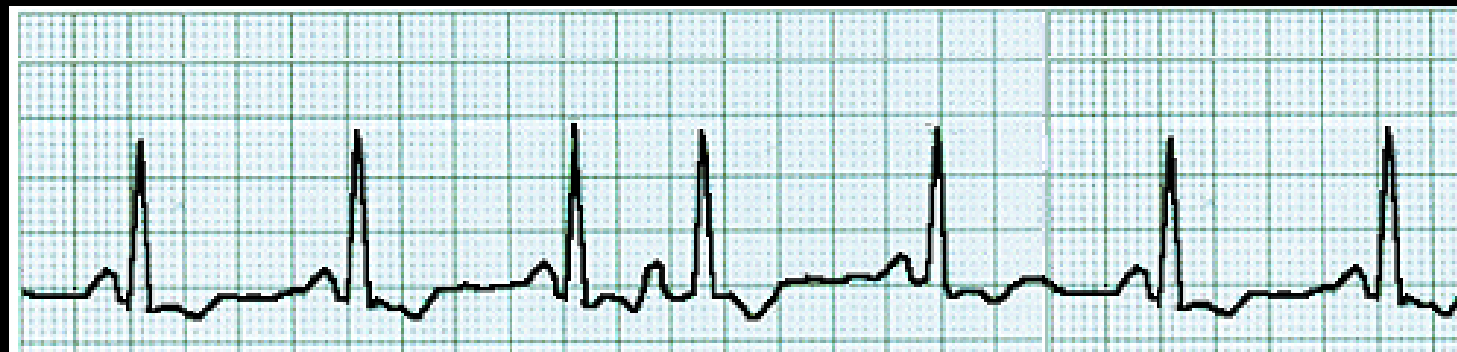
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

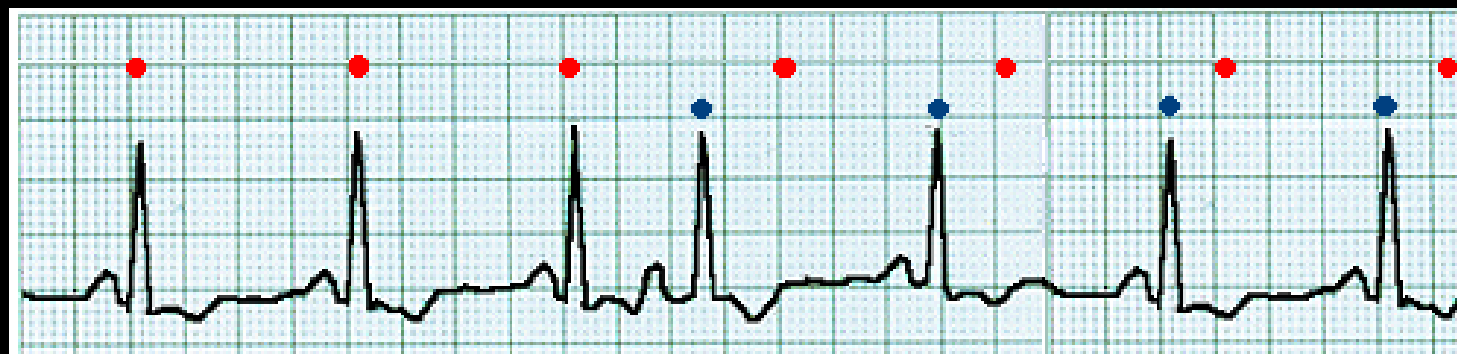
# THIS RHYTHM IS: NSR with PAC



MAIN IDENTIFICATION CHARACTERISTIC(S): **PREMATURE COMPLEX, NORMAL QRS; P-WAVE DIFFERENT THAN OTHERS; P-R INTERVAL FREQUENTLY LONGER or SHORTER THAN NORMAL; NO COMPENSATORY PAUSE**

RATE ----- **NORMAL**  
RHYTHM ----- **IRREGULAR**  
P-R INTERVAL ----- **NORMAL (except PAC may be LONGER or SHORTER)**  
P:QRS RATIO ----- **1:1**  
QRS INTERVAL ----- **NORMAL (unless BBB present)**

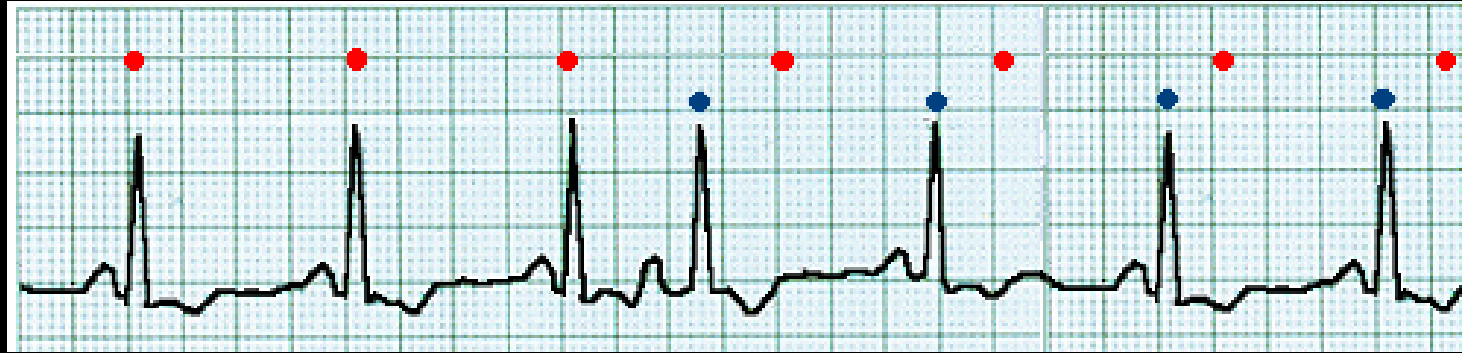
# THIS RHYTHM IS: NSR with PAC



**MAIN IDENTIFICATION CHARACTERISTIC(S): PREMATURE COMPLEX, NORMAL QRS; P-WAVE DIFFERENT THAN OTHERS; P-R INTERVAL FREQUENTLY LONGER or SHORTER THAN NORMAL; NO COMPENSATORY PAUSE**

**RATE ----- NORMAL**  
**RHYTHM ----- IRREGULAR**  
**P-R INTERVAL ----- NORMAL (except PAC may be LONGER or SHORTER)**  
**P:QRS RATIO ----- 1:1**  
**QRS INTERVAL ----- NORMAL (unless BBB present)**

# THIS RHYTHM IS: NSR with PAC

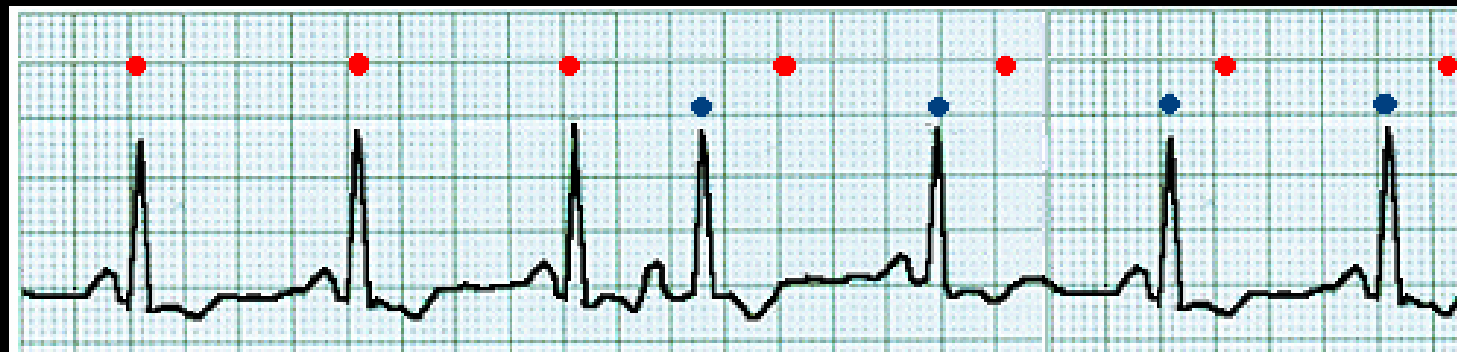


MAIN IDENTIFICATION CHARACTERISTIC(S): **PREMATURE COMPLEX, NORMAL QRS; P-WAVE DIFFERENT THAN OTHERS; P-R INTERVAL FREQUENTLY LONGER or SHORTER THAN NORMAL; NO COMPENSATORY PAUSE**

**POTENTIAL PROBLEMS(S):**

**USUALLY NONE**

# THIS RHYTHM IS: NSR with PAC



**MAIN IDENTIFICATION CHARACTERISTIC(S):** **PREMATURE COMPLEX,**  
**NORMAL QRS; P-WAVE DIFFERENT THAN OTHERS; P-R INTERVAL**  
**FREQUENTLY LONGER or SHORTER THAN NORMAL; NO COMPENSATORY PAUSE**

## TREATMENT / INTERVENTION(S):

**IDENTIFY UNDERLYING CAUSE OF ECTOPY,**  
**CORRECT IT (IF POSSIBLE)**

# CAUSES OF ECTOPY

---

## 1. PREMATURE

- HYPOXIA
- IRRITABILITY
- CHANGES IN SYMPATHETIC / PARASYMPATHETIC TONE
- DAMAGE TO MYOCARDIUM CAUSING CHANGES IN AUTOMATICITY (such as from MI / NECROSIS, etc.).
- MEDICATIONS / SUBSTANCES
- ELECTROLYTES

## 2. END-DIASTOLIC, ESCAPE, or COMPENSATORY

- FAILURE OF SA NODE
- FAILURE OF AV NODE

WHEN THESE FAIL TO PRODUCE OR PROPOGATE AN IMPULSE, ESCAPE FOCI MAY TAKE OVER PACING THE HEART BY PRODUCING END-DIASTOLIC BEATS

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: NSR with JUNCTIONAL ESCAPE BEAT



MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: NSR with JUNCTIONAL ESCAPE BEAT



**MAIN IDENTIFICATION CHARACTERISTIC(S): BEAT OCCURS LATER THAN NEXT EXPECTED BEAT; QRS IS NORMAL; P WAVE ABSENT or JUST IN FRONT OF or JUST AFTER QRS and is USUALLY INVERTED.**

**RATE ----- NORMAL**

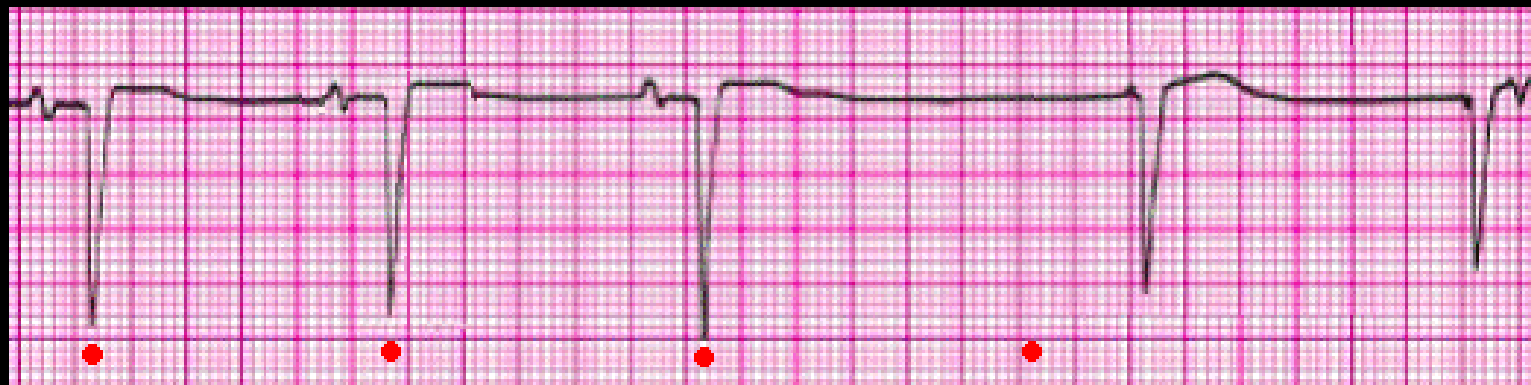
**RHYTHM ----- IRREGULAR (because of ESCAPE BEAT)**

**P-R INTERVAL ----- NORMAL for NSR / ABSENT or SHORT for ESCAPE BEAT**

**P:QRS RATIO ----- 1:1 for NSR / 0:1 or 1:1 for ESCAPE BEAT**

**QRS INTERVAL ----- NORMAL (unless BBB present)**

# THIS RHYTHM IS: NSR with JUNCTIONAL ESCAPE BEAT



**MAIN IDENTIFICATION CHARACTERISTIC(S): BEAT OCCURS LATER THAN NEXT EXPECTED BEAT; QRS IS NORMAL; P WAVE ABSENT or JUST IN FRONT OF or JUST AFTER QRS and is USUALLY INVERTED.**

**RATE ----- NORMAL**

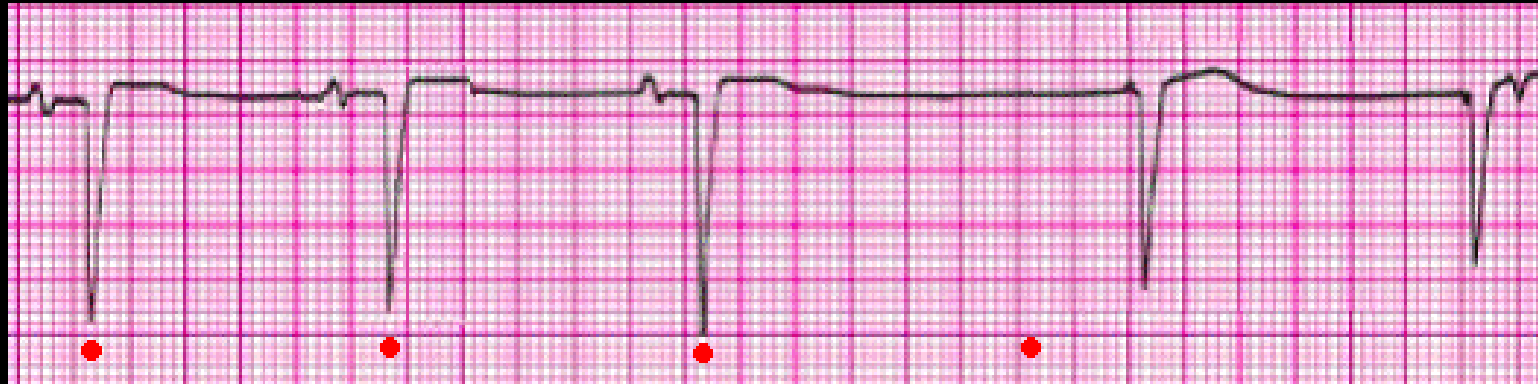
**RHYTHM ----- IRREGULAR (because of ESCAPE BEAT)**

**P-R INTERVAL ----- NORMAL for NSR / ABSENT or SHORT for ESCAPE BEAT**

**P:QRS RATIO ----- 1:1 for NSR / 0:1 or 1:1 for ESCAPE BEAT**

**QRS INTERVAL ----- NORMAL (unless BBB present)**

# THIS RHYTHM IS: NSR with JUNCTIONAL ESCAPE BEAT

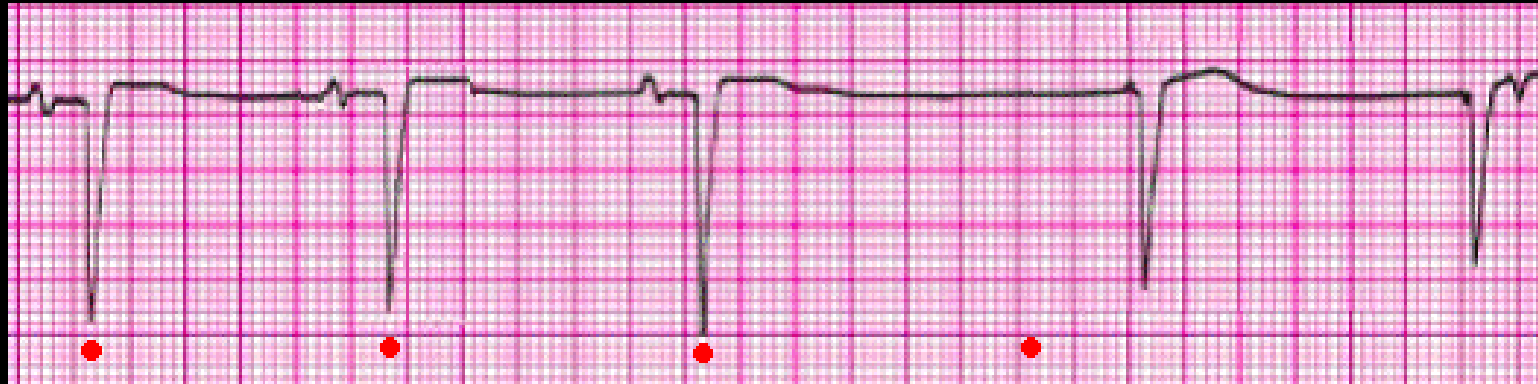


**MAIN IDENTIFICATION CHARACTERISTIC(S): BEAT OCCURS LATER THAN NEXT EXPECTED BEAT; QRS IS NORMAL; P WAVE ABSENT or JUST IN FRONT OF or JUST AFTER QRS and is USUALLY INVERTED.**

