MED FLEET
AMBULANCE

Basic ECG Interpretation

Presented by:

Wayne W Ruppert, CVT, CCC, NREMT-P

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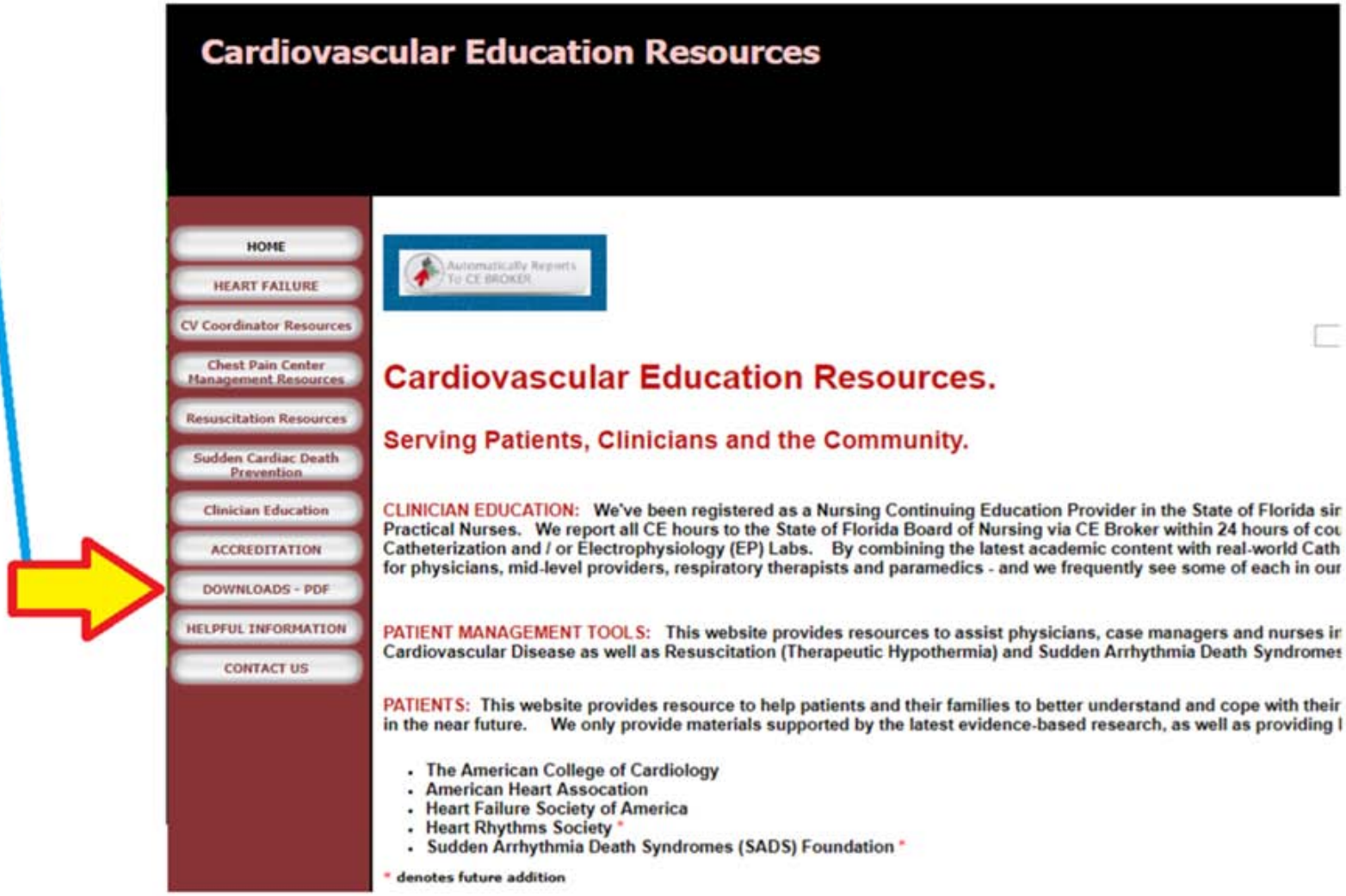

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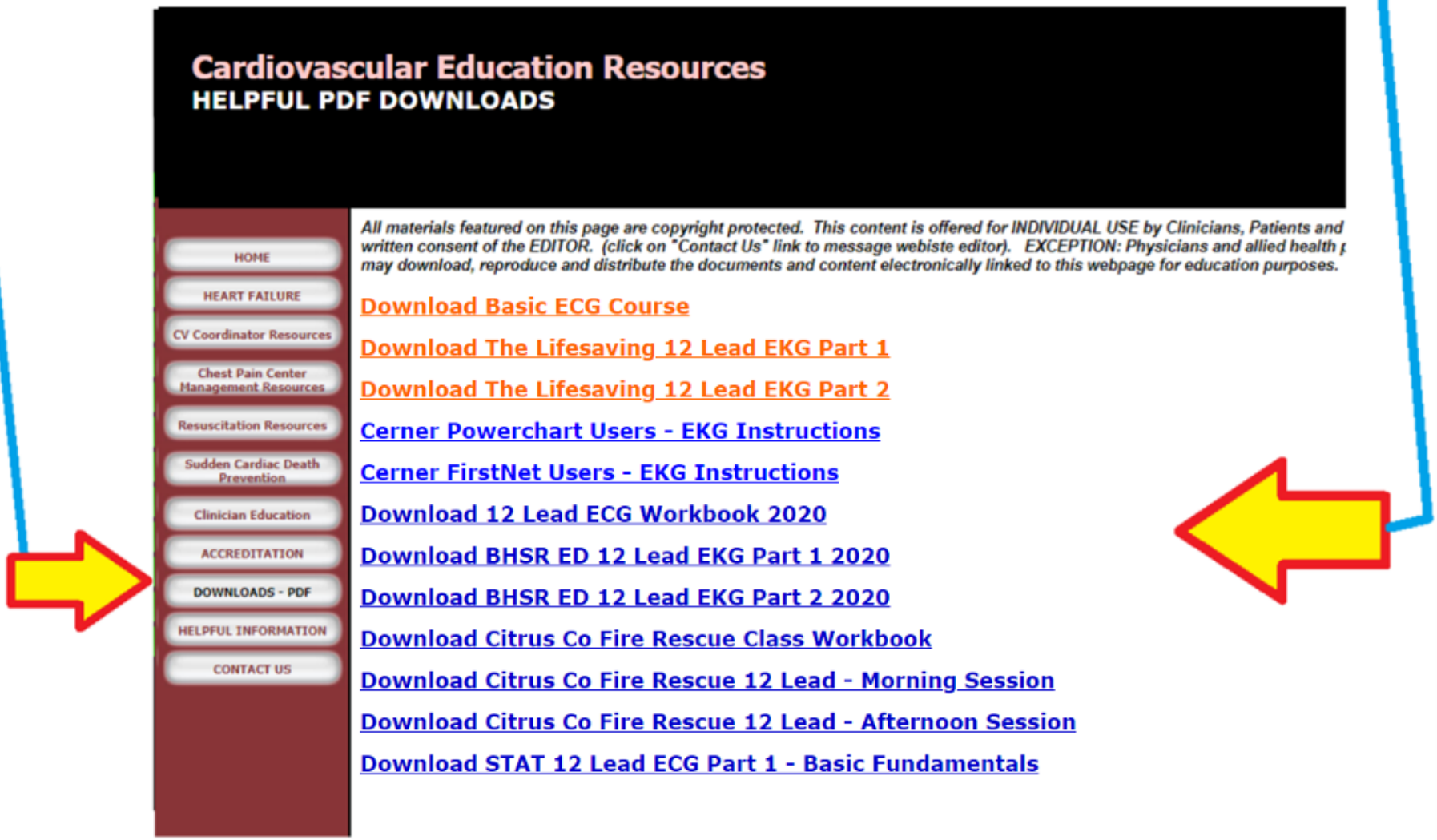

AMERICAN COLLEGE of CARDIOLOGY

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Standards for Inpatient Electrocardiographic Monitoring

Oct 04, 2017 | Richard L. Weinberg, MD, PhD, FACC

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.
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].**

Circulation

REVIEW ARTICLE | Originally Published 3 October 2017 |

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

Circulation • V

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.

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[1] 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 Rhytym (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

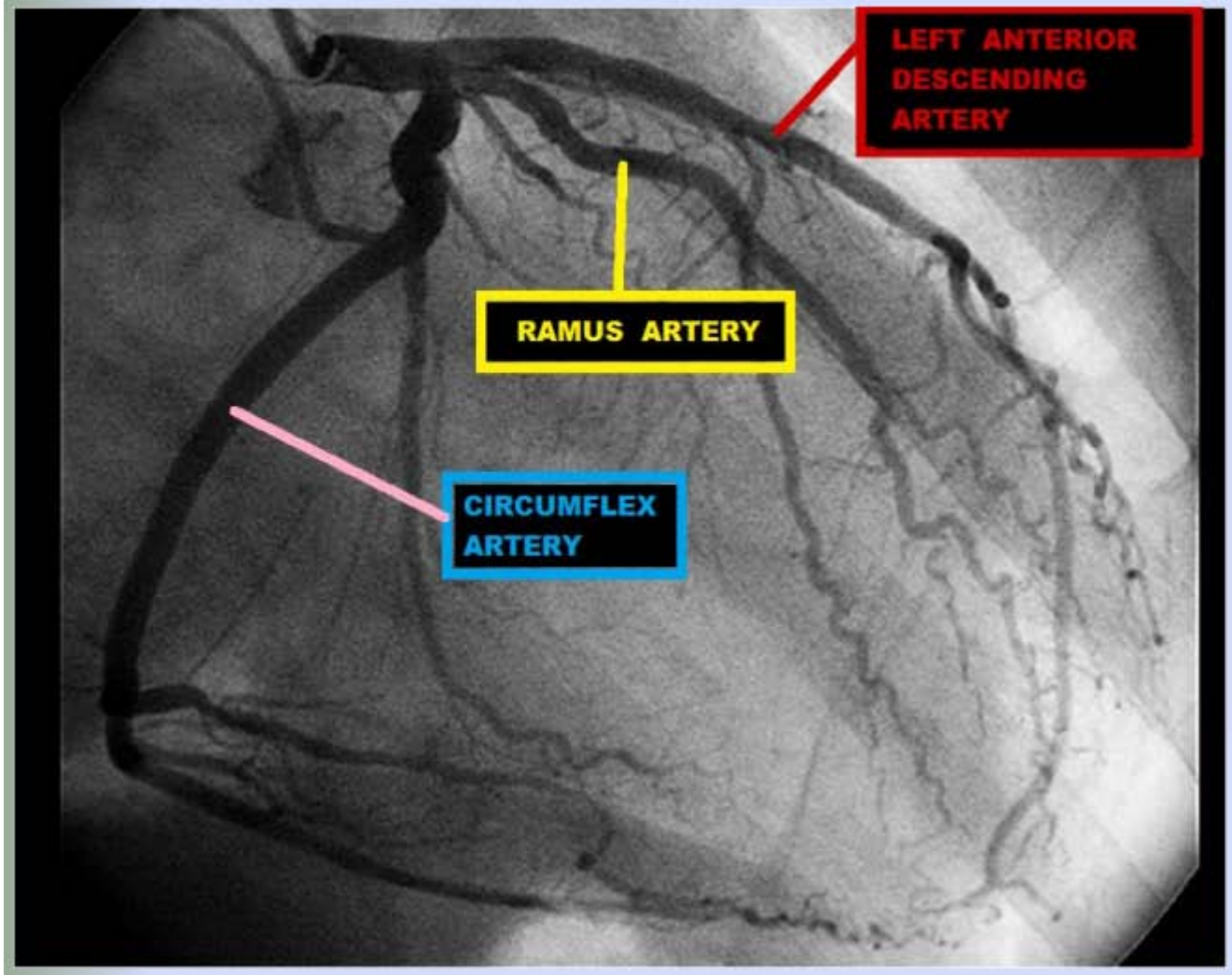
Present: ALS Coordinator, MedFleet

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)!