**PRESENTING PROBLEM(S):**

**USUALLY NONE**

# THIS RHYTHM IS: NSR with JUNCTIONAL ESCAPE BEAT



**MAIN IDENTIFICATION CHARACTERISTIC(S): BEAT OCCURS LATER THAN NEXT EXPECTED BEAT; QRS IS NORMAL; P WAVE ABSENT or JUST IN FRONT OF or JUST AFTER QRS and is USUALLY INVERTED.**

## TREATMENT / INTERVENTION (S):

- NONE DUE TO THIS RHYTHM
- TRY TO IDENTIFY WHAT UNDERLYING CONDITION IS CAUSING THE SINUS NODE TO FAIL

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: NSR with UNIFOCAL PVCs



MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

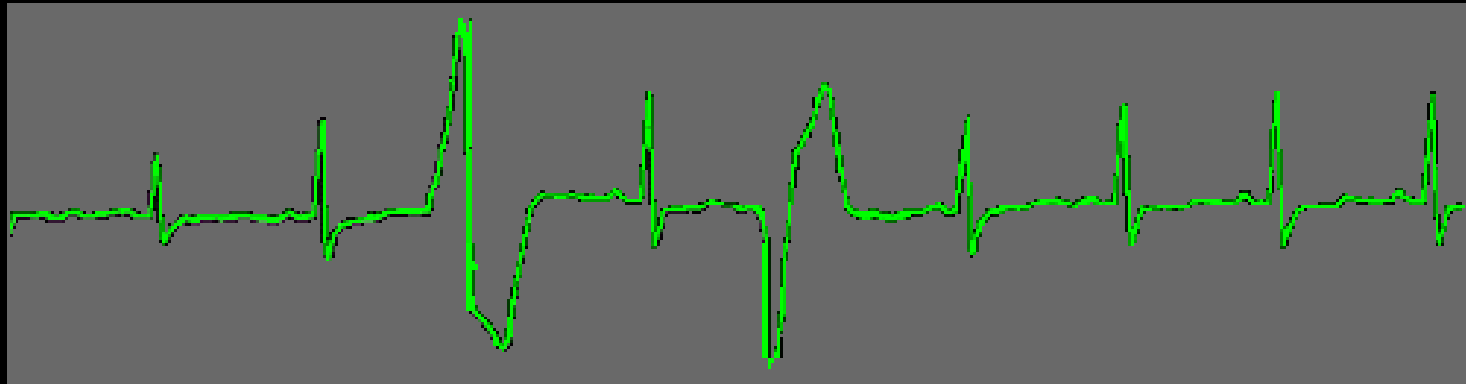
# THIS RHYTHM IS: NSR with UNIFOCAL PVCs



MAIN IDENTIFICATION CHARACTERISTIC(S): **ECTOPIC BEATS ARE PREMATURE, AND WIDE ( $> 120$  ms); COMPLEXES MAY BE OF ANY SHAPE or DEFLECTION, BUT ALL HAVE SAME APPEARANCE; THERE IS A COMPENSATORY PAUSE**

RATE -----	NORMAL
RHYTHM -----	<b>IRREGULAR (due to PVCs)</b>
P-R INTERVAL -----	NSR BEATS - NORMAL (120 - 200 ms) <b>PVCs - N/A</b>
P:QRS RATIO -----	NSR BEATS - 1:1 <b>PVCs - N/A</b>
QRS INTERVAL -----	NSR BEATS $< 120$ ms <b>PVCs <math>&gt; 120</math> ms</b>

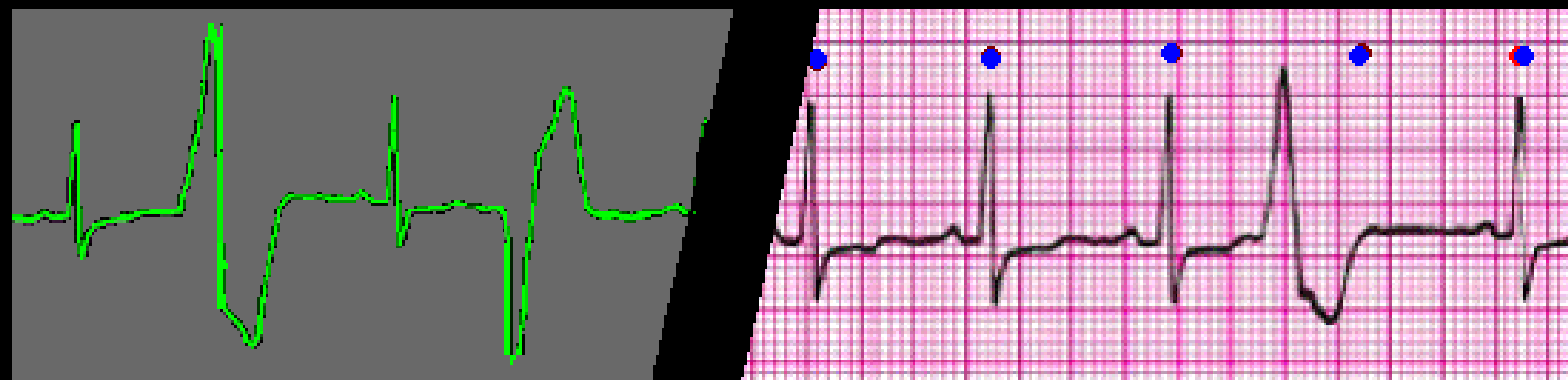
# THIS RHYTHM IS: NSR with MULTIFOCAL PVCs



**MAIN IDENTIFICATION CHARACTERISTIC(S): ECTOPIC BEATS ARE PREMATURE AND WIDE (> 120 ms); THEY VARY IN SHAPE and DEFLECTION; THERE IS A COMPENSATORY PAUSE**

RATE -----	NORMAL
RHYTHM -----	<b>IRREGULAR (due to PVCs)</b>
P-R INTERVAL ----	NSR BEATS - NORMAL (120 - 200 ms) <b>PVCs - N/A</b>
P:QRS RATIO ----	NSR BEATS - 1:1 <b>PVCs - N/A</b>
QRS INTERVAL ----	NSR BEATS < 120 ms <b>PVCs &gt; 120 ms</b>

## CONCERNS FOR : RHYTHMS WITH ALL TYPES OF PVCs



MAIN IDENTIFICATION CHARACTERISTIC(S): **ECTOPIC BEATS ARE PREMATURE AND WIDE ( $> 120$  ms); MAY BE UNIFOCAL or MULTIFOCAL IN APPEARANCE; THERE IS A COMPENSATORY PAUSE**

### POTENTIAL PROBLEMS (S):

- THE UNDERLYING REASON PVCs ARE PRESENT COULD BE A CRITICAL ISSUE . . .
- PVCs MAY HAVE A WEAKER PULSE, or NO PULSE
- PVCs DURING REFRACTORY PERIOD COULD CAUSE V-FIB
- PVCs COUPLED TOGETHER COULD PRECIPITATE V-TACH

# CAUSES OF ECTOPY

---

## 1. PREMATURE

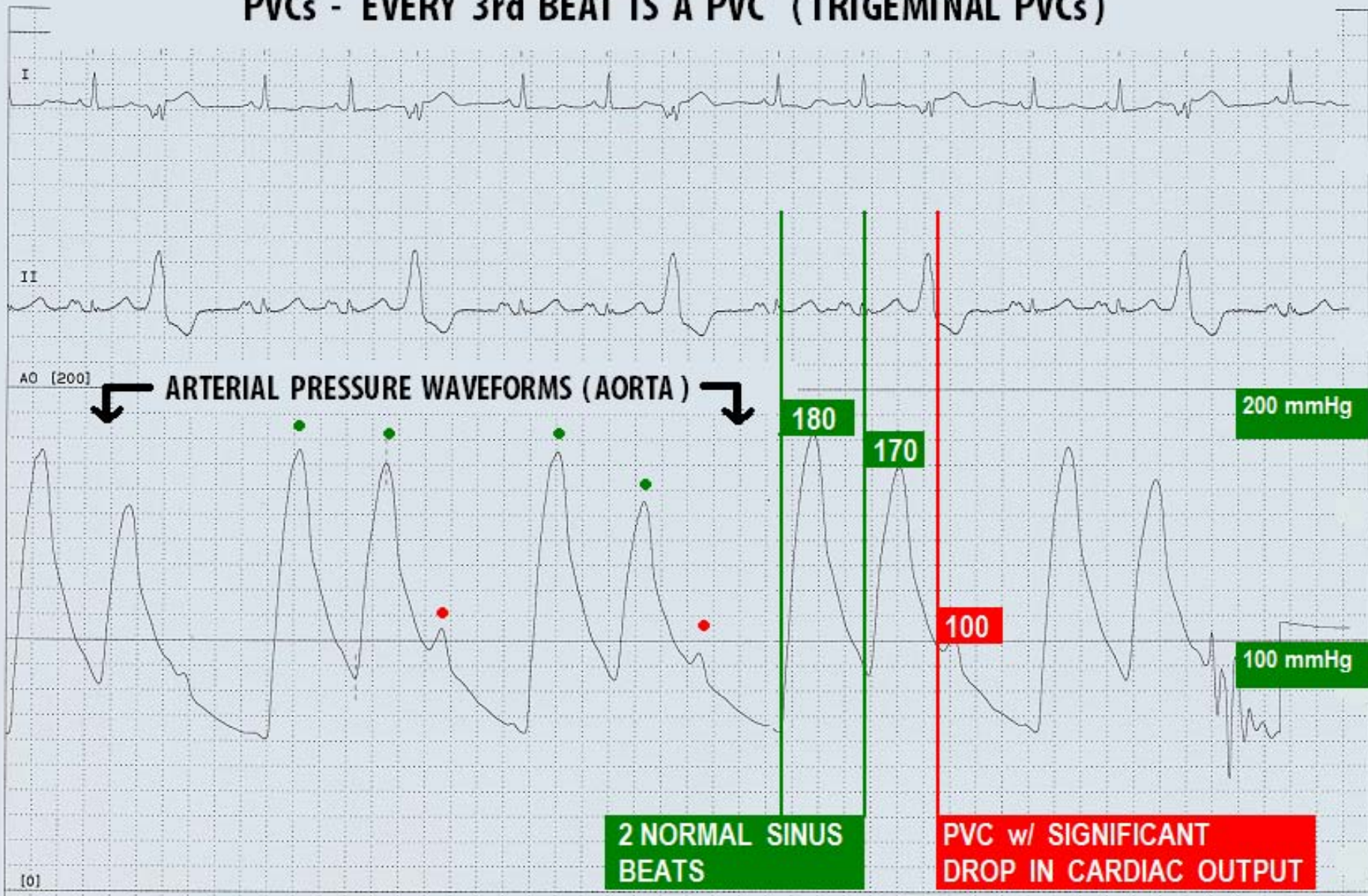
- HYPOXIA
- IRRITABILITY
- CHANGES IN SYMPATHETIC / PARASYMPATHETIC TONE
- DAMAGE TO MYOCARDIUM CAUSING CHANGES IN AUTOMATICITY (such as from MI / NECROSIS, etc.).
- MEDICATIONS / SUBSTANCES
- ELECTROLYTES

## 2. END-DIASTOLIC, ESCAPE, or COMPENSATORY

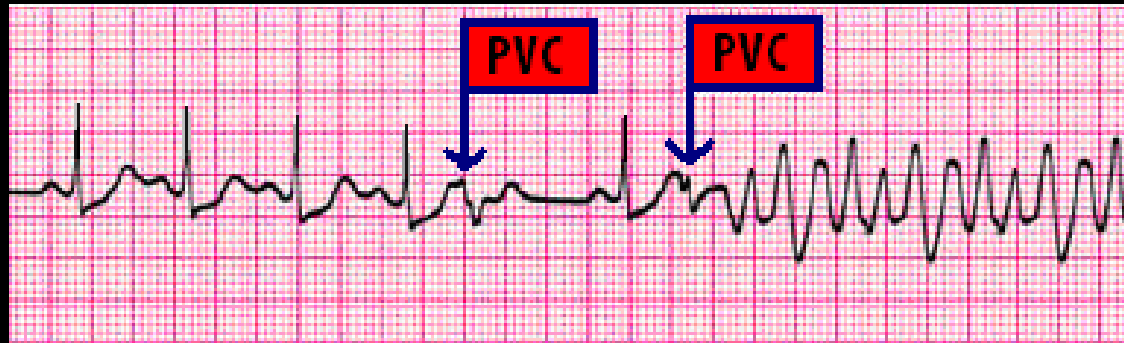
- FAILURE OF SA NODE
- FAILURE OF AV NODE

WHEN THESE FAIL TO PRODUCE OR PROPAGATE AN IMPULSE, ESCAPE FOCI MAY TAKE OVER PACING THE HEART BY PRODUCING END-DIASTOLIC BEATS

# PVCs - EVERY 3rd BEAT IS A PVC (TRIGEMINAL PVCs)



# THIS RHYTHM IS: NSR with **R on T** PHENOMENON

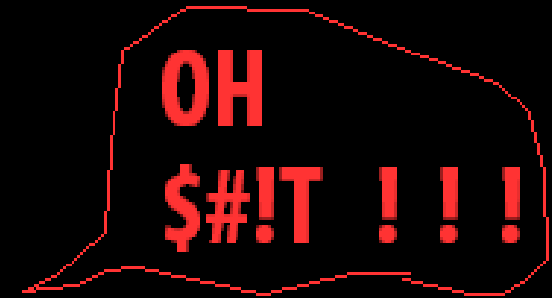
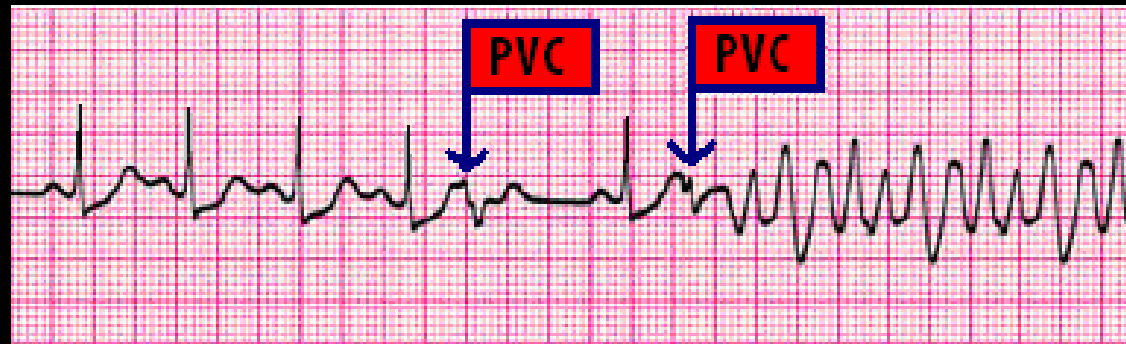


MAIN IDENTIFICATION CHARACTERISTIC(S): **ECTOPIC BEATS ARE WIDE (> 120 ms); ALL APPEAR TO HAVE SAME SHAPE and DEFLECTION; THERE IS A COMPENSATORY PAUSE**

## POTENTIAL PROBLEMS (S):

- THE UNDERLYING REASON PVCs ARE PRESENT COULD BE A CRITICAL ISSUE . . .
- PVCs MAY HAVE A WEAKER PULSE, or NO PULSE
- PVCs DURING REFRACTORY PERIOD COULD CAUSE V-FIB
- PVCs COUPLED TOGETHER COULD PRECIPITATE V-TACH