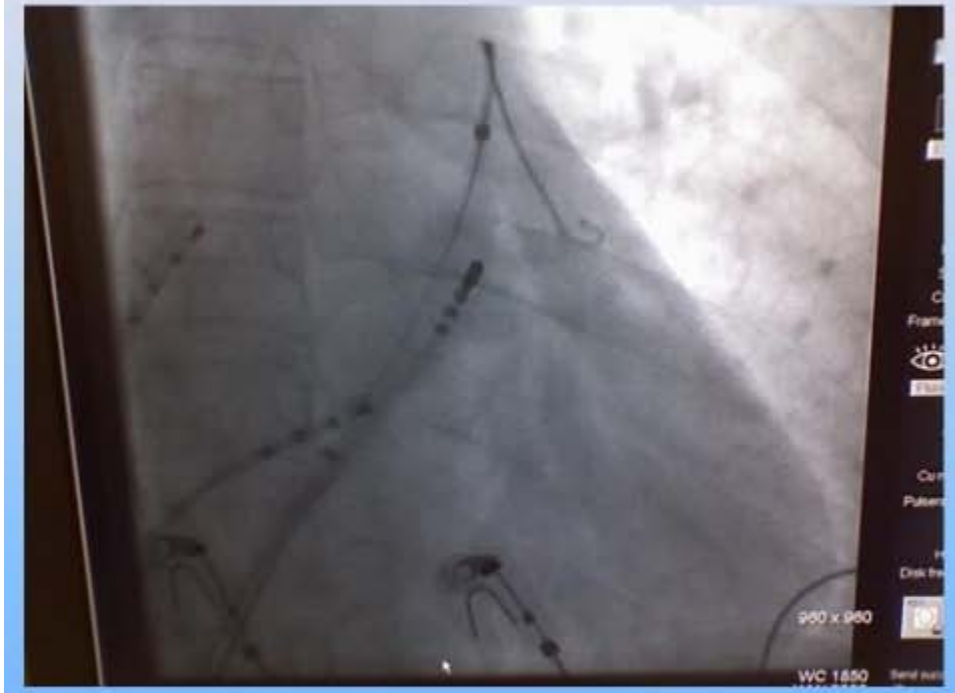

13,000 – 15,000 EP and Cath Lab cases between 1996 - Today
Wayne Ruppert and Dr. James Irwin, St Joseph's Hospital, Tampa, 7/29/2004
7.29 06:55

Cardiac Cath Lab Advantage:



Correlation of ECG leads with SPECIFIC cardiac anatomic structures.

Electrophysiology Lab Case Studies

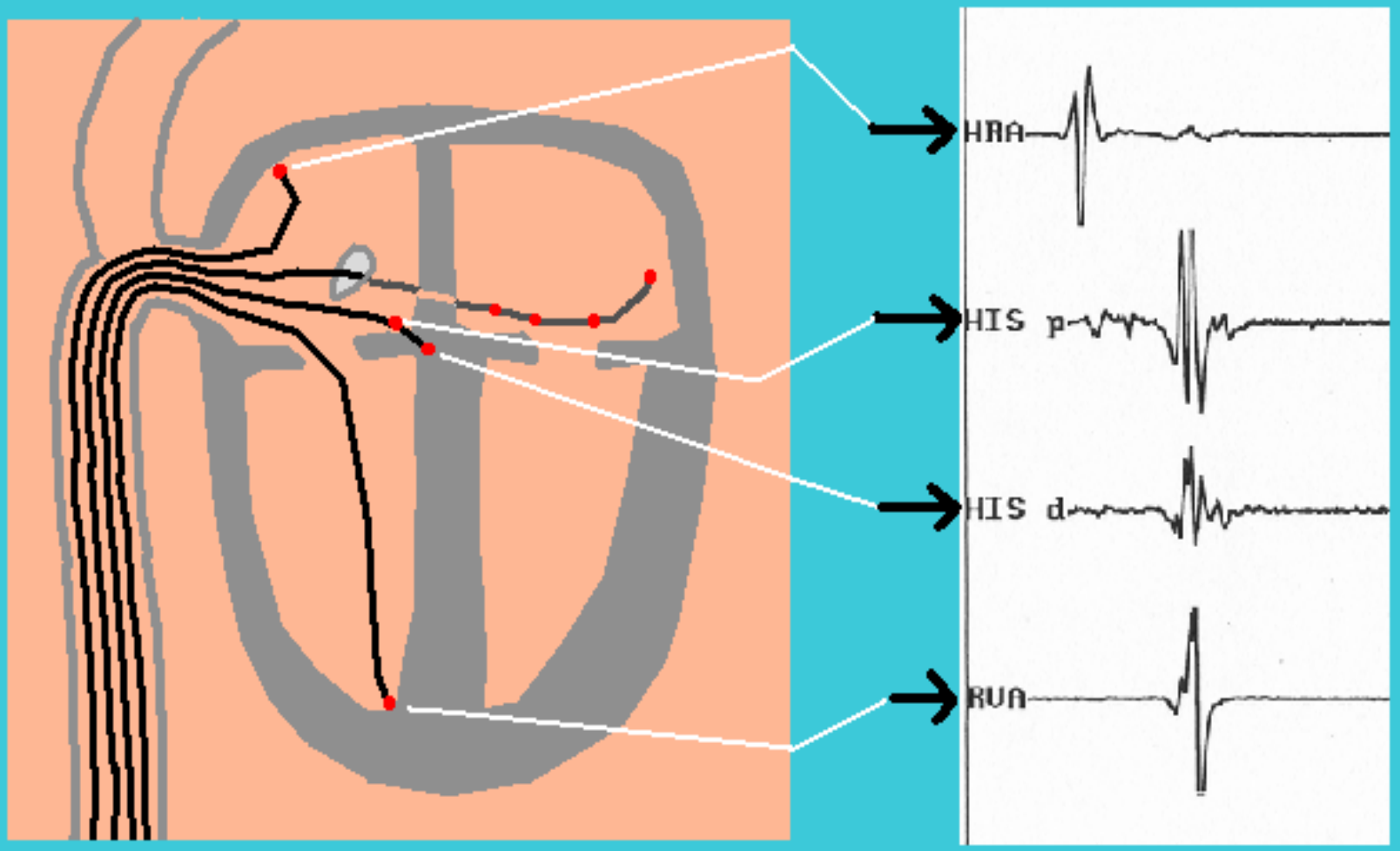


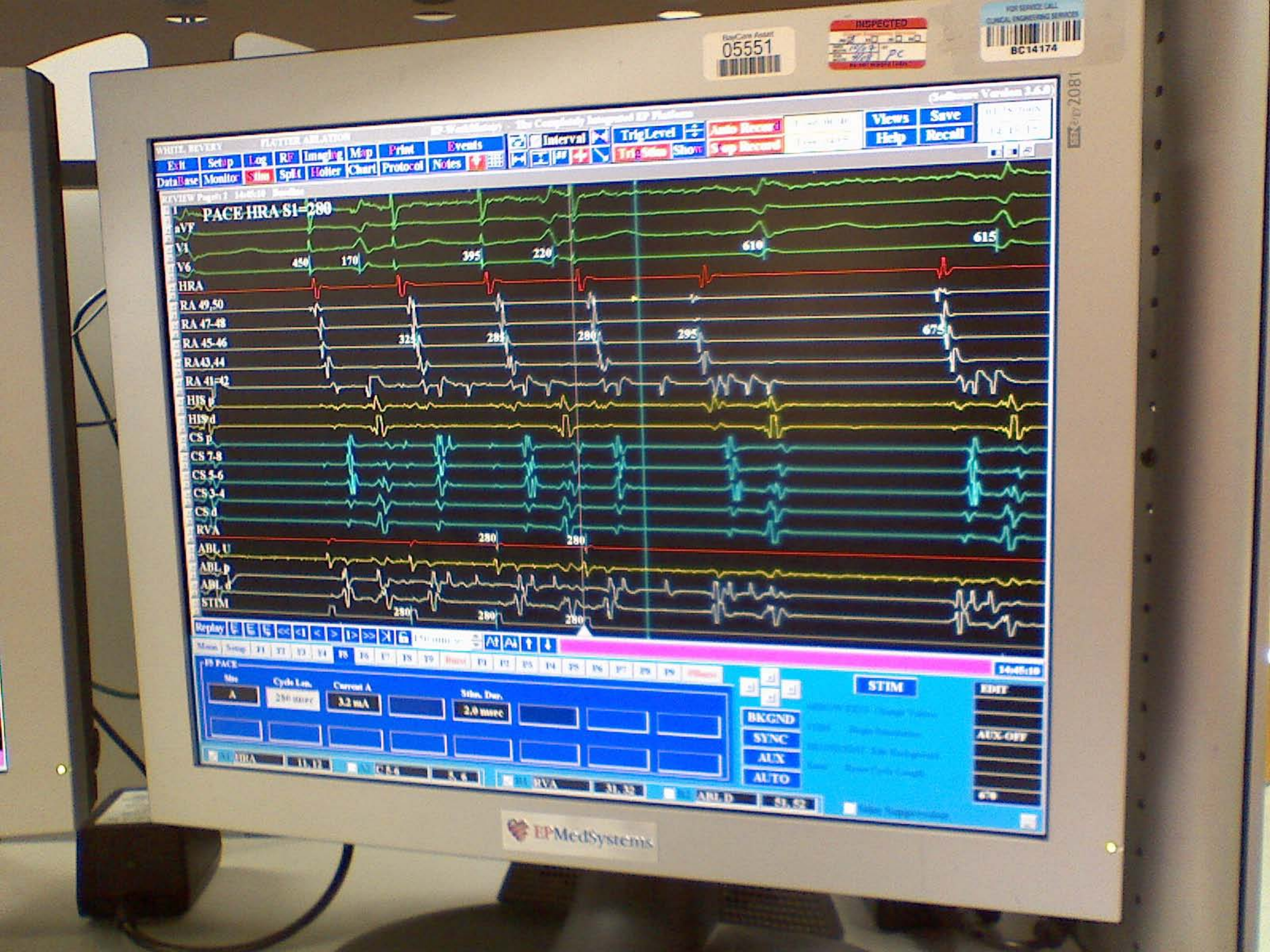
EP Catheters within the heart used for obtaining the Electrogram (the "internal ECG") Tracing and for Pace-mapping, an integral component of an EP study