# THIS RHYTHM IS: NSR with R on T PHENOMENON

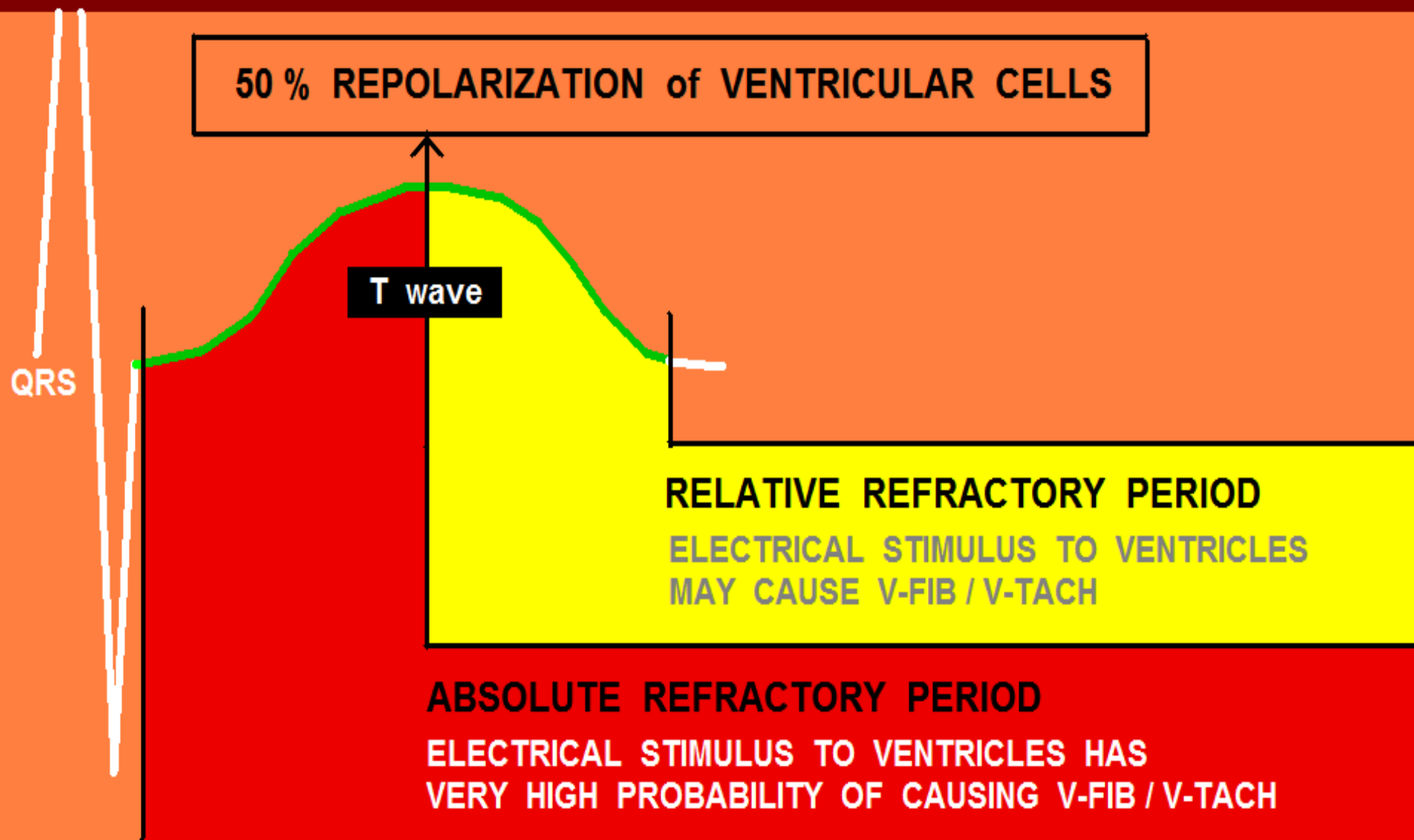


MAIN IDENTIFICATION CHARACTERISTIC(S): **ECTOPIC BEATS ARE WIDE (> 120 ms); ALL APPEAR TO HAVE SAME SHAPE and DEFLECTION; THERE IS A COMPENSATORY PAUSE**

## POTENTIAL PROBLEMS (S):

- THE UNDERLYING REASON PVCs ARE PRESENT COULD BE A CRITICAL ISSUE . . .
- PVCs MAY HAVE A WEAKER PULSE, or NO PULSE
- PVCs DURING REFRACTORY PERIOD COULD CAUSE V-FIB
- PVCs COUPLED TOGETHER COULD PRECIPITATE V-TACH

# CARDIAC ANATOMY and PHYSIOLOGY "101"



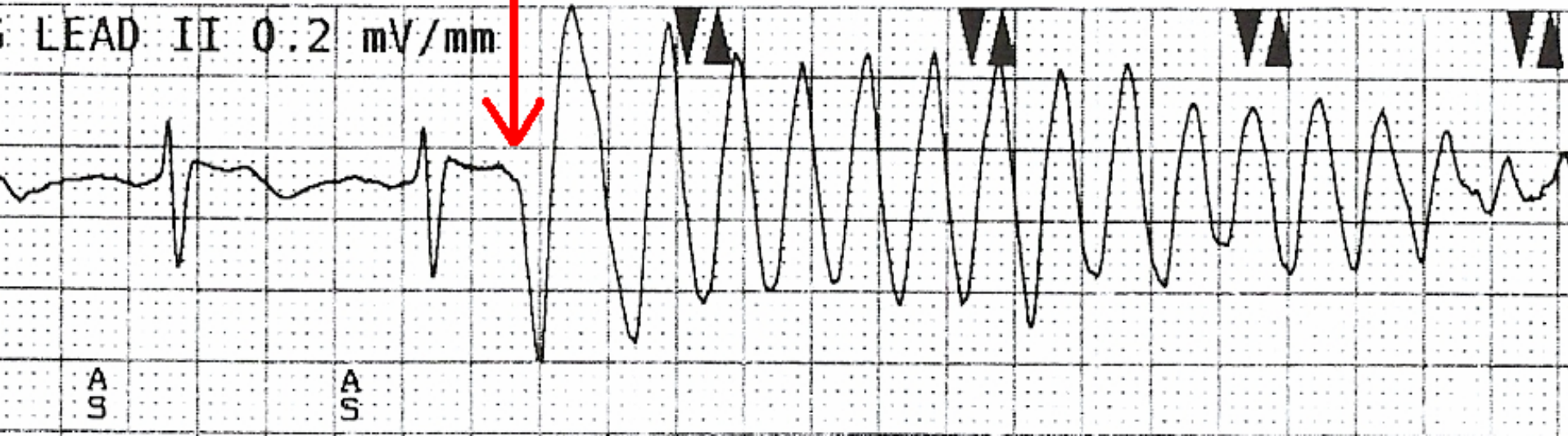
# ROUTINE TEST OF ICD

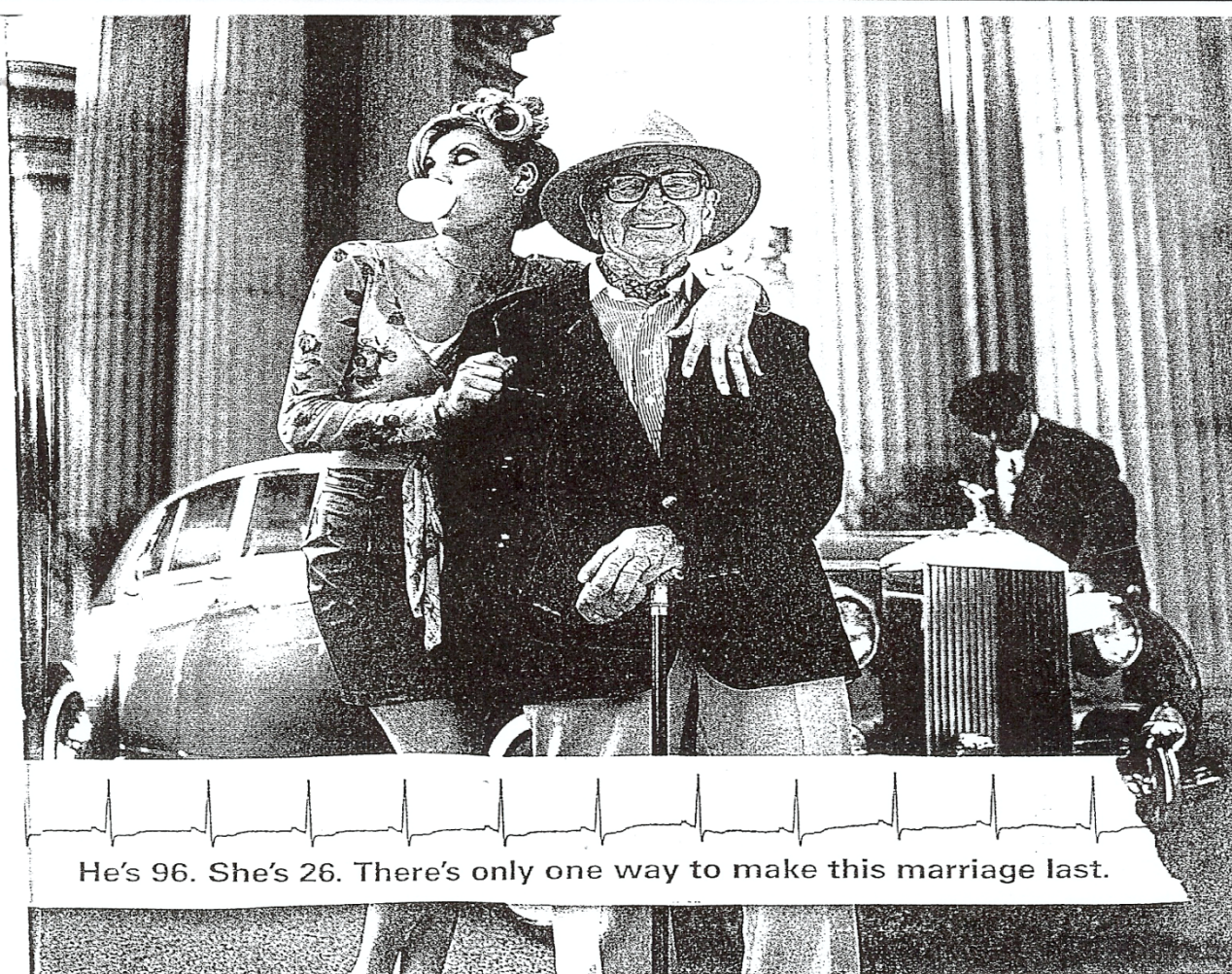
ELECTRICAL IMPULSE  
ADMINISTERED DURING ABSOLUTE  
REFRACTORY PERIOD -- INDUCES  
VENTRICULAR FIBRILLATION

08-Sep-2006 18:01:47

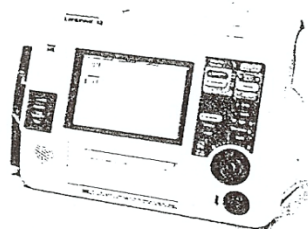
Test Started

**SPECIAL THANKS TO:**  
**Ray Heinley**  
**Medtronic Corporation**  
**for this contribution**





He's 96. She's 26. There's only one way to make this marriage last.

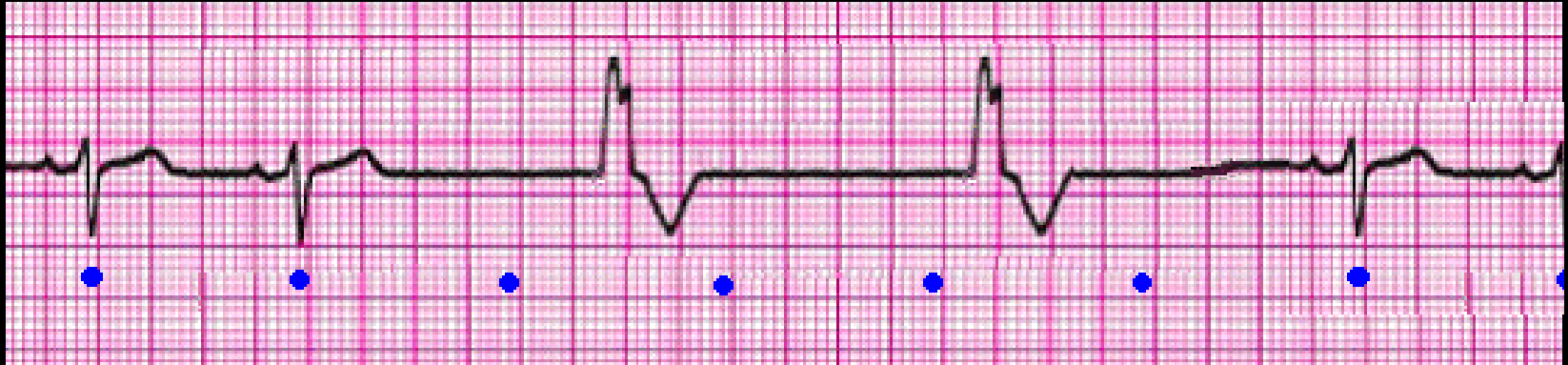


defibrillator/monitor series

Introducing a new era in acute cardiac care response—the new LIFEPAK 12 defibrillator/monitor series. A defibrillator and multiparameter monitor, all in one small, rugged, lightweight unit. With both AED and manual modes, it can be used by healthcare professionals with varied skill levels. A large, easy-to-read display and user-friendly Selector knob make training on the 12 simple. And the FASTPAK<sup>2</sup> battery provides a fuel gauge to show the state of charge at the push of a button. Plus, an extensive data management system ties it all together. The 12 is also fully upgradeable, which means this will be the only system you'll need for quite a while. In fact it just may last longer than most marriages. For more information give us a call: 1.800.442.1142, or circle #101 on the reader service card.



# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

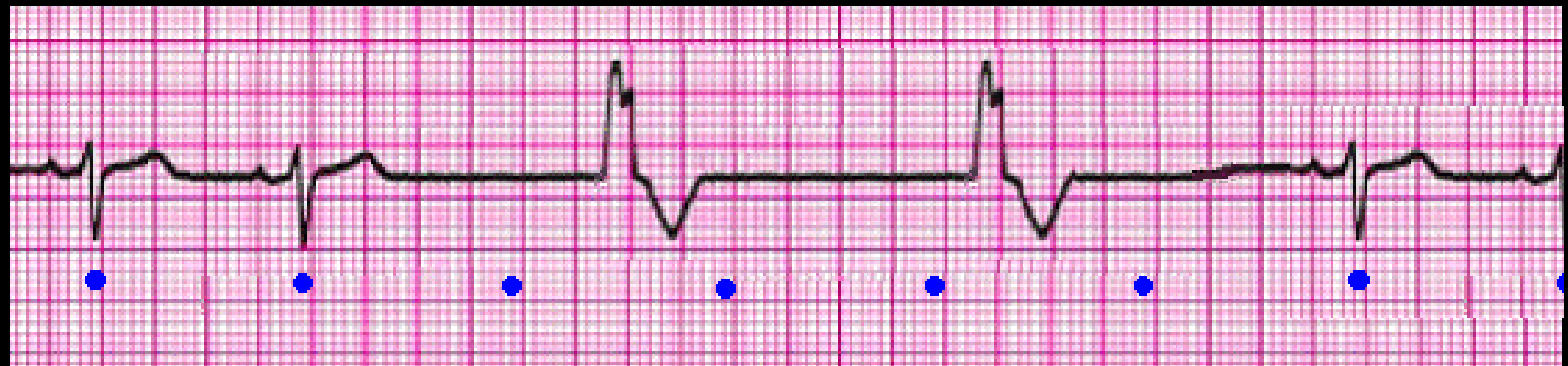
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: SINUS ARREST w/ VENT. ESCAPE



MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

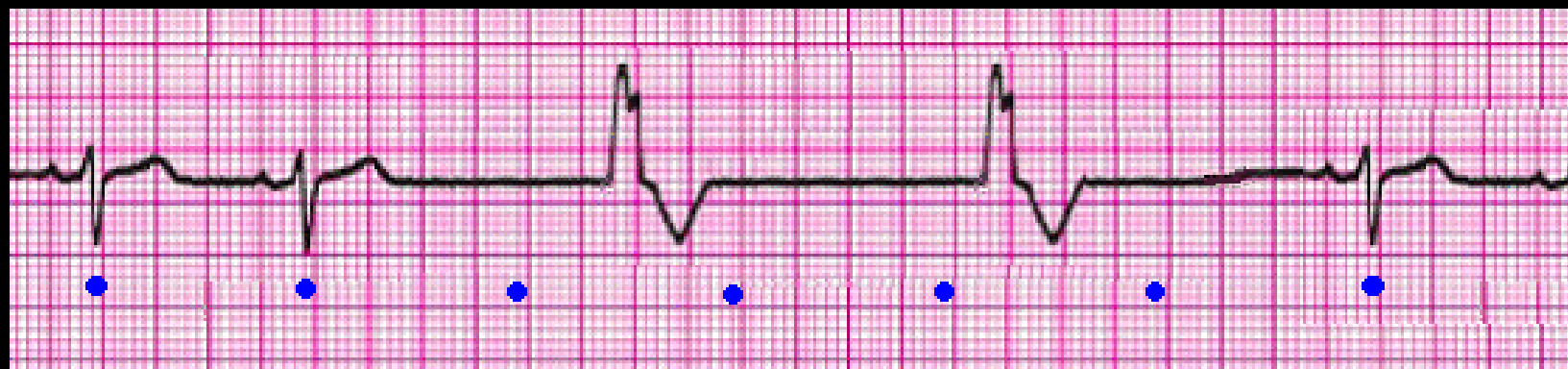
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

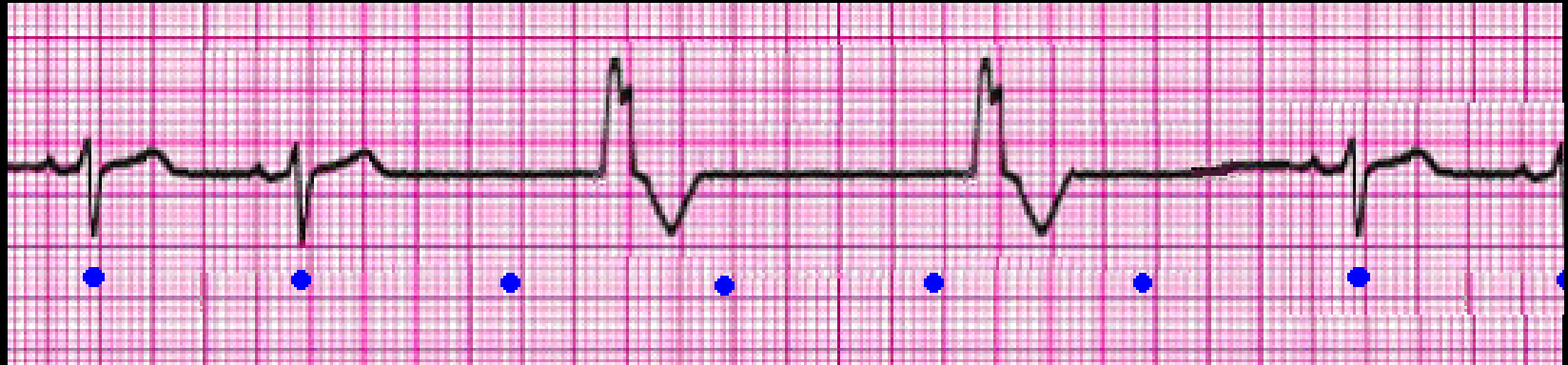
# THIS RHYTHM IS: SINUS ARREST w/ VENT. ESCAPE



**MAIN IDENTIFICATION CHARACTERISTIC(S): END DIASTOLIC (ESCAPE) BEAT(S); COMPLEXES WIDER THAN 120 ms ; MAY BE UNIFOCAL or MULTIFOCAL ; MAY or MAY NOT HAVE GOOD PULSE w/ COMPLEXES**

<b>RATE</b> -----	<b>USUALLY &lt; 40</b>
<b>RHYTHM</b> -----	<b>VENT. ESCAPE : USUALLY REGULAR</b>
<b>P-R INTERVAL</b> -----	<b>VENT. ESCAPE : N / A</b>
<b>P:QRS RATIO</b> -----	<b>VENT. ESCAPE : N / A</b>
<b>QRS INTERVAL</b> -----	<b>VENT. ESCAPE : &gt; 20 ms</b>

# THIS RHYTHM IS: SINUS ARREST w/ VENT. ESCAPE

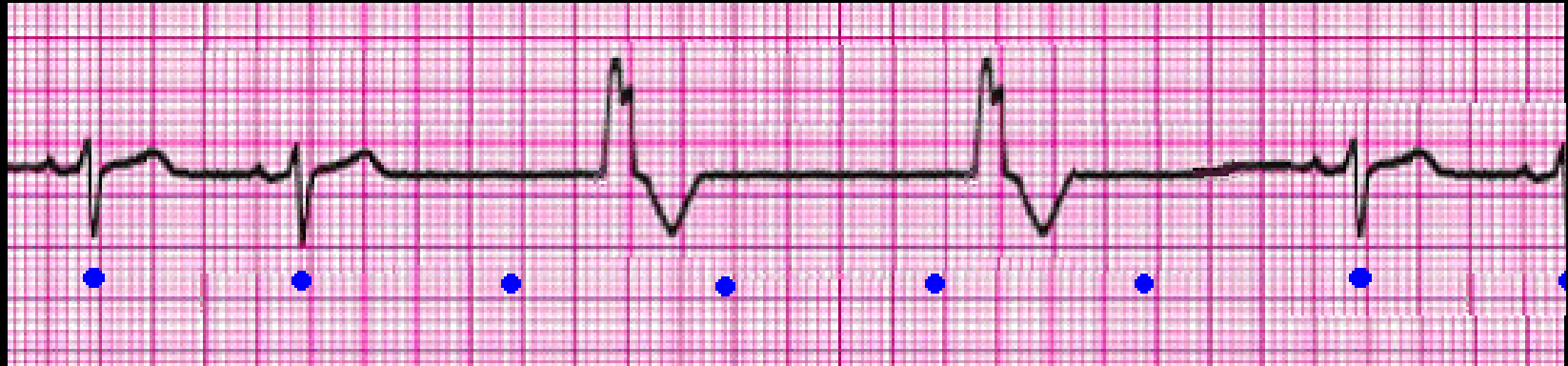


**MAIN IDENTIFICATION CHARACTERISTIC(S):** END DIASTOLIC (ESCAPE) BEAT(S); COMPLEXES WIDER THAN 120 ms ; MAY BE UNIFOCAL or MULTIFOCAL ; MAY or MAY NOT HAVE GOOD PULSE w/ COMPLEXES

## PRESENTING PROBLEM(S):

- PROBLEM IS WITH UNDERLYING REASON WHY SINUS NODE and AV NODE HAVING PERIODS OF ARREST.
- THE VENTRICULAR ESCAPE COMPLEXES MAY BE VERY SLOW, BUT MAY BE ONLY THING KEEPING PATIENT PERFUSED DURING PERIODS OF SINUS/AV ARREST.

# THIS RHYTHM IS: SINUS ARREST w/ VENT. ESCAPE



## TREATMENT / INTERVENTION (S):

- EMERGENT TREATMENT IS TRANSCUTANEOUS PACING.
- TREAT UNDERLYING CAUSE OF SINUS / AV ARREST
- **DO NOT** ATTEMPT TO SUPPRESS VENTRICULAR ESCAPE BEATS WITHOUT HAVING BACK-UP TRANSCUTANEOUS / TRANSVENOUS PACING ATTACHED TO PATIENT !!!

# THIS RHYTHM IS: NSR w/ COUPLET and RUN of V-TACH



MAIN IDENTIFICATION CHARACTERISTIC(S): **ECTOPIC BEATS ARE WIDE (> 120 ms); PVCs ARE COUPLED TOGETHER (2 = "COUPLET"), (3 or more = RUN OF V-TACH)**

## POTENTIAL PROBLEMS (S):

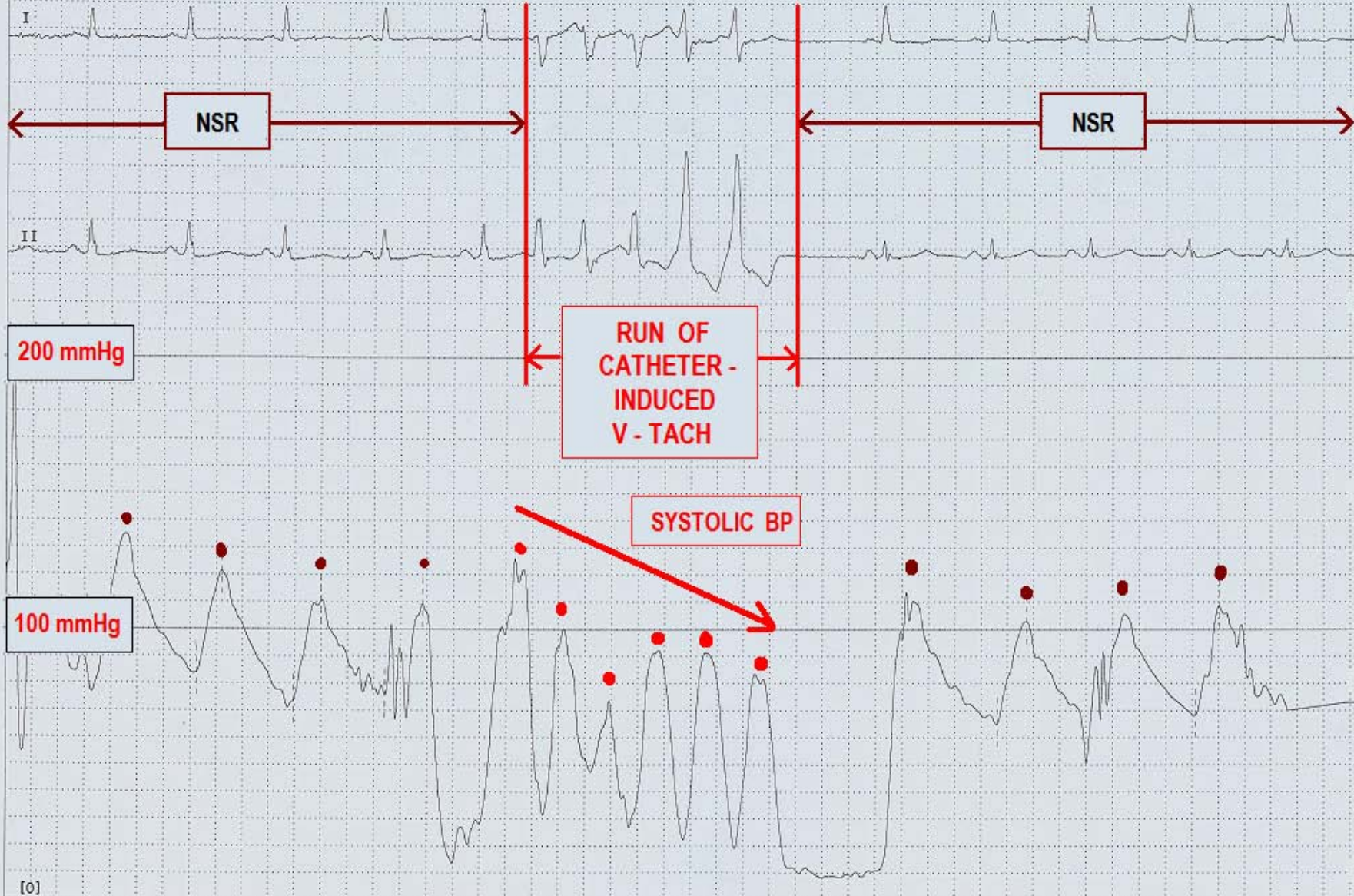
- **THE UNDERLYING REASON PVCs ARE PRESENT COULD BE A CRITICAL ISSUE . . .**
- **PVCs MAY HAVE A WEAKER PULSE, or NO PULSE**
- **PVCs DURING REFRACTORY PERIOD COULD CAUSE V-FIB**
- **PVCs COUPLED TOGETHER COULD PRECIPITATE V-TACH**

# THIS RHYTHM IS: NSR w/ COUPLET and **RUN of V-TACH**



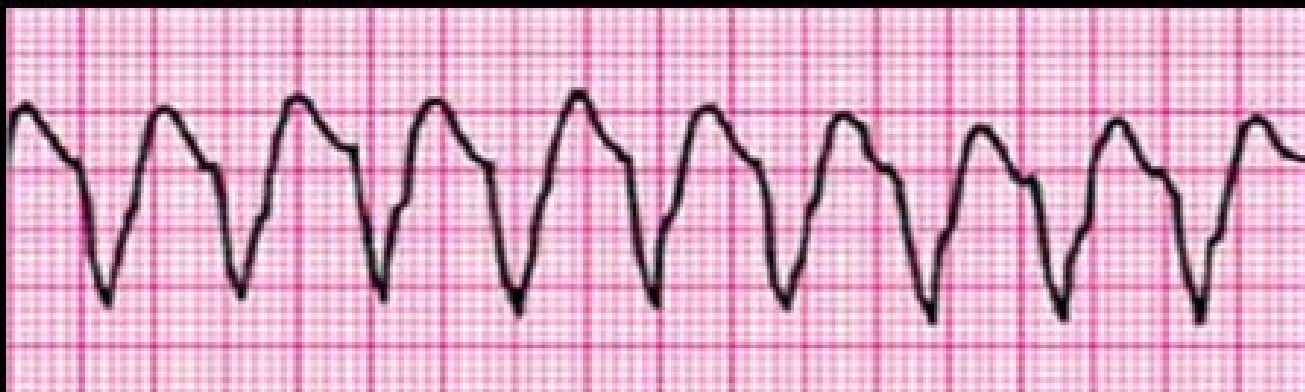
## TEXTBOOK STANDARDS:

- 3 or more PVCs IN A ROW = RUN OF VENTRICULAR TACHYCARDIA
- DEFINITION OF "SUSTAINED V-TACH" VARIES FROM "3 or more BEATS IN A ROW" to "MORE THAN 30 SECONDS OF V-TACH."  
(*"Electrophysiologic Testing,"* by: Richard N. Fogoros, MD, p. 179)
- ACLS 2006 Standards DO NOT define WHEN you treat VENTRICULAR ECTOPY, or attempt to define when "RUNS OF PVCs" are to be considered as "VENTRICULAR TACHYCARDIA."



ID: 31732688 Name: CALLES, RUBEN Date: 08/09/2006 Time: 09: 50: 32 Condition: 1  
Sequence: 7 AO S/D/M 109/74/85 SpO2: 96% NIBP: 120/77/88  
HR: 81 ECG  
Sample length: 10 s Paper speed: 25 mm/s Page: 1(1)

# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

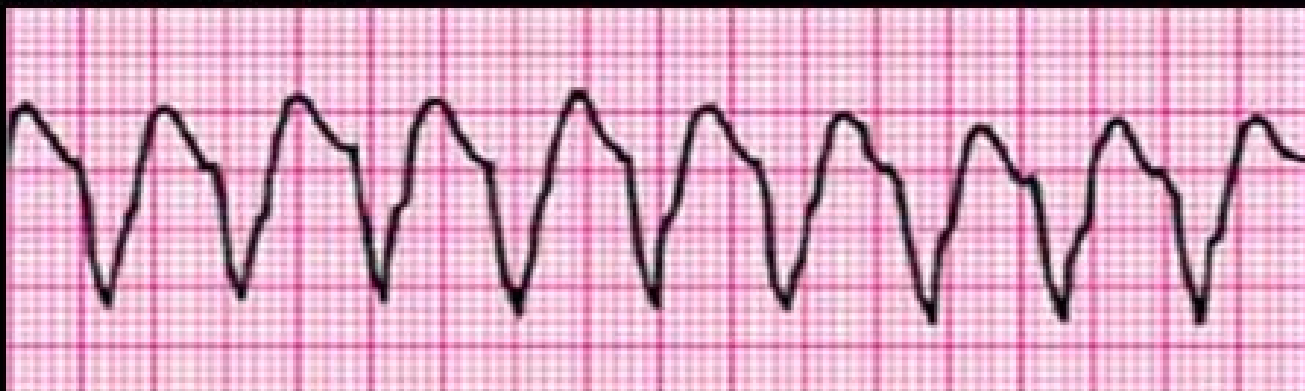
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: MONOMORPHIC V-TACH



MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

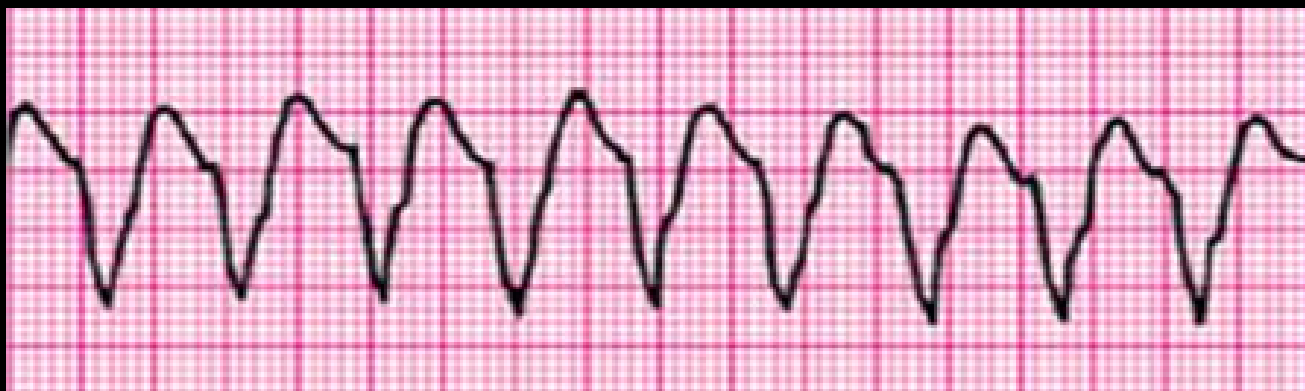
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

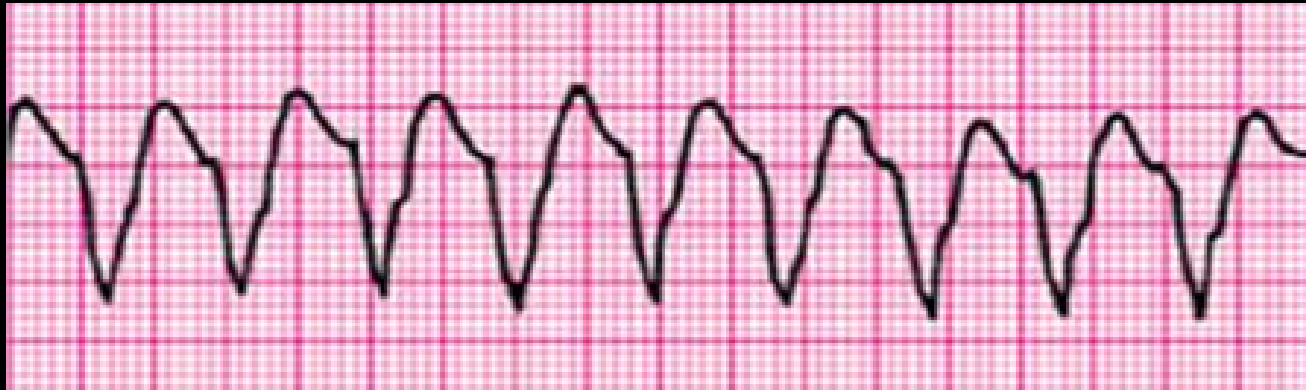
# THIS RHYTHM IS: MONOMORPHIC V-TACH



**MAIN IDENTIFICATION CHARACTERISTIC(S): WIDE QRS COMPLEXES (> 120 ms)  
HR USUALLY BETWEEN 150 - 200; ALL QRS COMPLEXES APPEAR SAME IN  
SHAPE and DEFLECTION; IF P WAVES SEEN, DISASSOCIATED w/ QRS**

RATE -----	> 100 (usually 150 - 200)
RHYTHM -----	REGULAR
P-R INTERVAL -----	N/A
P:QRS RATIO -----	N/A
QRS INTERVAL -----	> 120 ms