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





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aVF
V1
V6
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RA 49,50
RA 47-48
RA 45-46
RA43,44
RA 41-42
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CS p
CS 7-8
CS 5-6
CS 3-4
CS d
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ABL p
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SYNC
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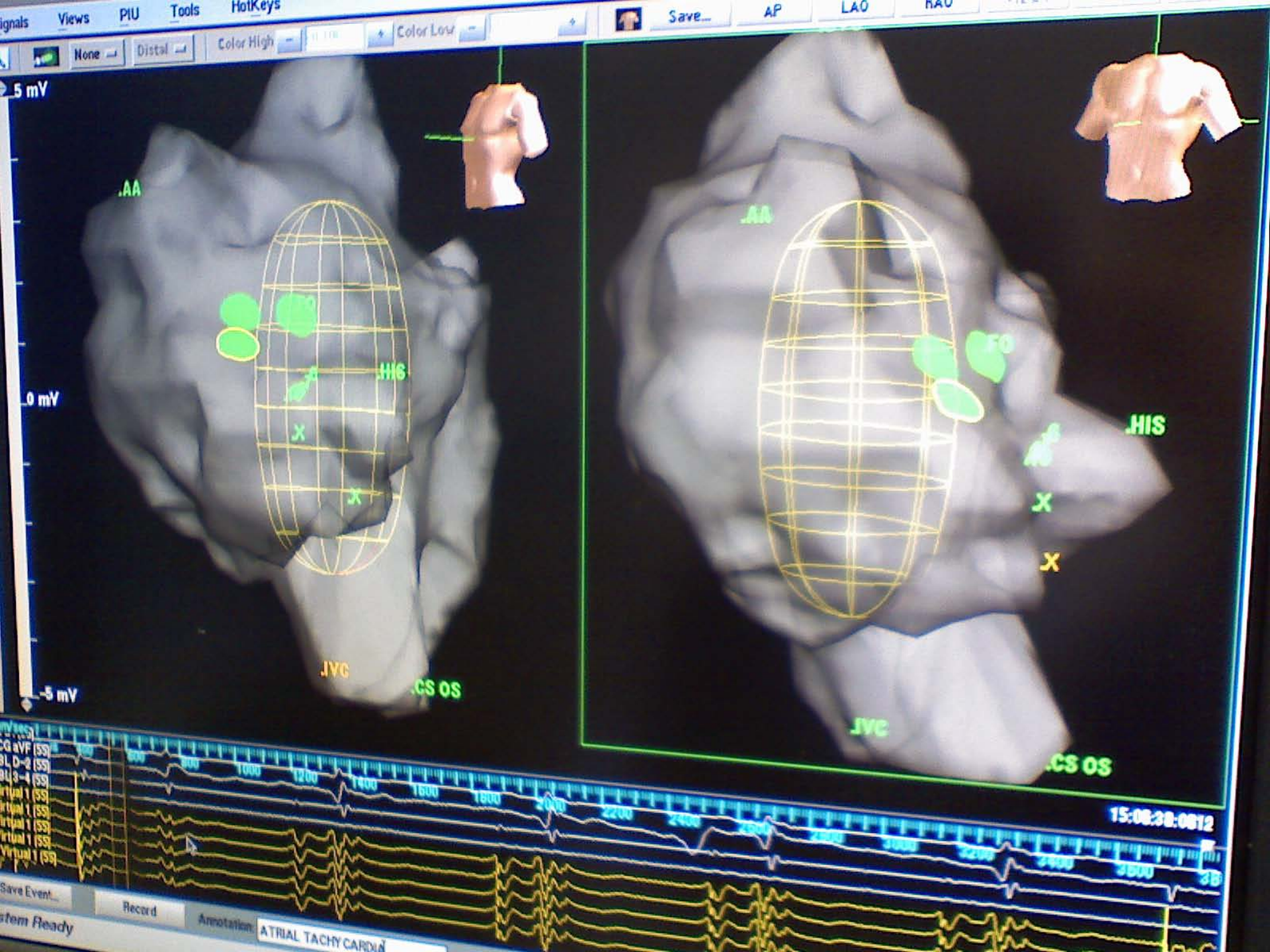
AUTO
EDIT
AUX-OFF
HRA
RVA
EPMedSystems


Views
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.JVC
.CS OS
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Annotation:
ATRIAL TACHYCARDIA

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

This book prepares you to:

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

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

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

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

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

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

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

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

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

ISBN 978-0-9829172-1-3
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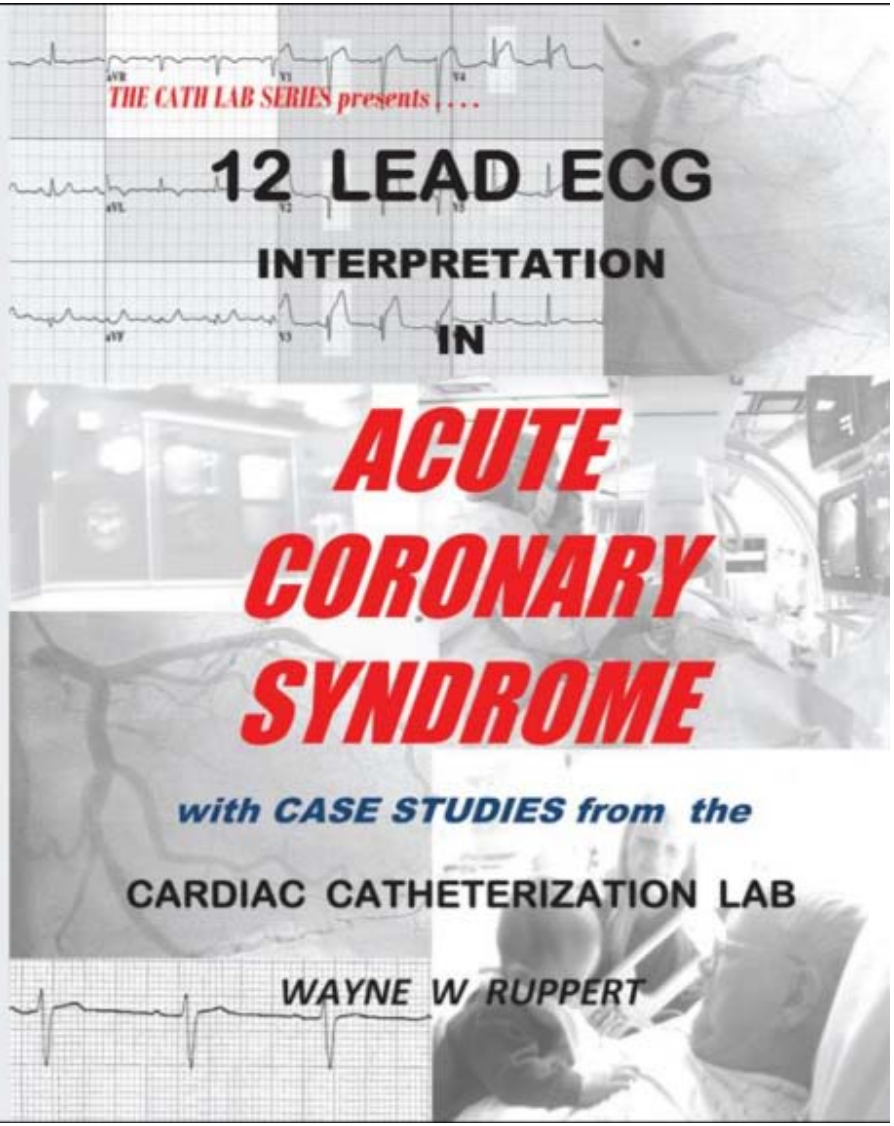
12 LEAD ECG INTERPRETATION in ACUTE CORONARY SYNDROME with CASE STUDIES from the CATH LAB -- WAYNE RUPPERT



Published in 2010. Working on updated version.