# THIS RHYTHM IS: MONOMORPHIC V-TACH

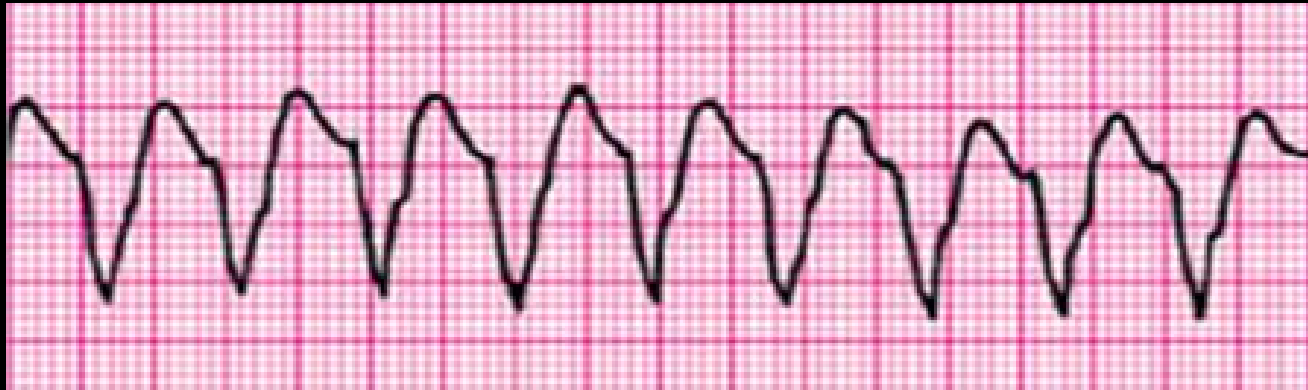


MAIN IDENTIFICATION CHARACTERISTIC(S): **WIDE QRS COMPLEXES (> 120 ms)**  
**HR USUALLY BETWEEN 150 - 200; ALL QRS COMPLEXES APPEAR SAME IN SHAPE and DEFLECTION; IF P WAVES SEEN, DISASSOCIATED w/ QRS**

## POTENTIAL PROBLEM(S):

- PATIENT MAY HAVE NO PULSE
- PATIENT WITH PULSE MAY BE UNSTABLE / HYPOTENSIVE
- PATIENT WITH PULSE MAY QUICKLY DEGENERATE INTO V-FIB

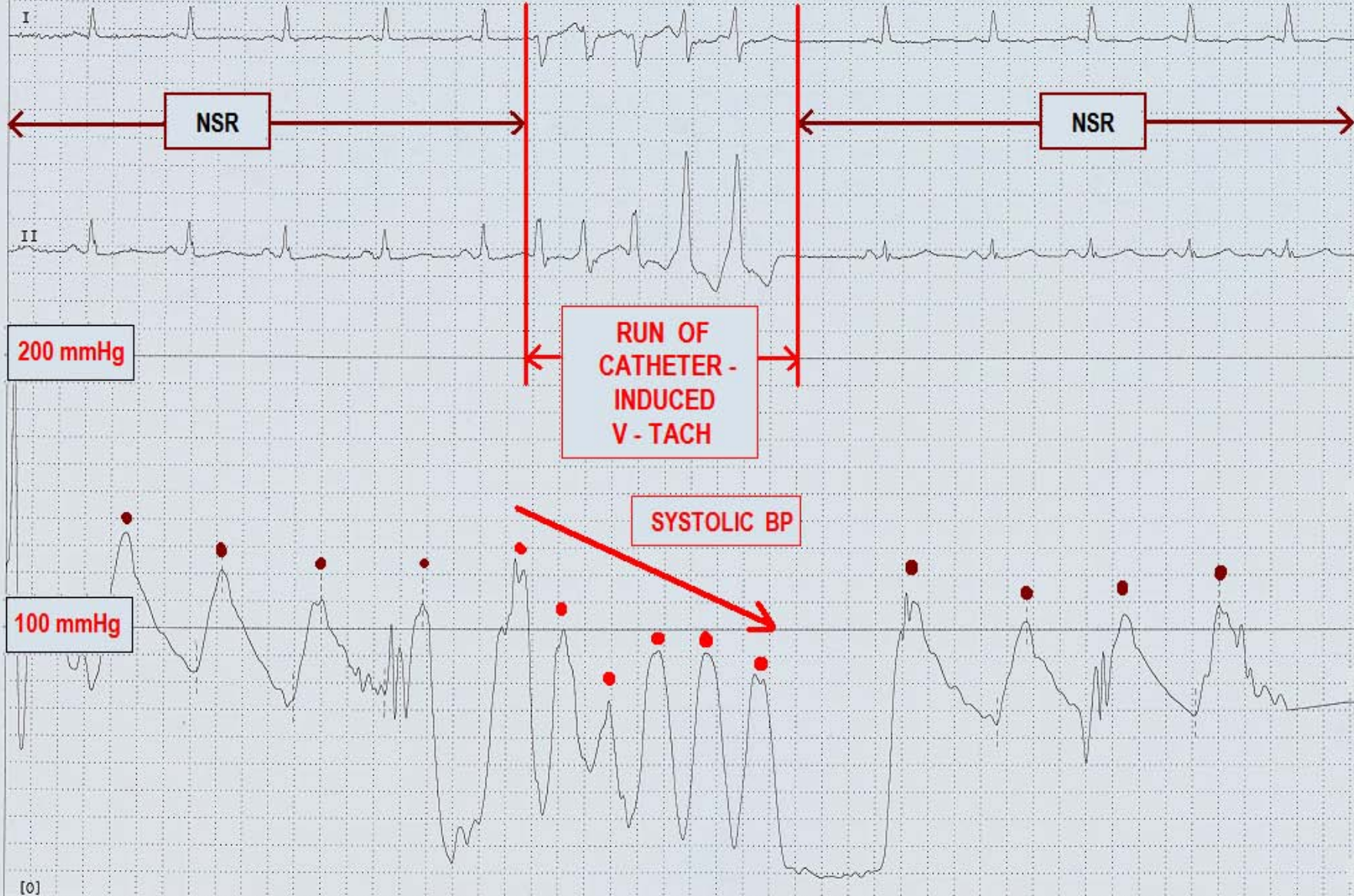
# THIS RHYTHM IS: MONOMORPHIC V-TACH



**MAIN IDENTIFICATION CHARACTERISTIC(S): WIDE QRS COMPLEXES (> 120 ms )  
HR USUALLY BETWEEN 150 - 200; ALL QRS COMPLEXES APPEAR SAME IN  
SHAPE and DEFLECTION; IF P WAVES SEEN, DISASSOCIATED w/ QRS**

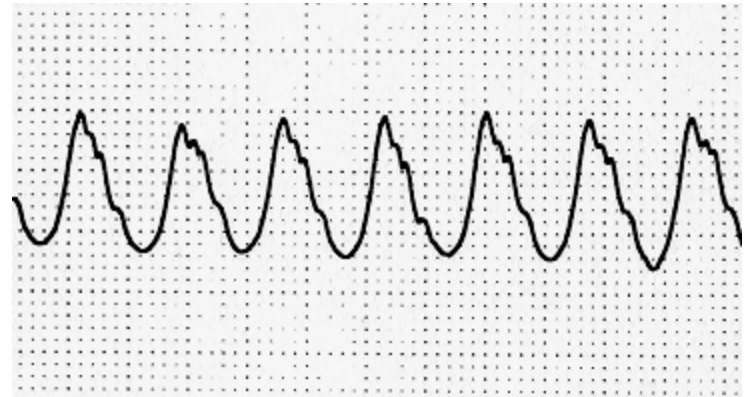
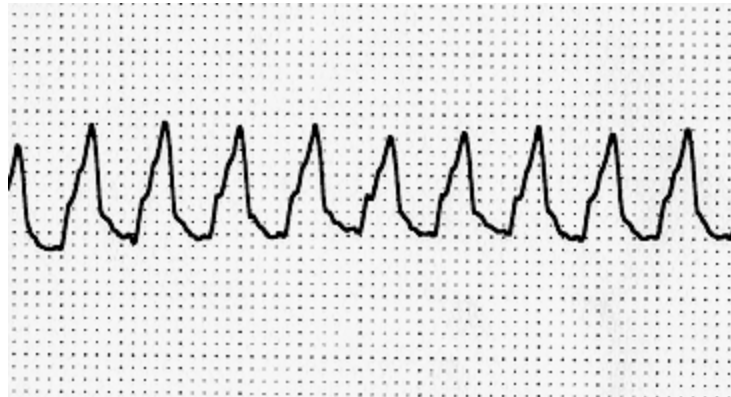
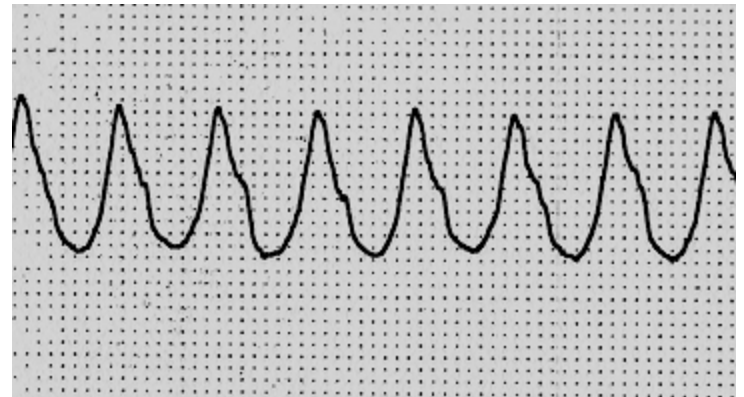
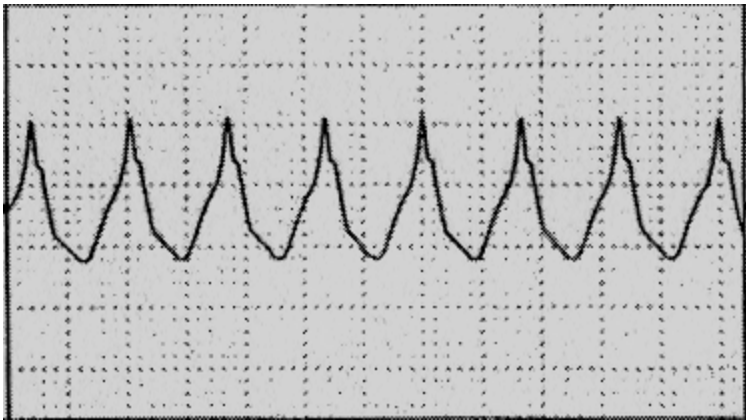
## TREATMENT / INTERVENTION(S) :

- **RAPID PATIENT ASSESSMENT (ABCs + GEN. SUP. CARE)**
- **IF PATIENT PULSELESS, TX AS V-FIB**
- **IF PATIENT HAS PULSE, BUT UNSTABLE -- CARDIOVERSION**
- **IF PATIENT HAS PULSE & IS STABLE, ADMINISTER**
- **ANTI-ARRHYTHMIC MEDS (AMIODARONE, LIDOCAINE, MAG)**

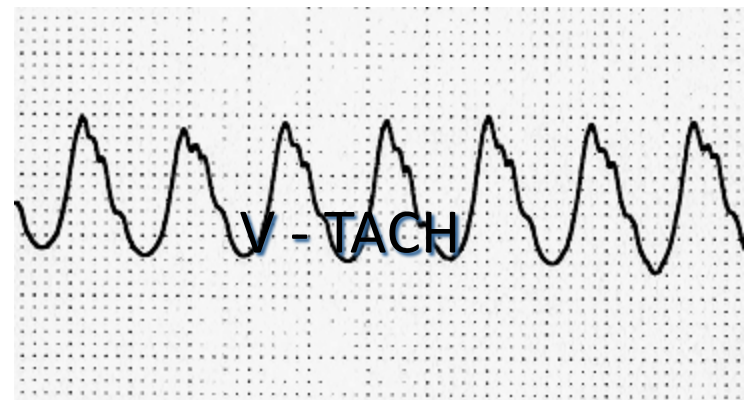
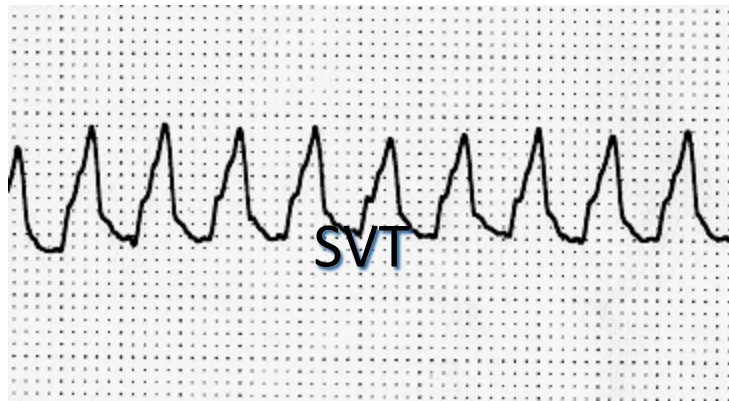
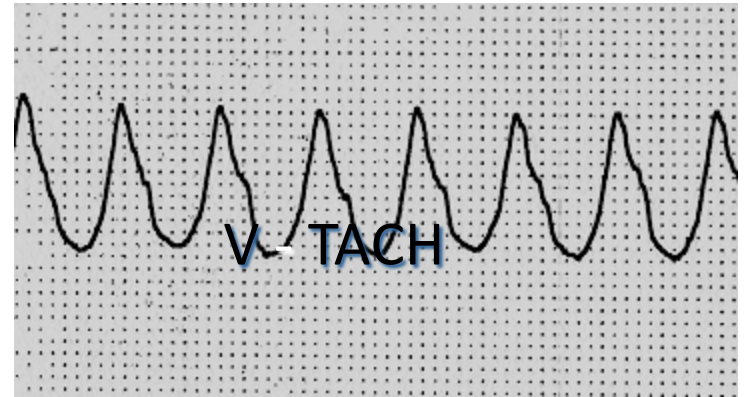
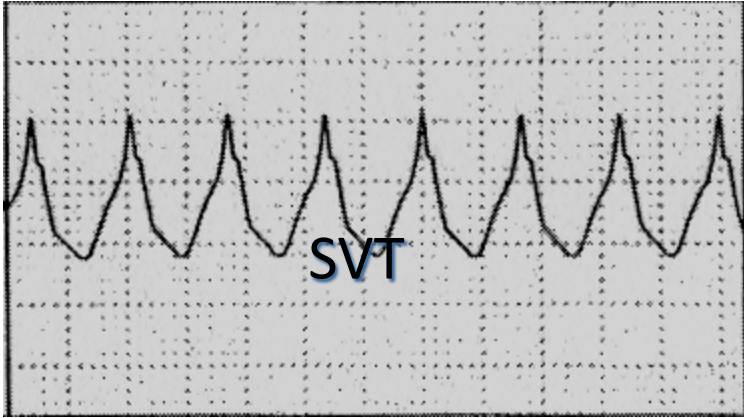


ID: 31732688 Name: CALLES, RUBEN Date: 08/09/2006 Time: 09: 50: 32 Condition: 1  
Sequence: 7 AO S/D/M 109/74/85 SpO2: 96% NIBP: 120/77/88  
HR: 81 ECG  
Sample length: 10 s Paper speed: 25 mm/s Page: 1(1)