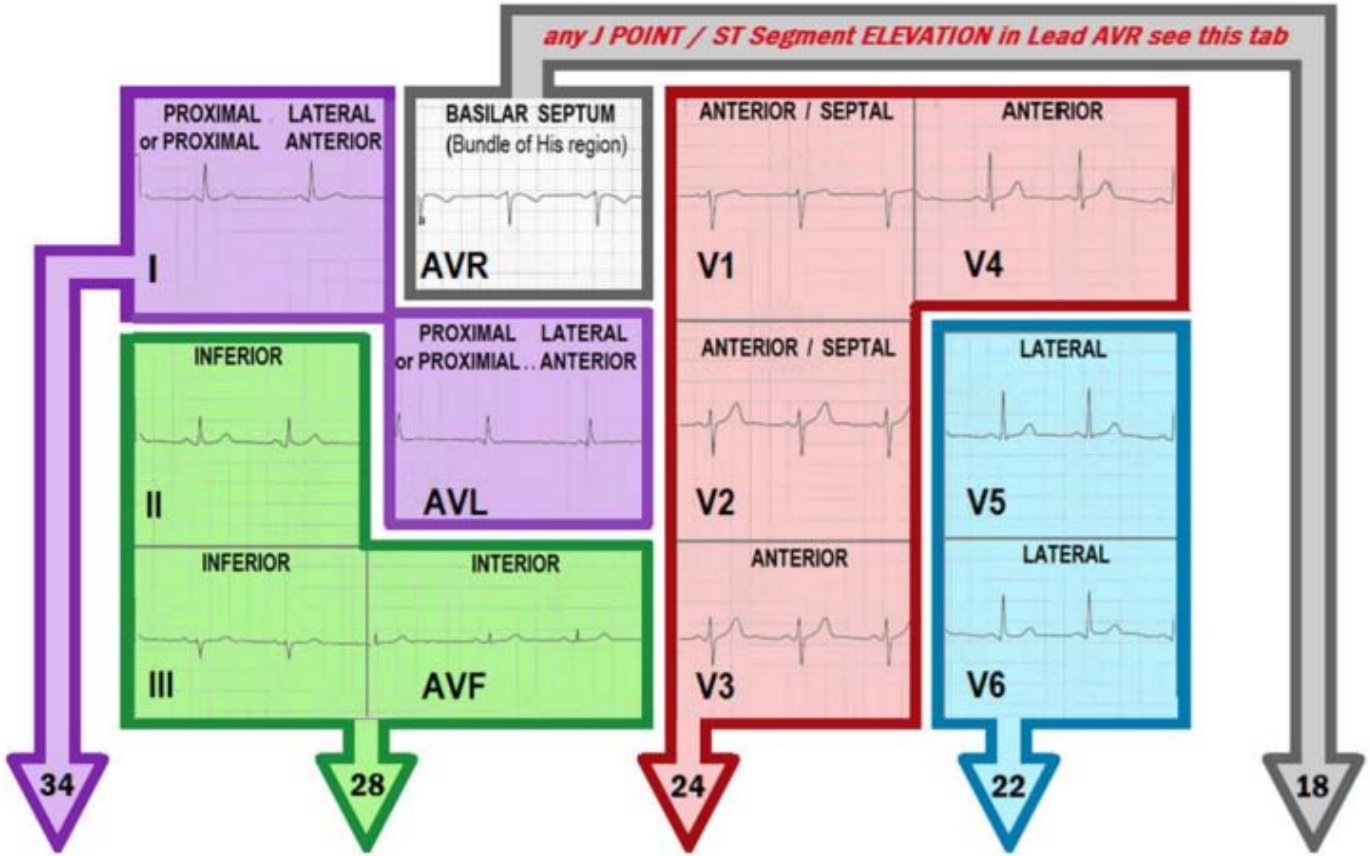
STEMI Assistant

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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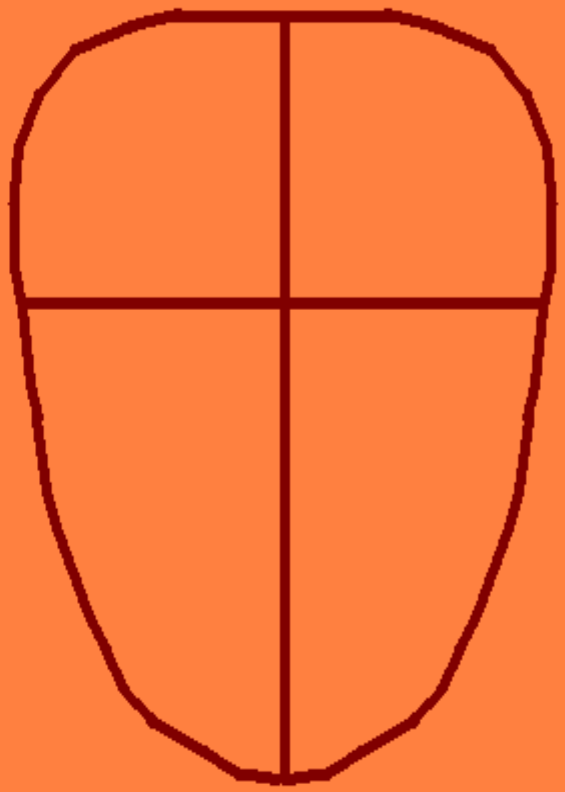
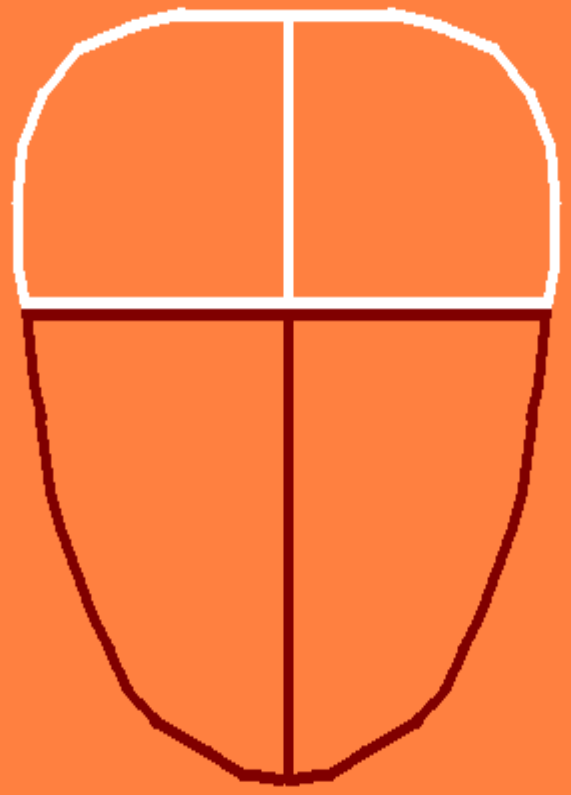
FOUR CHAMBERED PUMP



FOUR CHAMBERED PUMP . . .

2 ATRIUM

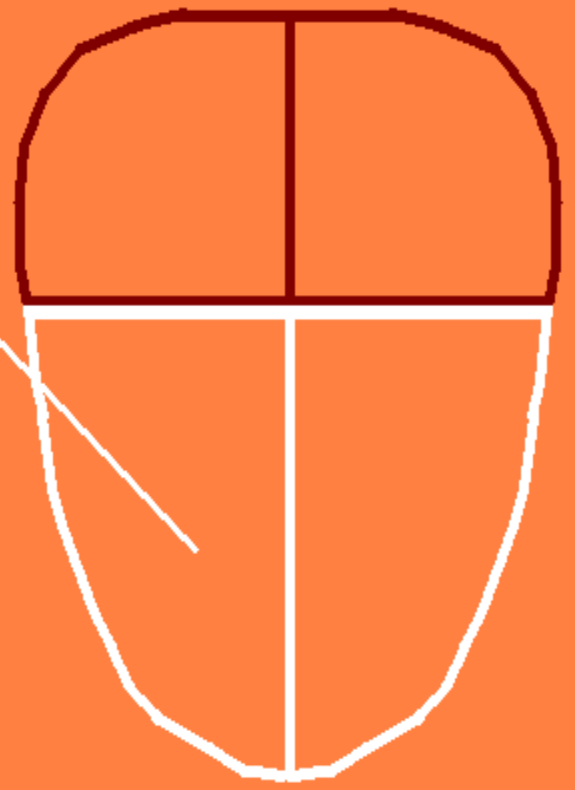


PRIMARY JOB:

"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

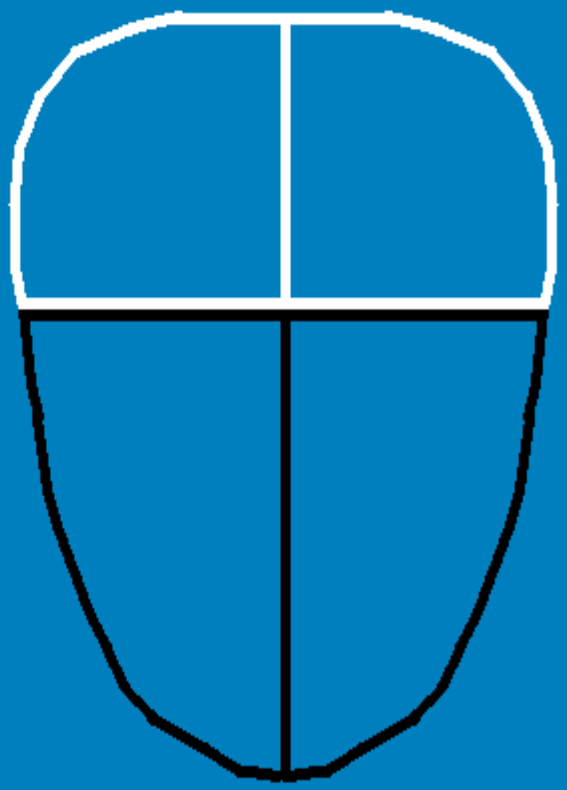
APPROXIMATELY

WHAT

PERCENTAGE

OF THE

CARDIAC OUTPUT ?



WHEN FUNCTIONING PROPERLY,

THE ATRIUM SUPPLY

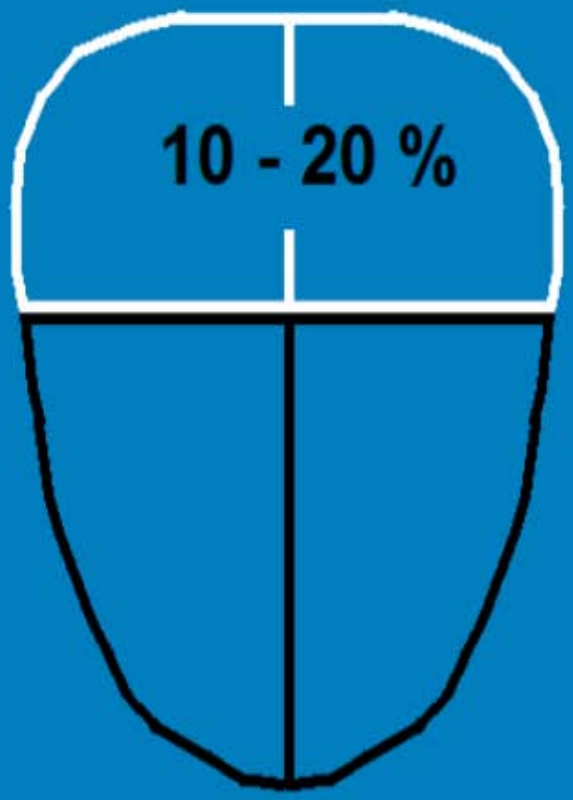
APPROXIMATELY

WHAT

PERCENTAGE

OF THE

CARDIAC OUTPUT ?