# ? WIDE COMPLEX TACHYCARDIA ?



# ? WIDE COMPLEX TACHYCARDIA ?



# THIS RHYTHM IS:



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

# THIS RHYTHM IS: POLYMORPHIC V-TACH



## MAIN IDENTIFICATION CHARACTERISTIC(S):

RATE -----

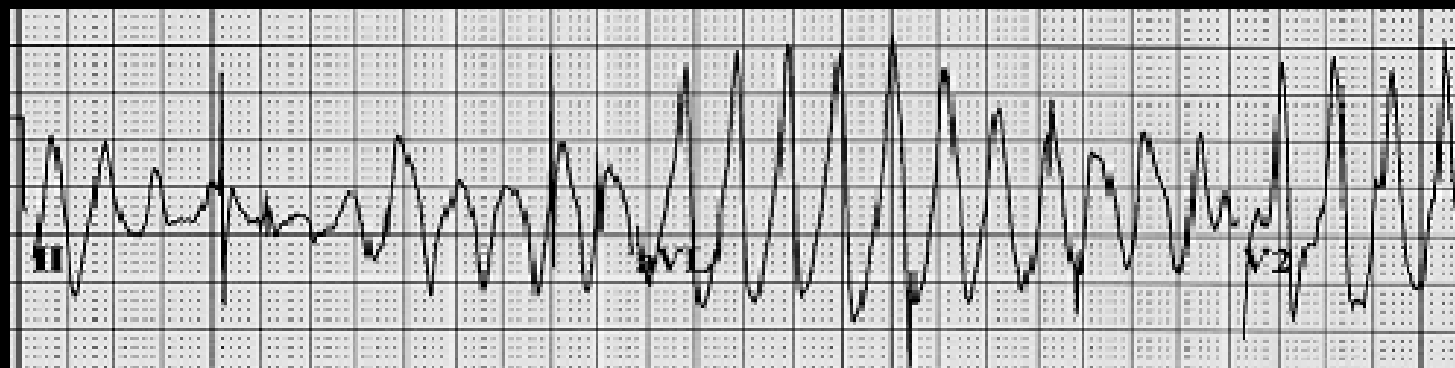
RHYTHM -----

P-R INTERVAL -----

P:QRS RATIO -----

QRS INTERVAL -----

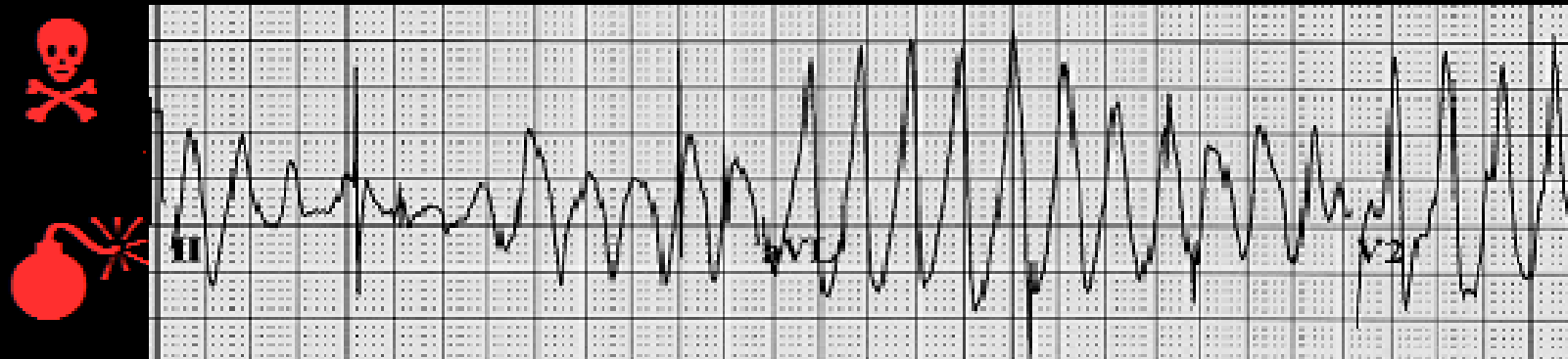
# THIS RHYTHM IS: POLYMORPHIC V-TACH



MAIN IDENTIFICATION CHARACTERISTIC(S): **WIDE QRS COMPLEXES, MULTIPLE SHAPES AND FORMS, POSITIVE AND NEGATIVE DEFLECTIONS, APPEARS TO ROTATE BETWEEN NEGATIVE AND POSITIVE (TWISTING OF POINTS)**

RATE	-----	<b>200 - 300</b>
RHYTHM	-----	<b>VARIES</b>
P-R INTERVAL	-----	<b>N/A</b>
P:QRS RATIO	-----	<b>N/A</b>
QRS INTERVAL	-----	<b>VARIES</b>

# THIS RHYTHM IS: POLYMORPHIC V-TACH

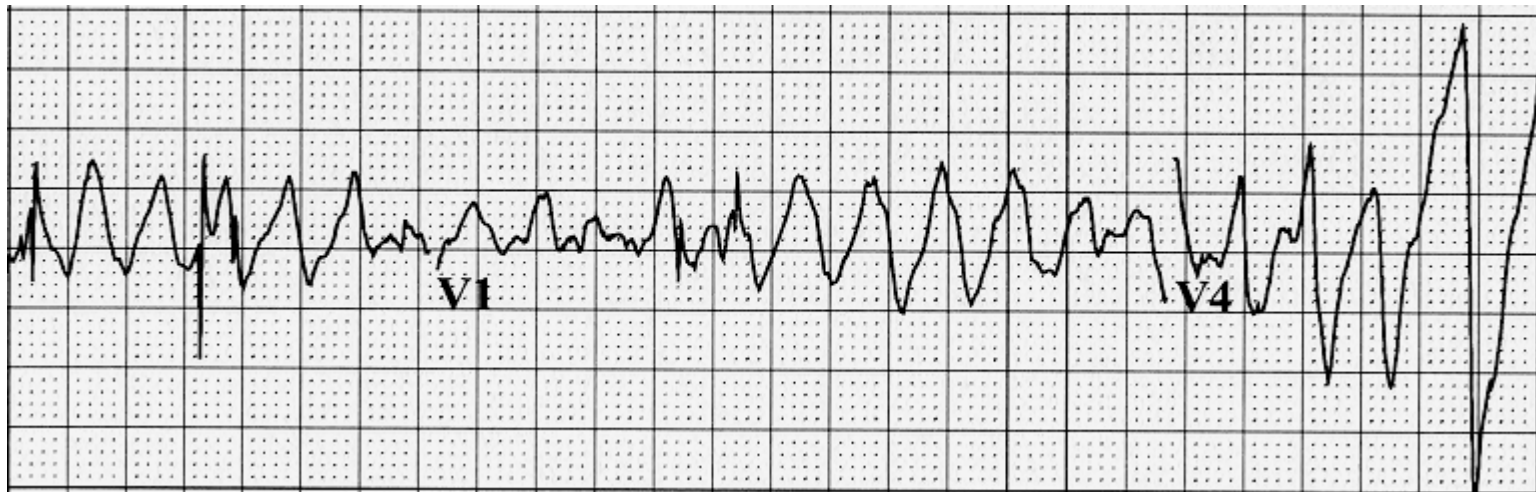
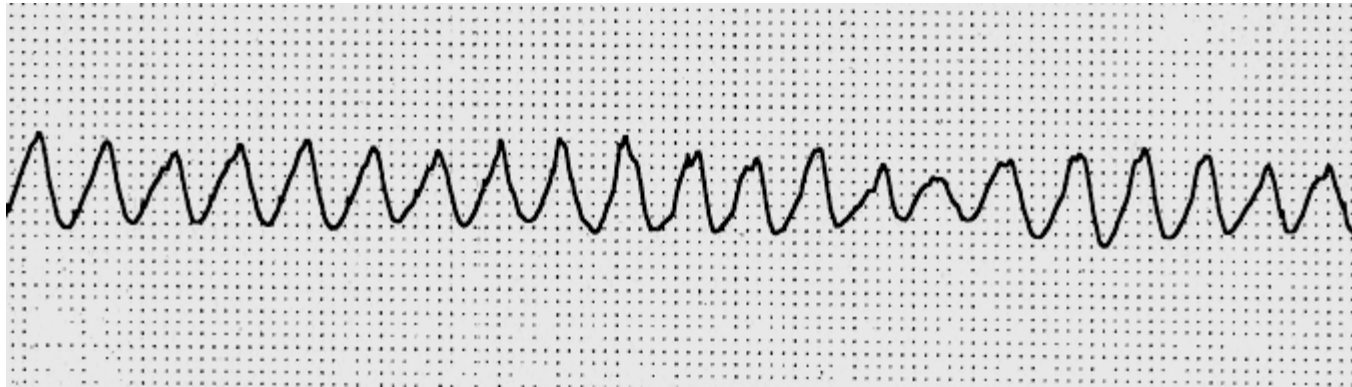


**MAIN IDENTIFICATION CHARACTERISTIC(S):** **WIDE QRS COMPLEXES,**  
**MULTIPLE SHAPES AND FORMS, POSITIVE AND NEGATIVE DEFLECTIONS,**  
**APPEARS TO ROTATE BETWEEN NEGATIVE AND POSITIVE (TWISTING OF POINTS)**

## PRESENTING PROBLEM(S):

- **USUALLY A LETHAL RHYTHM IF NOT QUICKLY CONVERTED**
- **PATIENT MAY BE IN CARDIAC ARREST WITH THIS RHYTHM**
- **IF PATIENT HAS PULSE, USUALLY UNSTABLE**

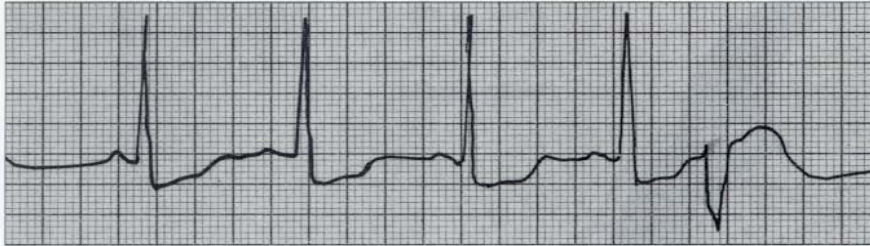
Some Torsades rhythm strips are harder to determine. . . .



If a rhythm presents to you like it “may possibly be Torsades” – it will most likely benefit the patient if you TREAT IT as TORSADES. . . .

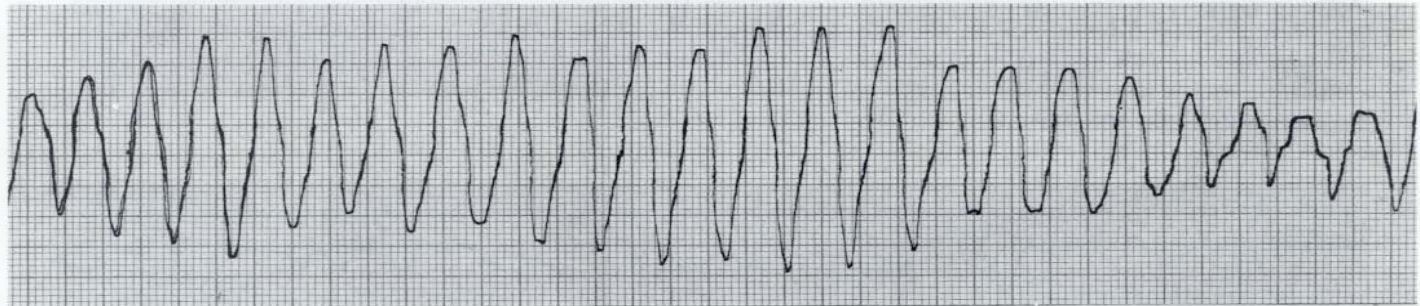
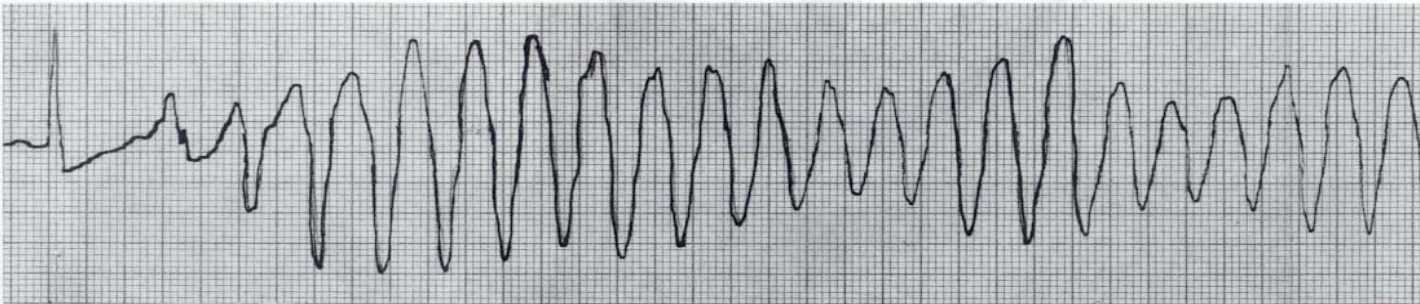
## Torsades de pointes

II

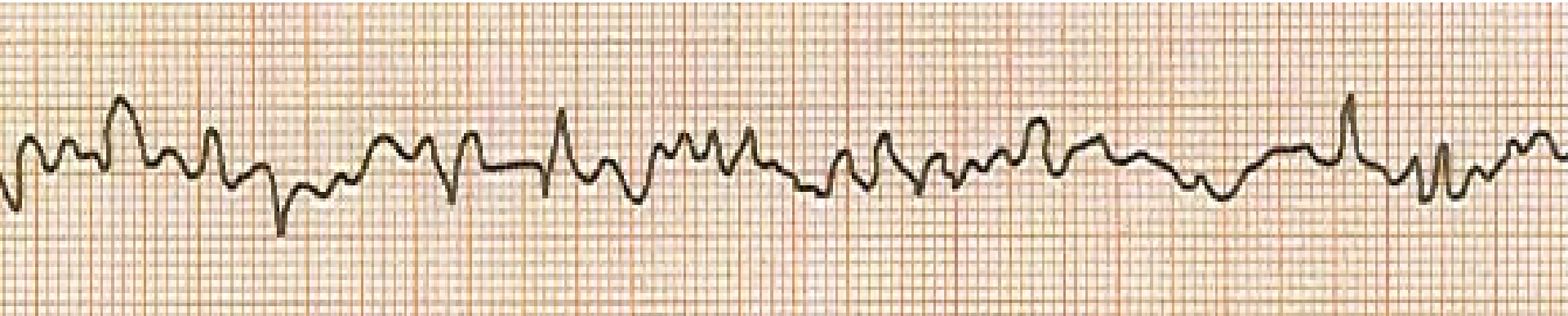


Torsades de pointes (twists of points) is a type of ventricular tachycardia that is often paroxysmal and that occurs in the setting of a long QT interval, which is commonly secondary to therapy with quinidine or quinidine-like drugs (procainamide and disopyramide) but which may also be the result of hypokalemia and complete heart block. The above tracing is from a patient who had been receiving procainamide (500 mg four times a day, orally).

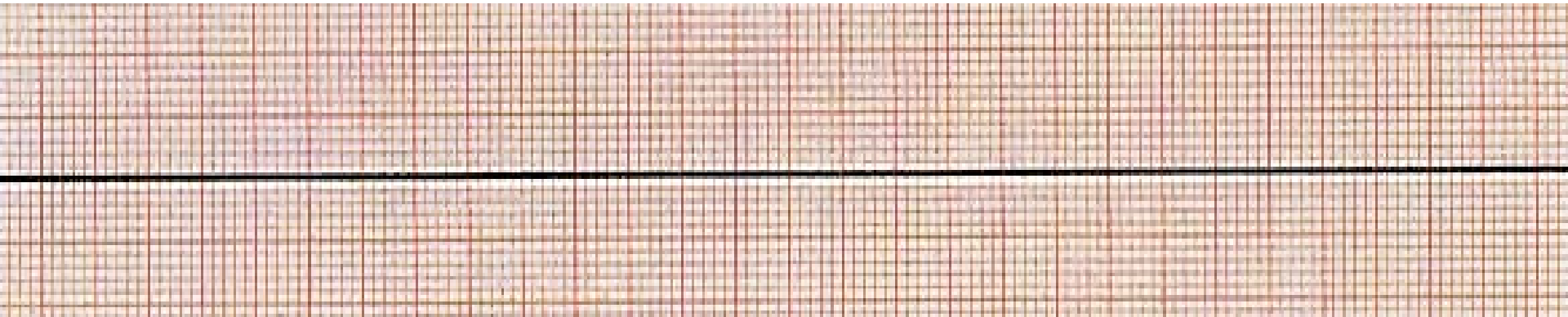
Continuous tracing.



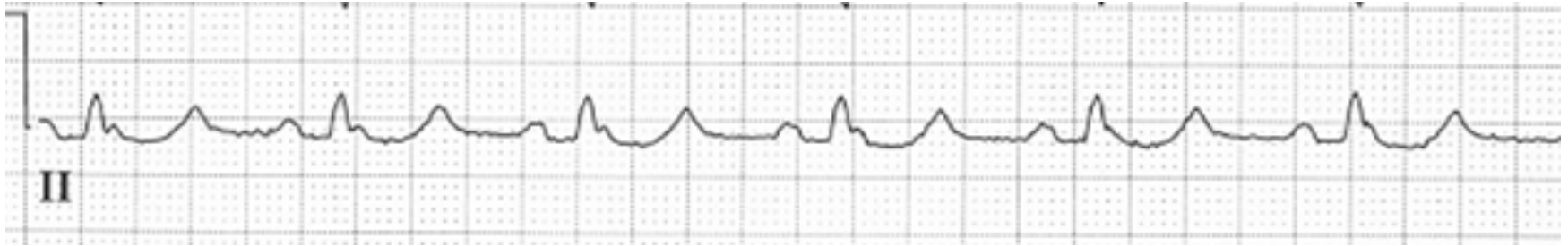
# Ventricular Fibrillation



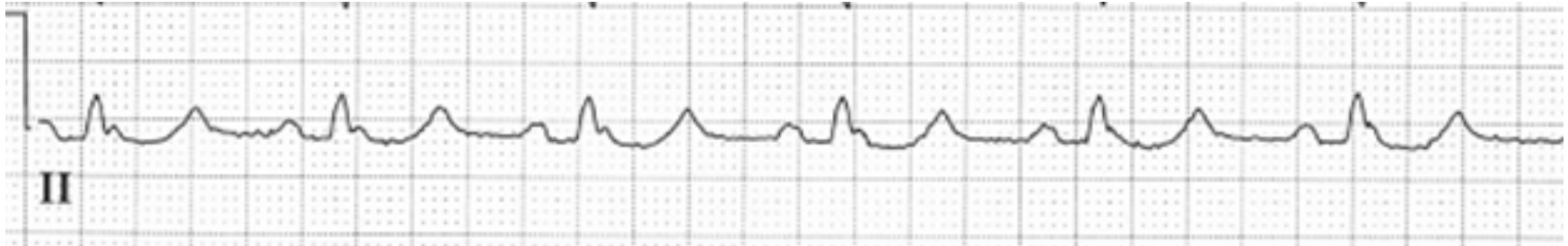
# Ventricular Asystole



What's this rhythm?



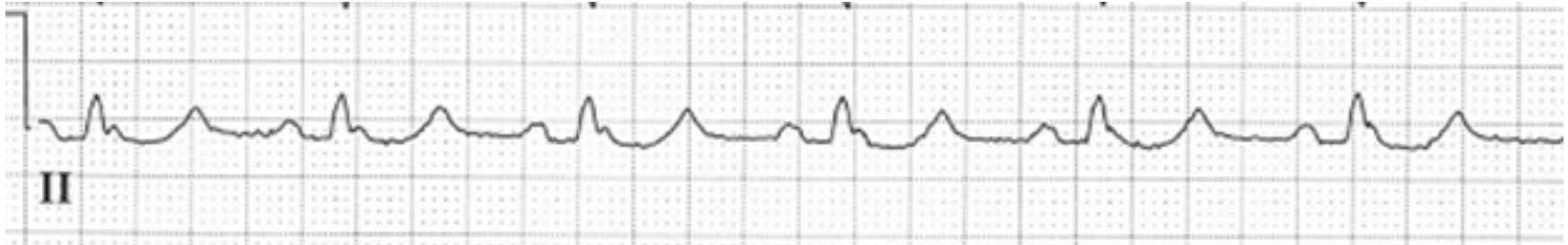
What's this rhythm?



It' "Normal Sinus Rhythm" . . . .

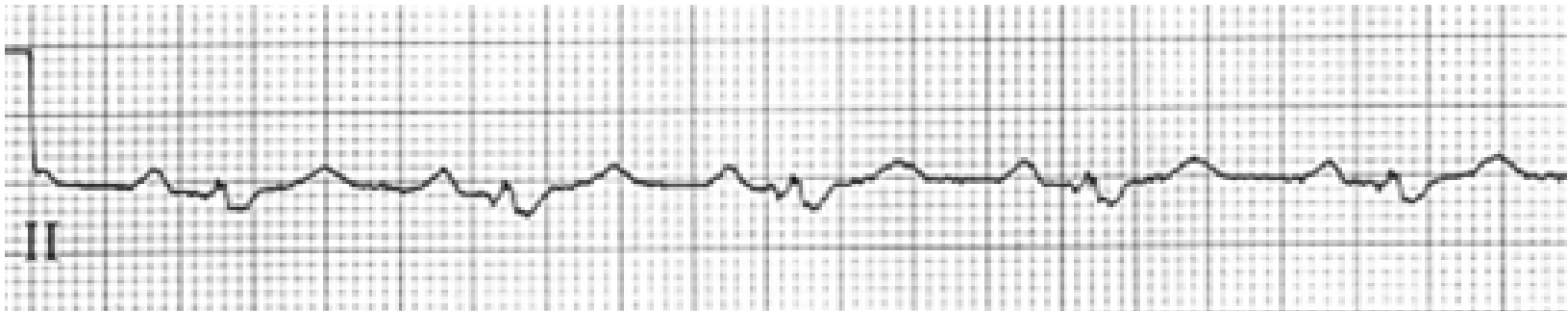
But the QRS it too wide!

What's this rhythm?



It' "Normal Sinus Rhythm" . . . .

But the QRS it too wide!



SAME WITH THE ABOVE RHYTHM

When the QRS is TOO WIDE  
( $>3\text{mm}$  -or-  $120\text{ms}$ ) .....

IT USUALLY INDICATES  
“BUNDLE BRANCH BLOCK”

Sinus node

AV node

Right bundle  
branch

Left bundle  
branch

Purkinje fibers



When the QRS is TOO WIDE  
( $>3\text{mm}$  -or-  $120\text{ms}$ ) .....

.....it DISTORTS the:

- J Points
- ST Segments
- T Waves

# EASIEST METHOD TO DETERMINE “RIGHT” vs “LEFT” BUNDLE BRANCH BLOCK:

## THE “TURN SIGNAL METHOD” for identifying BUNDLE BRANCH BLOCK

V1

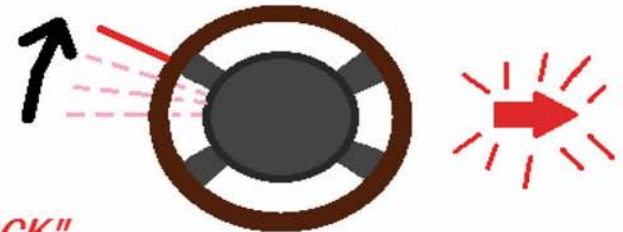


**USE LEAD V1 for this technique**

To make a **RIGHT TURN**  
you push the turn signal lever **UP** . . . . .

THINK:

*“QRS points UP = RIGHT BUNDLE BRANCH BLOCK”*



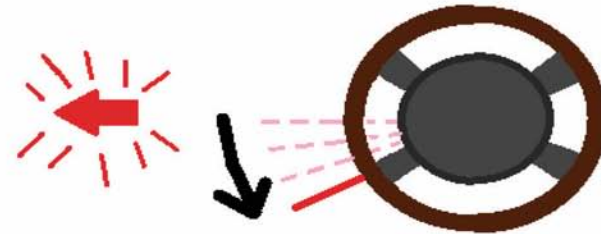
V1



To make a **LEFT TURN**  
you push the turn signal lever **DOWN** . . . . .

THINK:

*“QRS points DOWN = LEFT BUNDLE BRANCH BLOCK”*



## STEP 1 – evaluate QRS width:

- **QRS is ABNORMALLY WIDE (>120 ms),**
  - **indicates DEPOLARIZATION ABNORMALITY**  
**(e.g. “bundle branch block, Wolff-Parkinson-White Syndrome, etc).**

## STEP 1 – evaluate QRS width:

- **QRS is ABNORMALLY WIDE (>120 ms),**
  - indicates **DEPOLARIZATION ABNORMALITY** (e.g. “bundle branch block, Wolff-Parkinson-White Syndrome, etc).
  - **DEPOLARIZATION ABNORMALITIES** in turn cause **REPOLARIZATION ABNORMALITIES**, which alters the: *J Points, ST-Segments and/or T Waves.*

# When the QRS is WIDE (> 3mm):

- If you **KNOW** the Rhythm is originating **ABOVE** the Ventricles (such as NSR or any Supraventricular Rhythm) – you should determine if the QRS has a **RIGHT** or **LEFT** Bundle Branch Block morphology.

Sinus node

AV node

Right bundle branch

Left bundle branch

Purkinje fibers



09:16:40

74 yr  
Female Caucasian

Vent. rate 64 BPM  
PR interval 188 ms  
QRS duration 152 ms  
QT/QTc 472/486 ms  
P-R-T axes 78 3 106

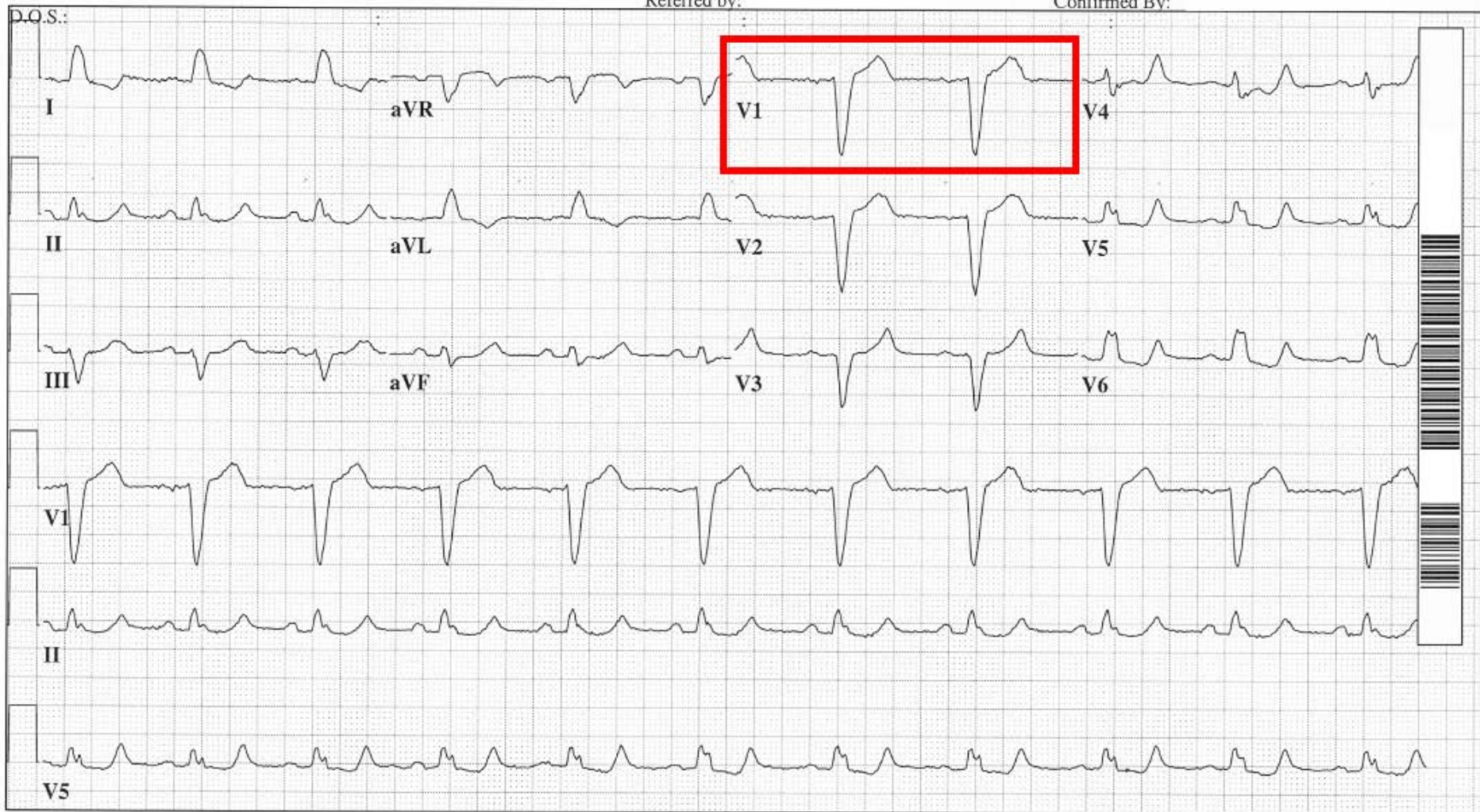
Normal sinus rhythm  
Left bundle branch block  
Abnormal ECG  
When compared with ECG of 28-MAY-2003 06:36,

EKG #WR03029959

Technician: WW

Referred by:

Confirmed By:



09:16:40

74 yr  
Female Caucasian

Vent. rate 64 BPM  
PR interval 188 ms  
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QT/QTc 472/486 ms  
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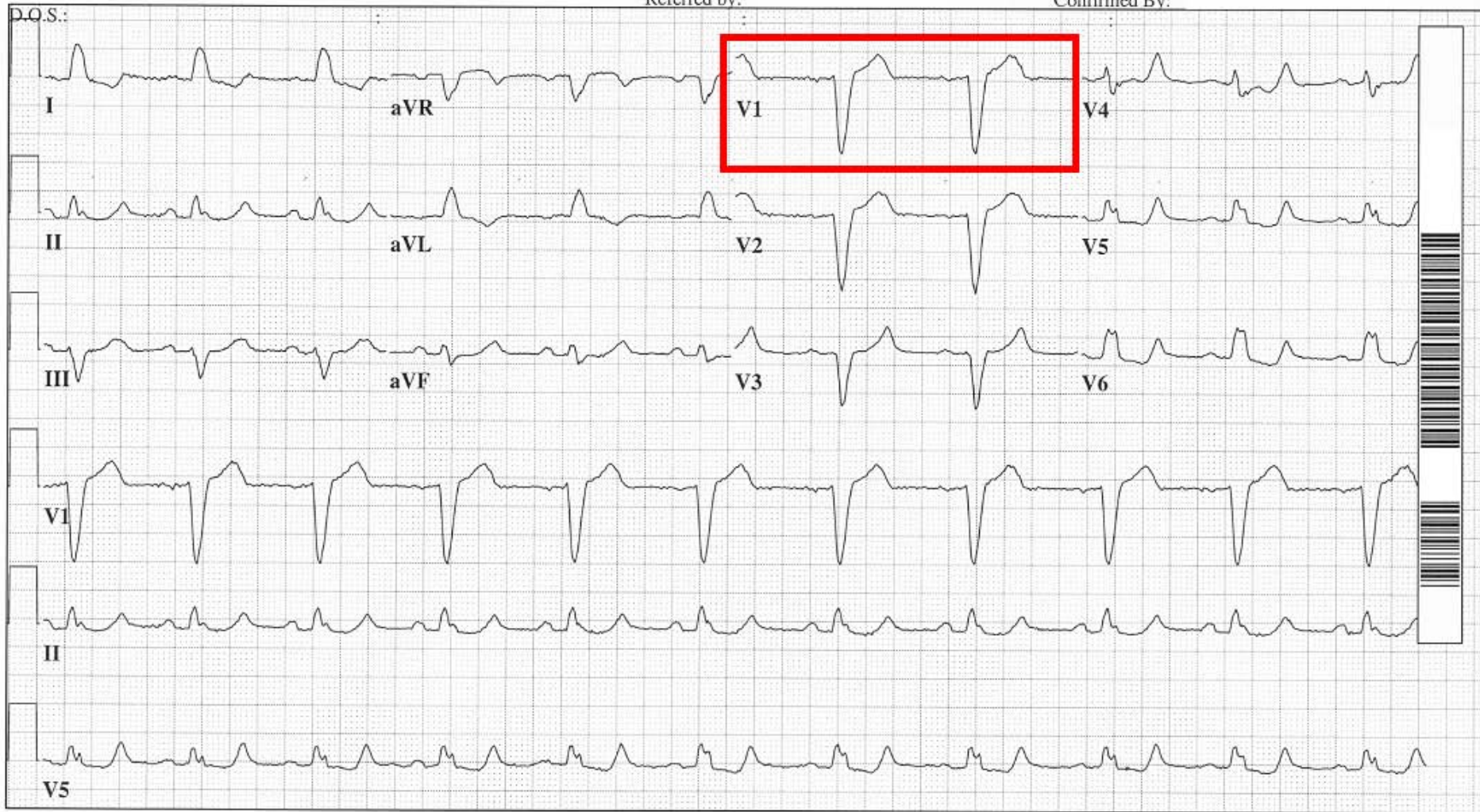
Normal sinus rhythm  
Left bundle branch block  
Abnormal ECG  
When compared with ECG of 28-MAY-2003 06:36,

EKG #WR03029959

Technician: WW

Referred by:

Confirmed By:

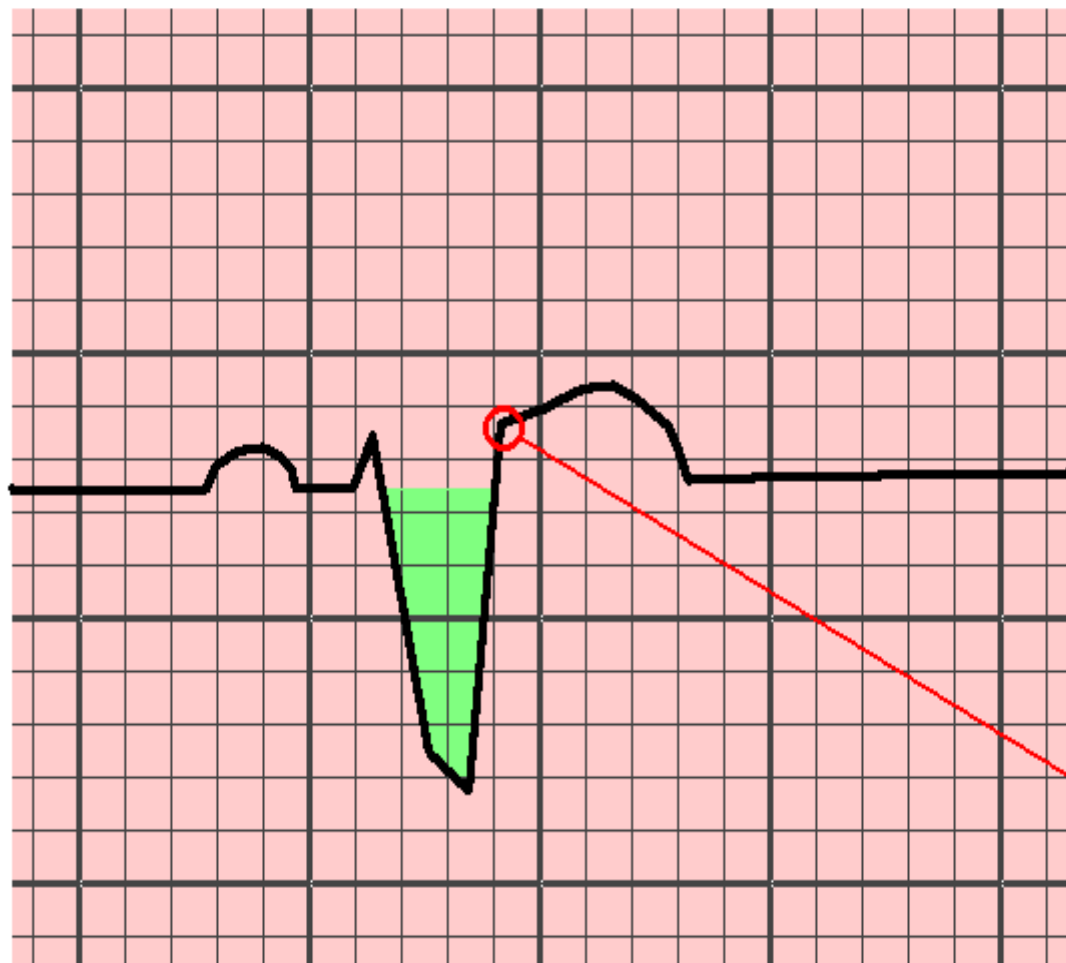


**TERMINAL PHASE OF QRS IS  
NEGATIVE**



**= LEFT BUNDLE  
BRANCH BLOCK**

## DIAGNOSING LBBB IN LEAD V1:



- QRS GREATER THAN 120 ms (.12)
- EVIDENCE THAT THIS IS NOT VENTRICULAR BEAT
- TERMINAL PHASE (LAST PART) OF QRS COMPLEX IS NEGATIVE DEFLECTION
- S-T SEGMENTS ARE NORMALLY ALWAYS ELEVATED !