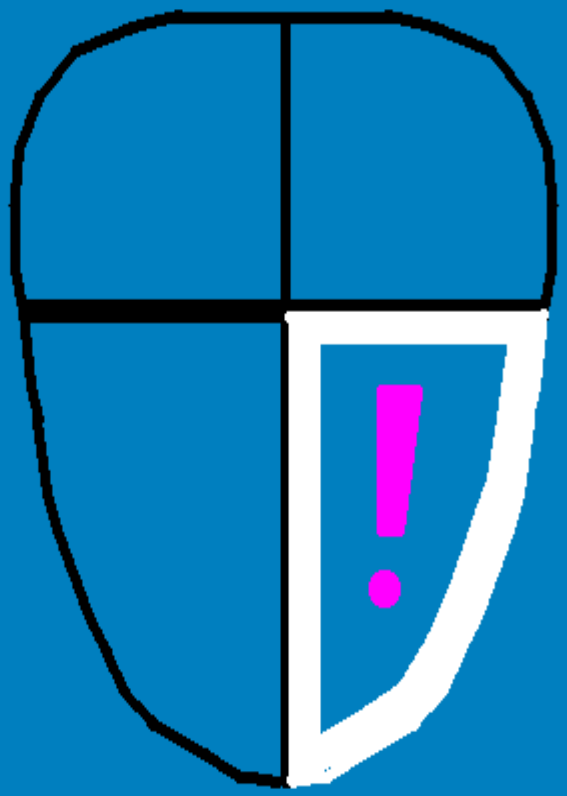
THE CHAMBER MOST IMPORTANT TO KEEPING THE PATIENT ALIVE

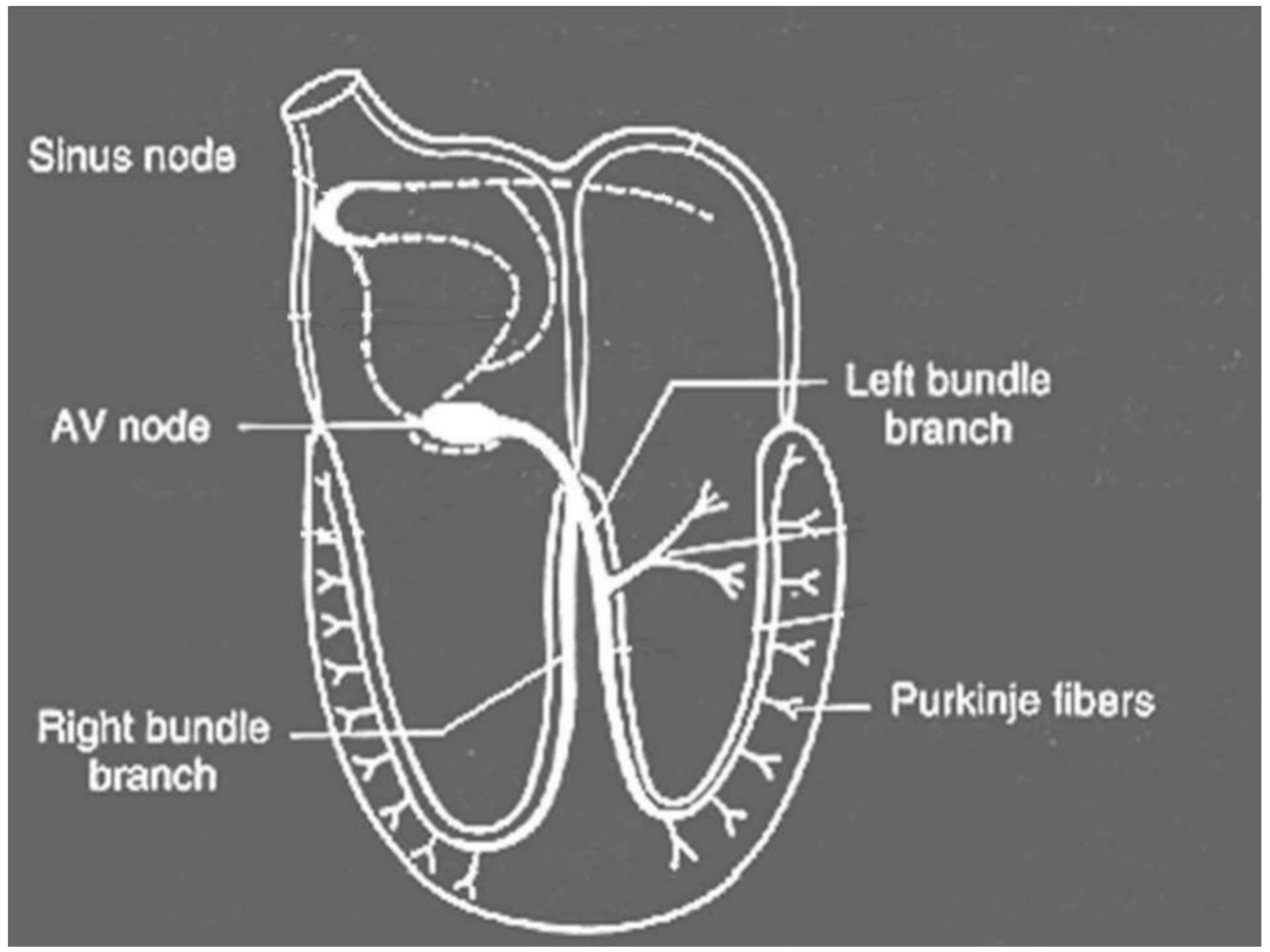
(and the ONLY one you can't live without)