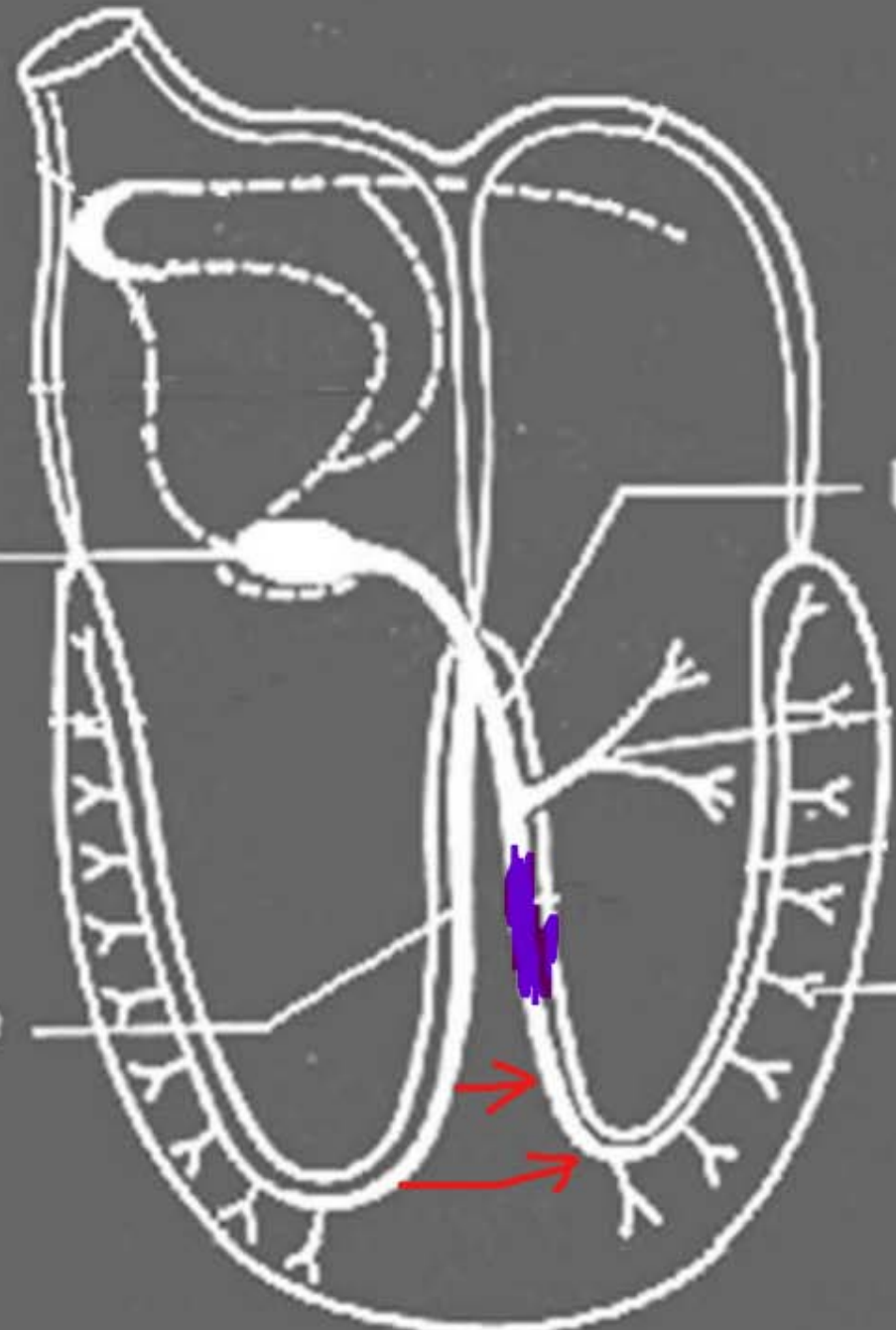
Sinus node

AV node

Right bundle branch

Left bundle branch

Purkinje fibers



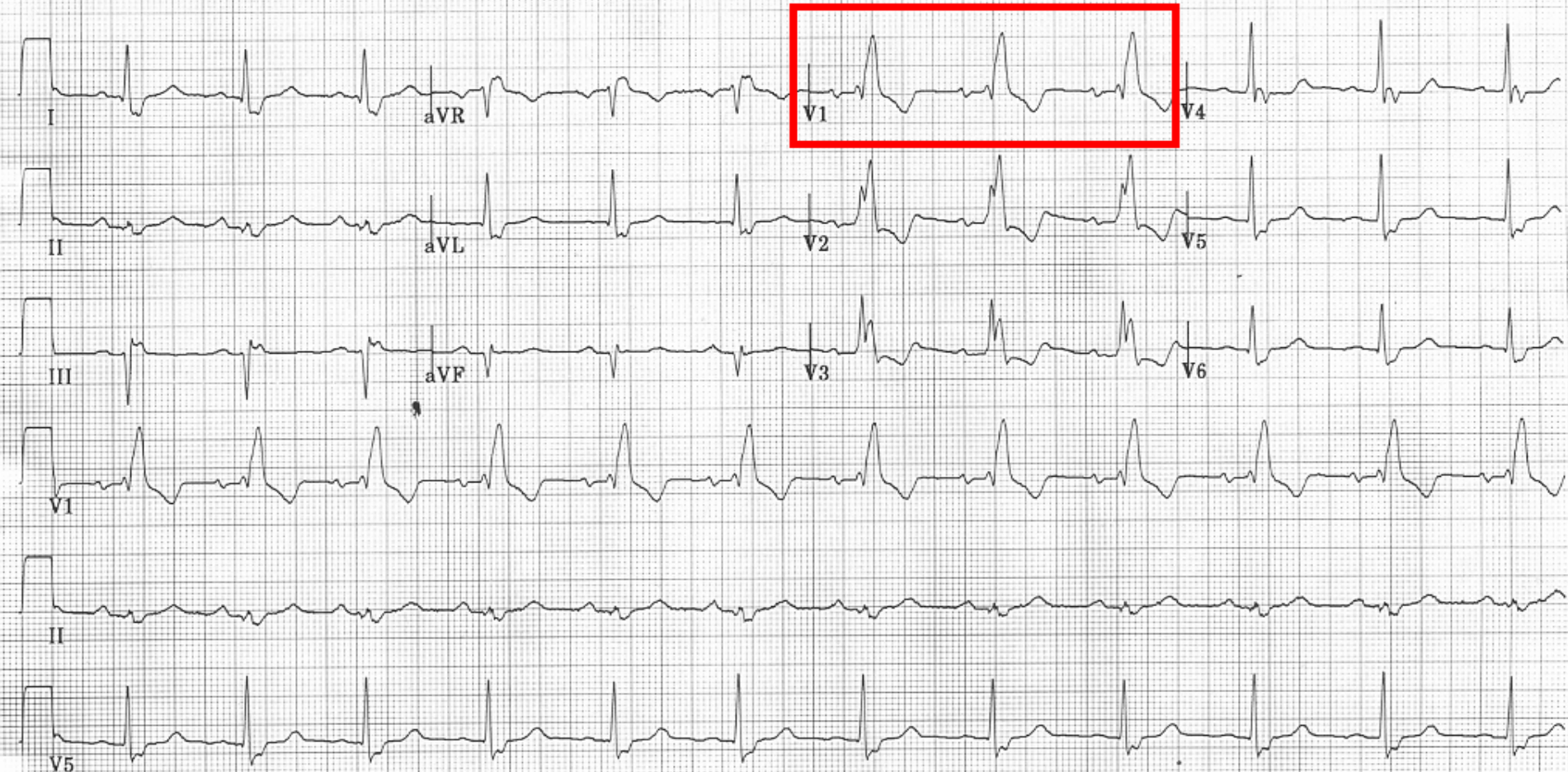
74years		Vent. rate	72 bpm	Normal sinus rhythm
Male	Caucasian	PR interval	186 ms	Left axis deviation
		QRS duration	166 ms	Right bundle branch block
Room:		QT/QTc	436/477 ms	Inferior infarct, age undetermined
Loc: 0	Opt:	P-R-T axes	57 -32 32	Abnormal ECG

Technician: WR

Referred by:

Unconfirmed

D.O.S.:



**TERMINAL PHASE OF QRS IS**  
**POSITIVE**



**= RIGHT BUNDLE  
BRANCH BLOCK**

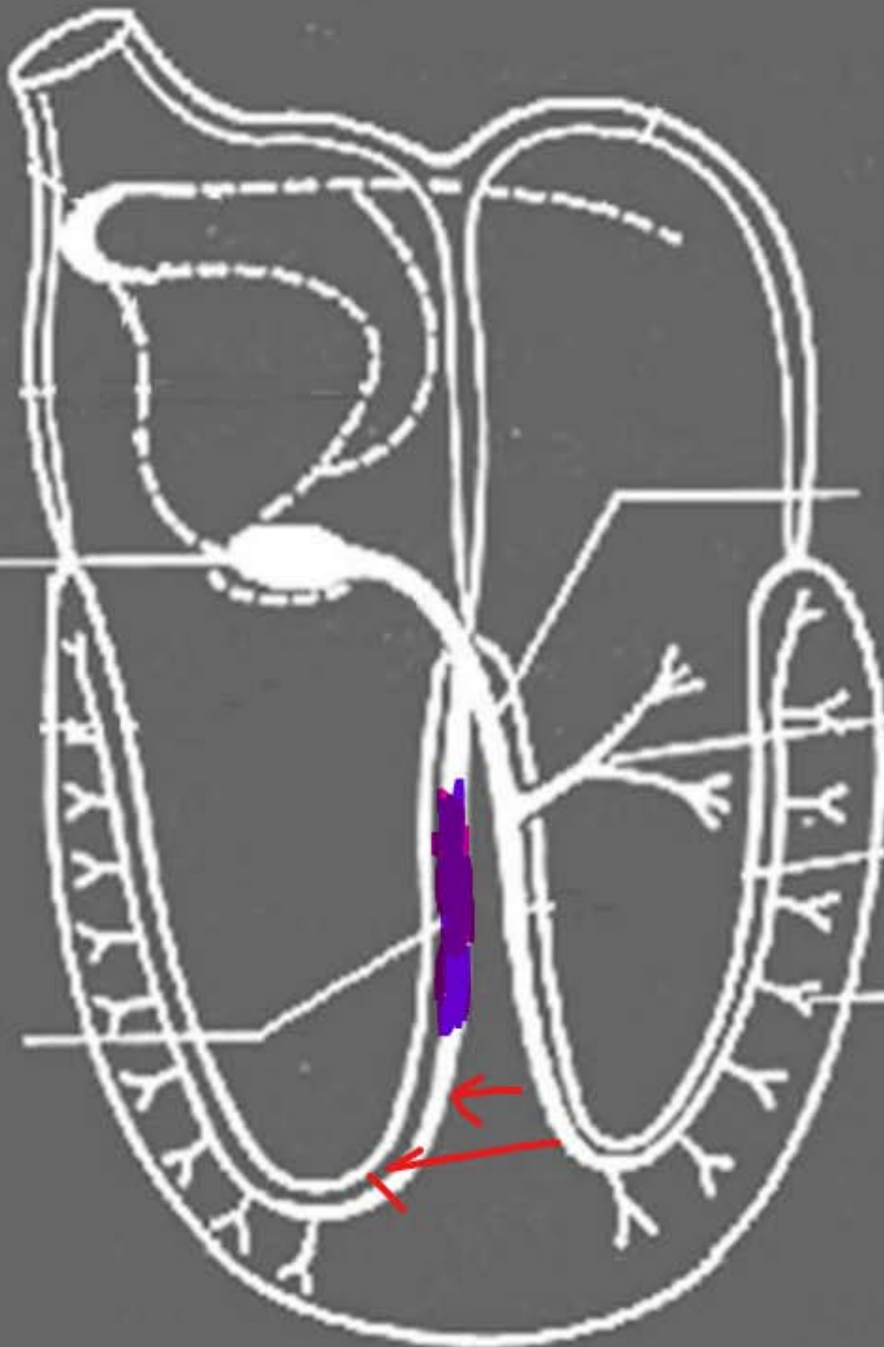
Sinus node

AV node

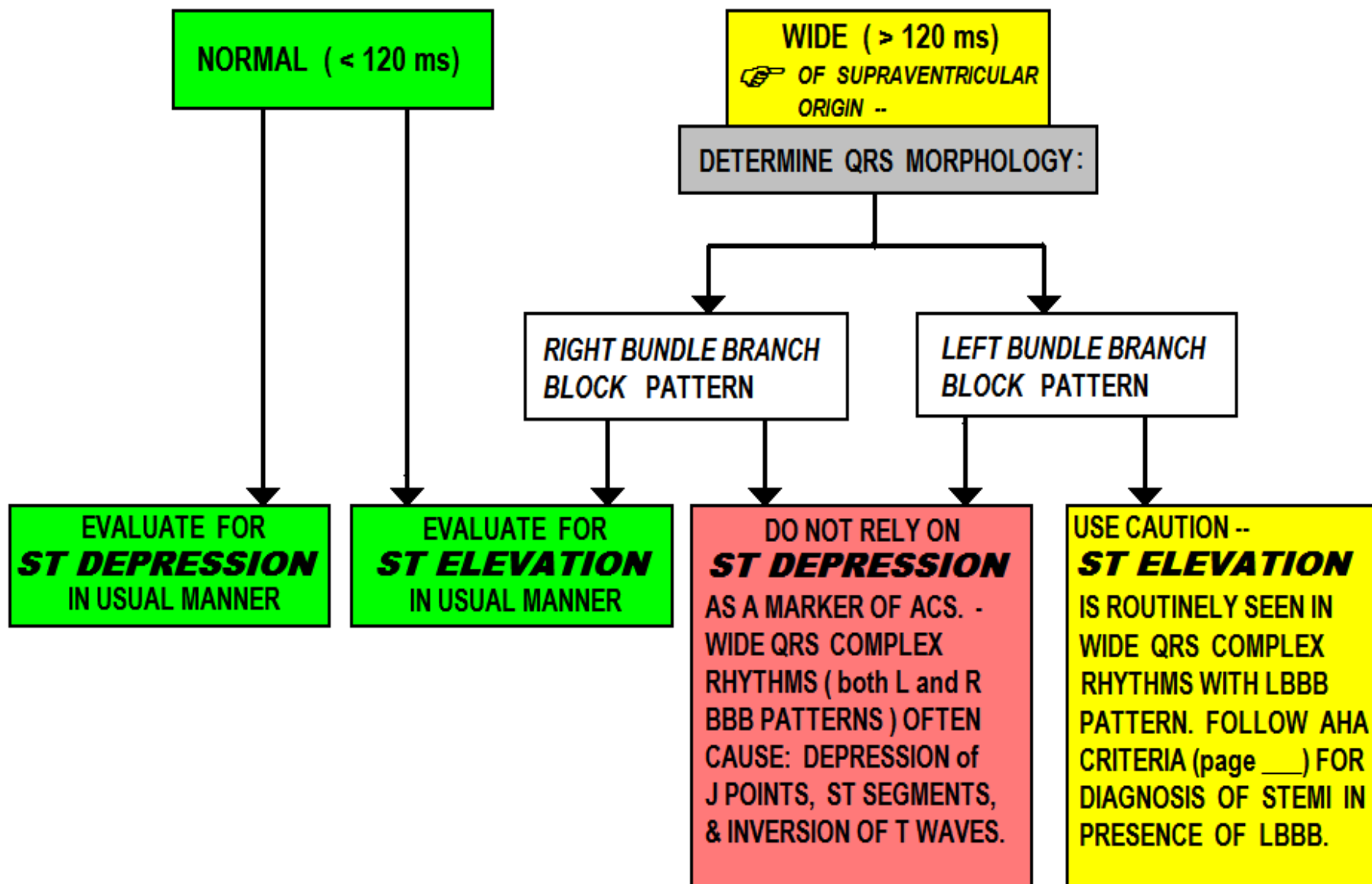
Right bundle branch

Left bundle branch

Purkinje fibers



# STEP 1 - EVALUATE WIDTH OF QRS:



**YOU SURVIVED !!!**