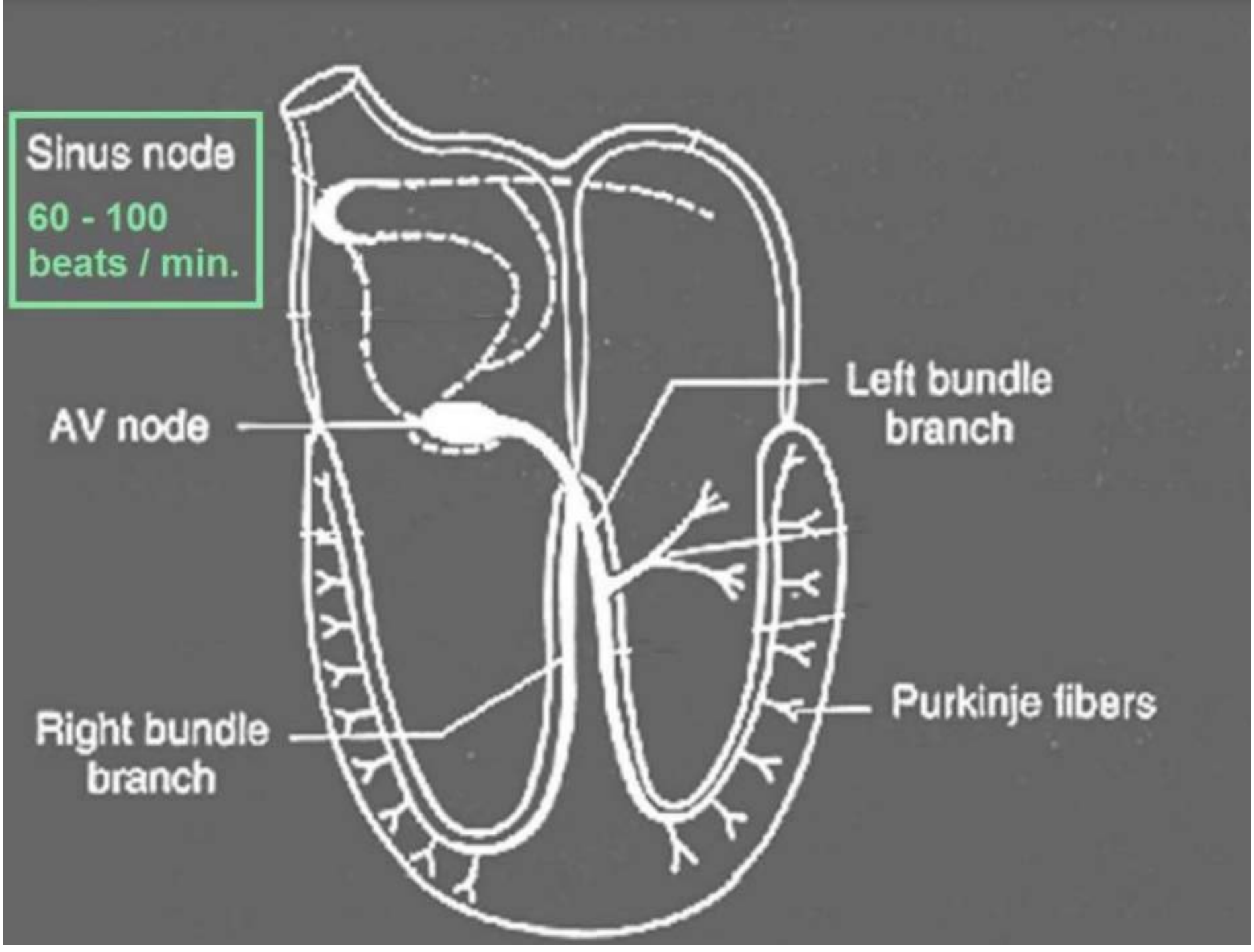
IS THE

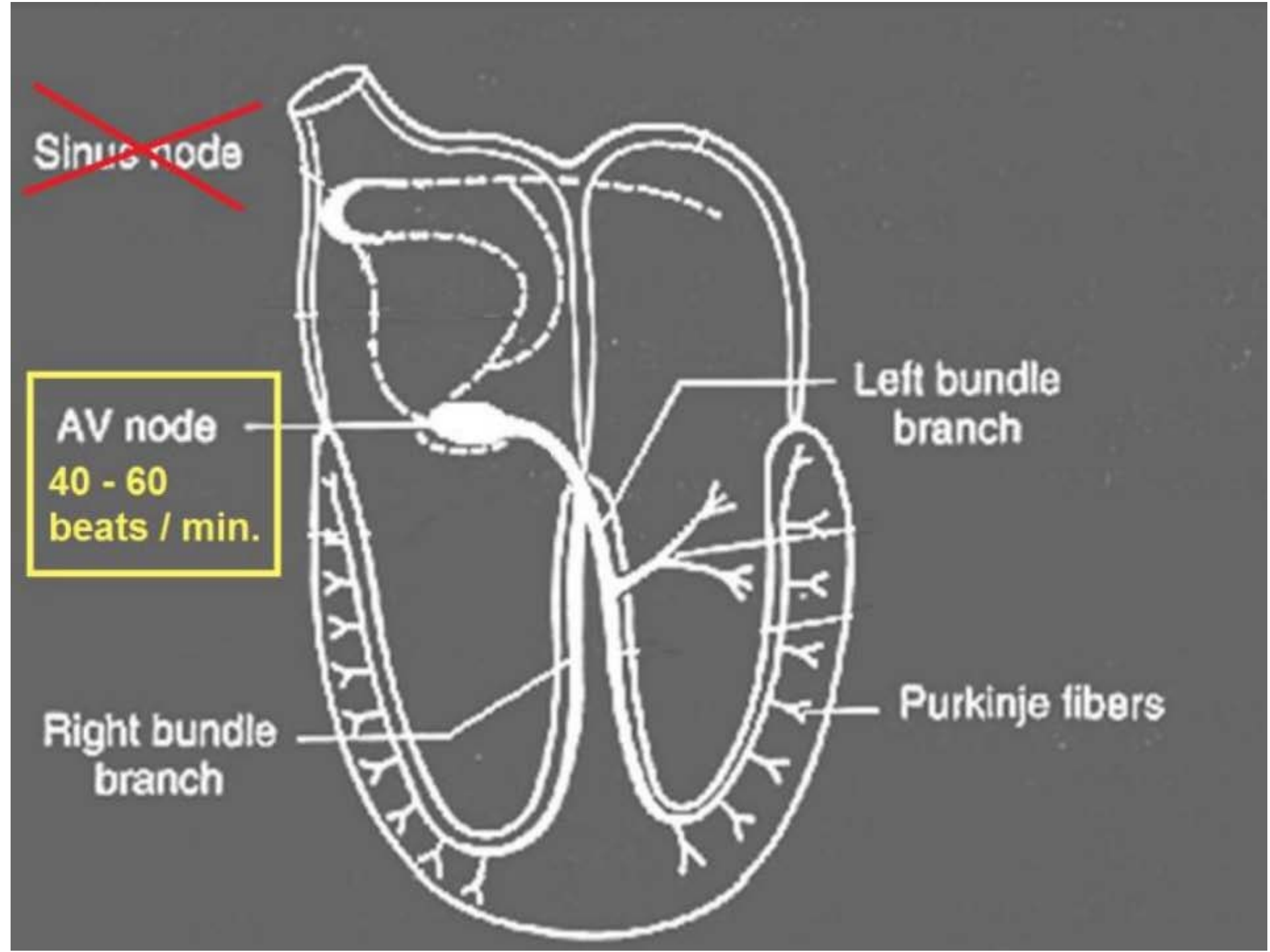
LEFT VENTRICLE

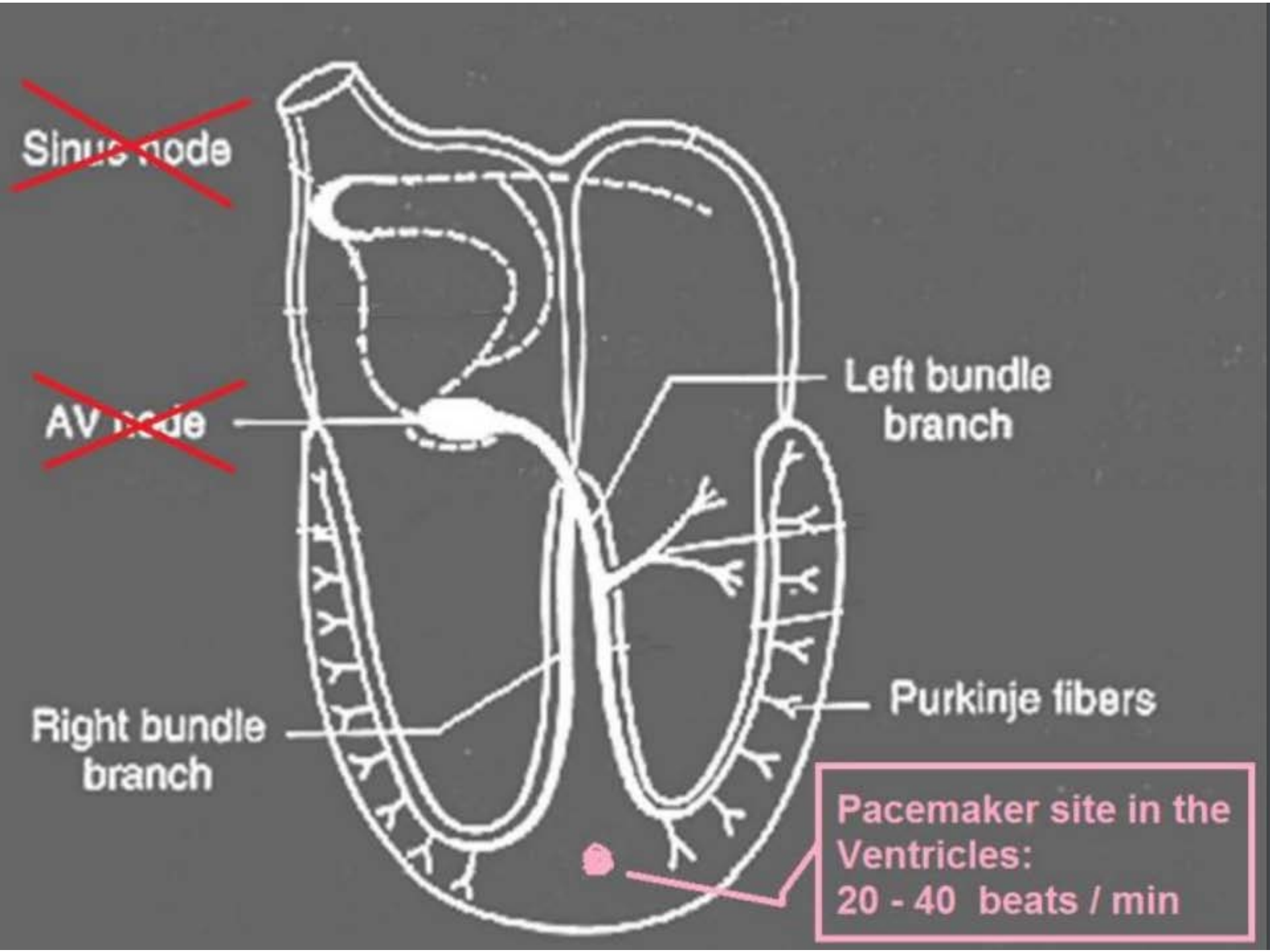
WHICH WE WILL REFER TO AS **THE PUMP**




Sinus node
AV node
Left bundle branch
Right bundle branch
Purkinje fibers

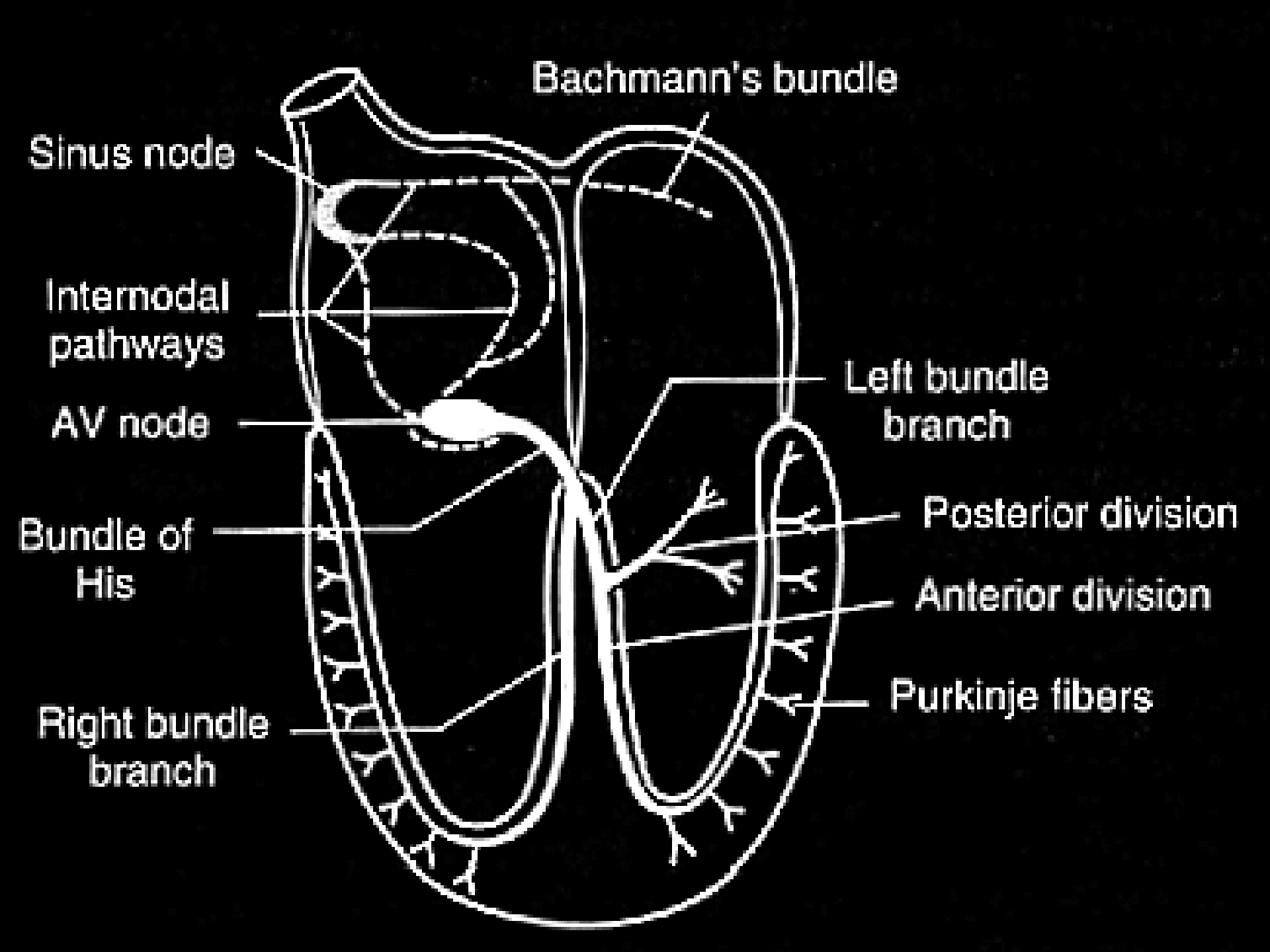

Sinus node
60 - 100
beats / min.
AV node
Left bundle
branch
Right bundle
branch
Purkinje fibers

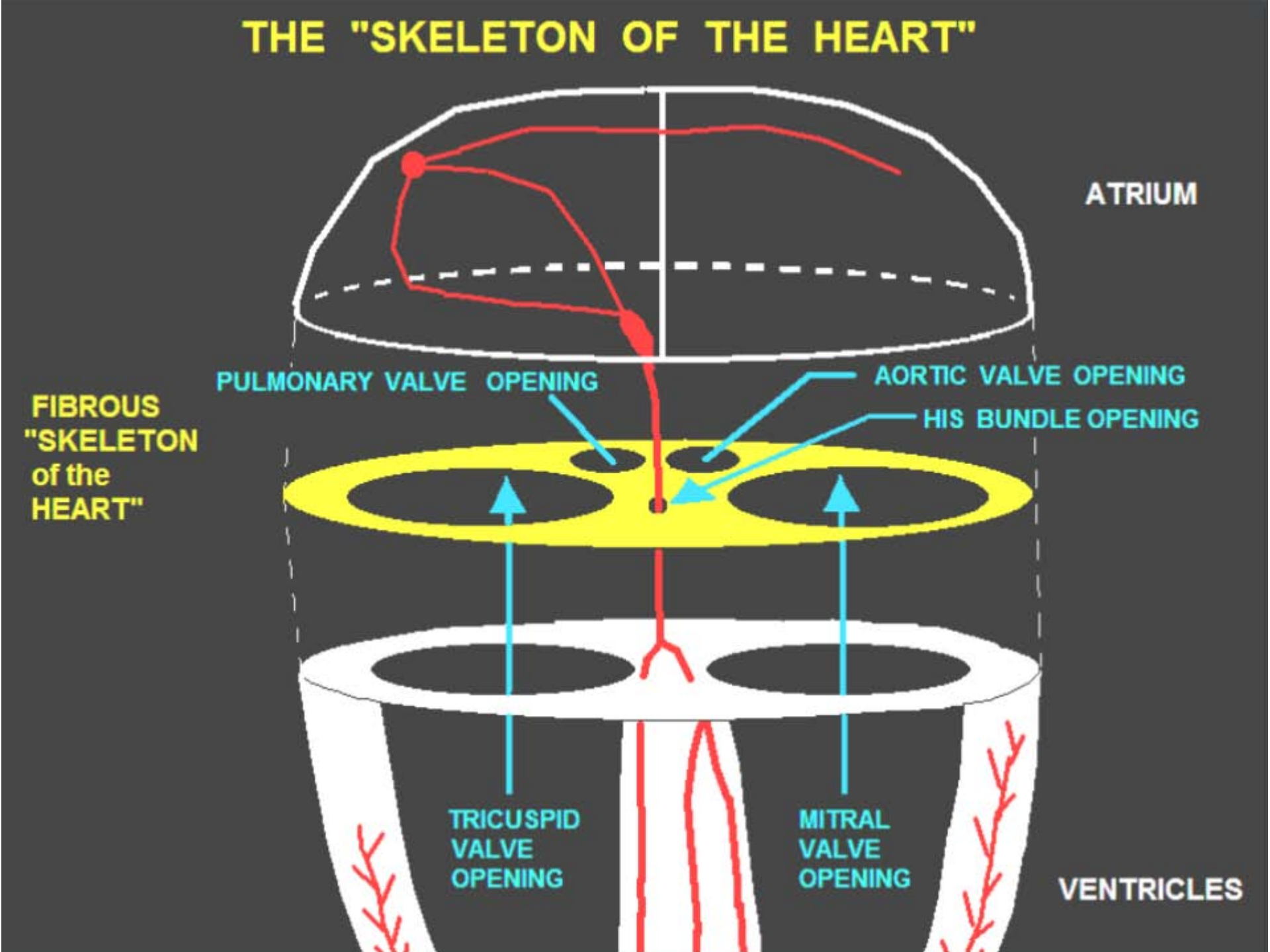

Sinus node
AV node
40 - 60
beats / min.
Left bundle
branch
Right bundle
branch
Purkinje fibers

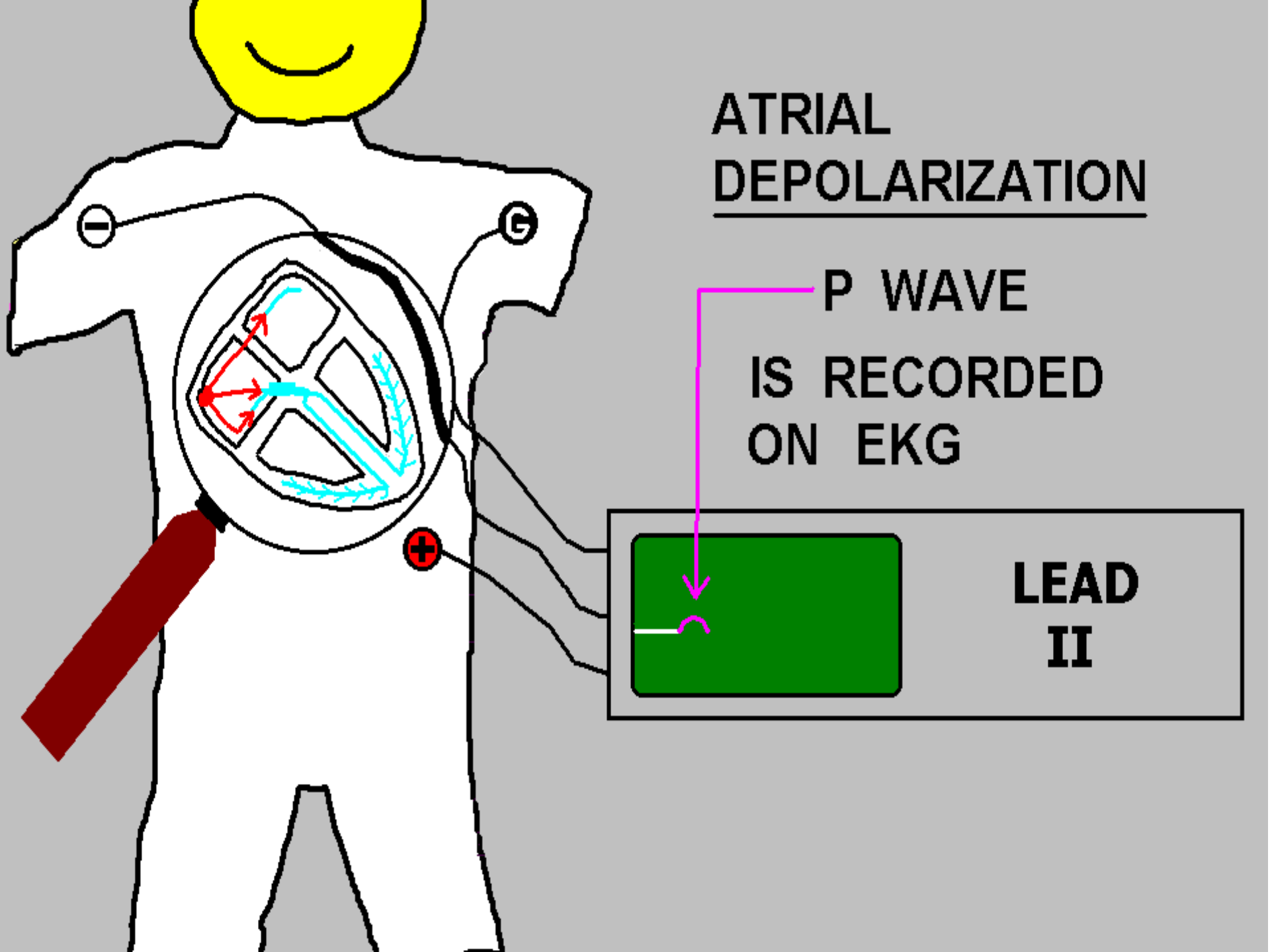

Sinus node
AV node
Left bundle branch
Right bundle branch
Purkinje fibers
Pacemaker site in the Ventricles:
20 - 40 beats / min

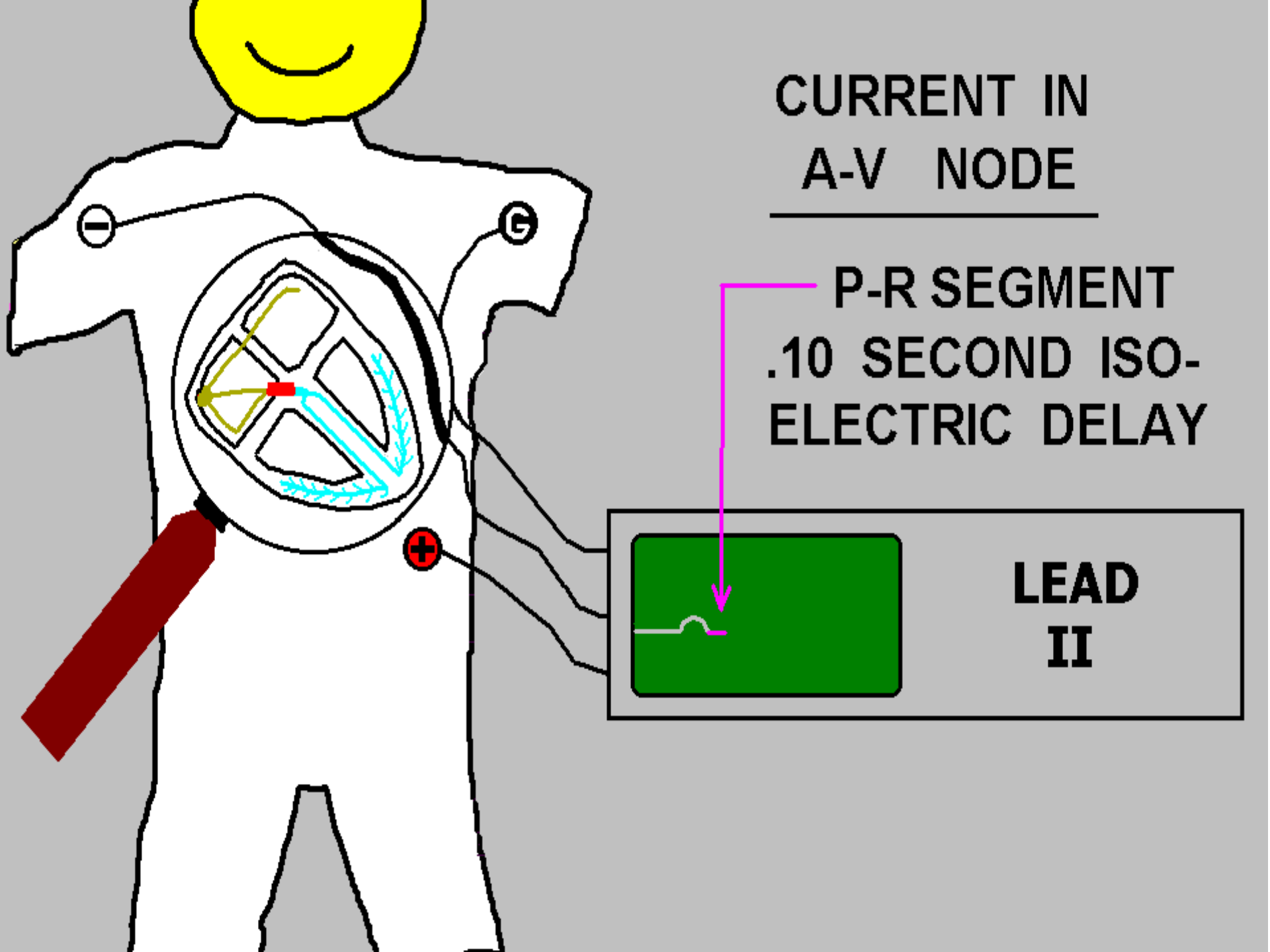
NORMAL "INHERENT" RATES:

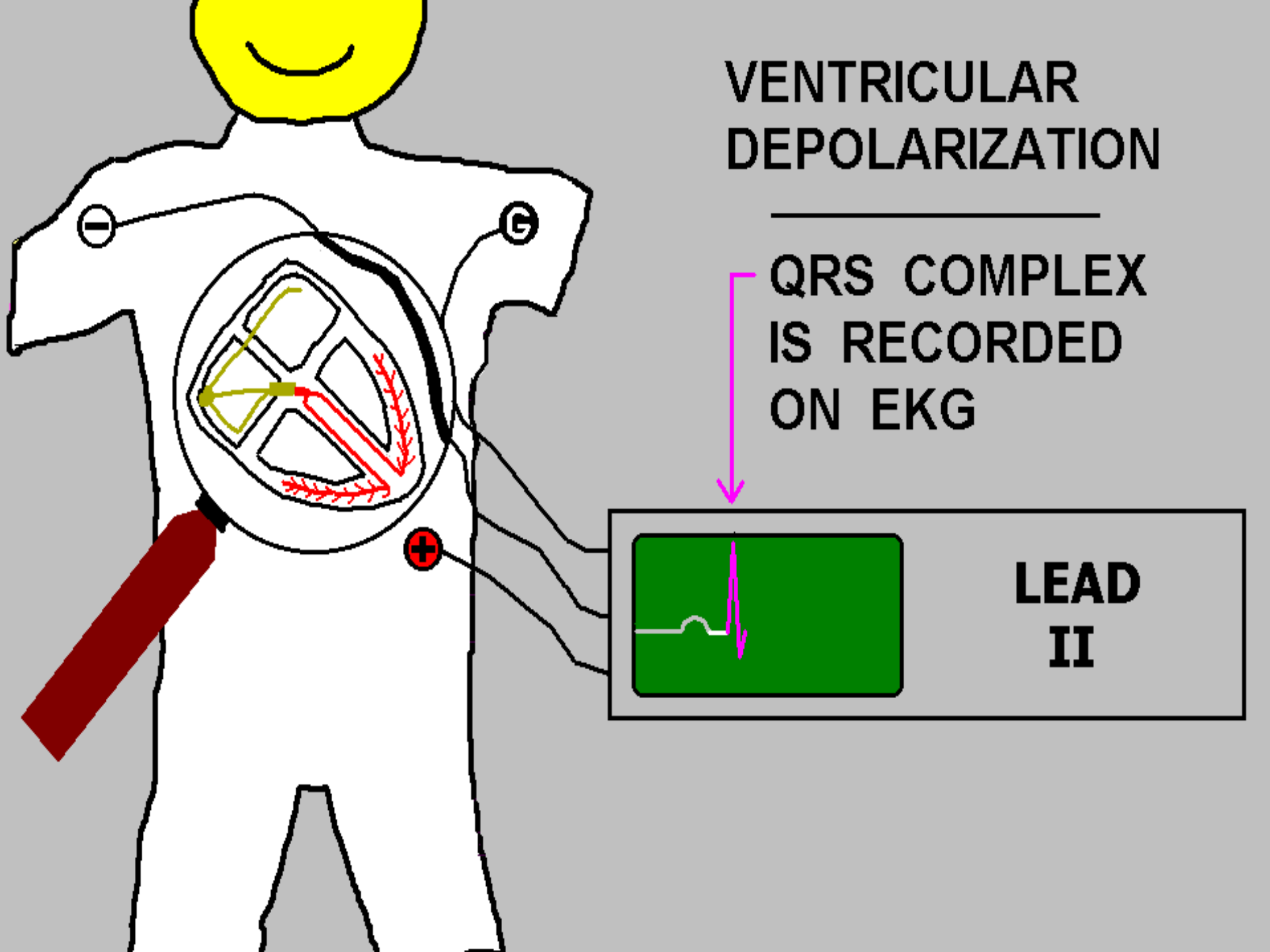
SA NODE:	60 - 100
AV NODE:	40 - 60
VENTRICLES:	1 - 40

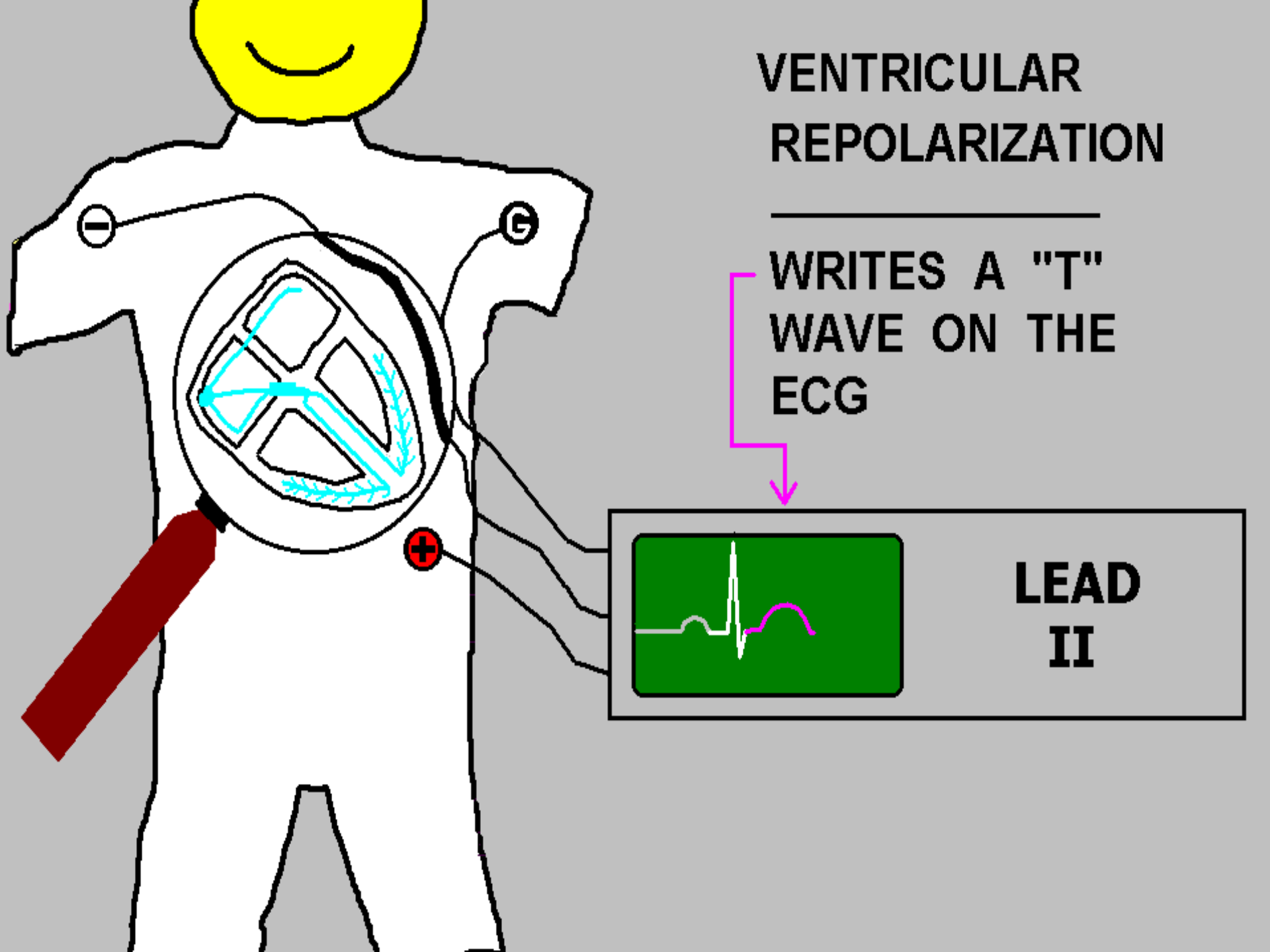

Bachmann's bundle
Sinus node
Internodal pathways
AV node
Bundle of His
Right bundle branch
Left bundle branch
Posterior division
Anterior division
Purkinje fibers


THE "SKELETON OF THE HEART"
ATRIUM
PULMONARY VALVE OPENING
AORTIC VALVE OPENING
HIS BUNDLE OPENING
FIBROUS "SKELETON of the HEART"
TRICUSPID VALVE OPENING
MITRAL VALVE OPENING
VENTRICLES


ATRIAL
DEPOLARIZATION
P WAVE
IS RECORDED
ON EKG
LEAD
II


CURRENT IN
A-V NODE
P-R SEGMENT
.10 SECOND ISO-
ELECTRIC DELAY
LEAD
II


VENTRICULAR
DEPOLARIZATION
QRS COMPLEX
IS RECORDED
ON EKG
LEAD
II


VENTRICULAR
REPOLARIZATION
WRITES A "T"
WAVE ON THE
ECG
LEAD
II

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

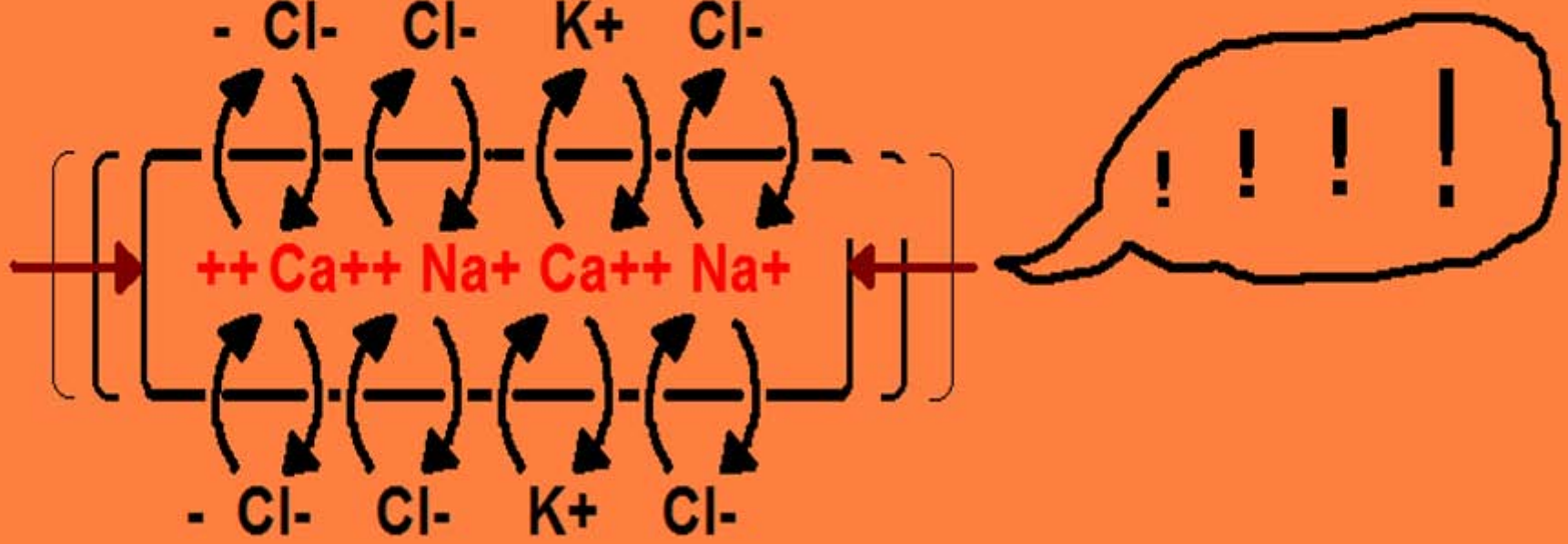
Ca++ Na+ Ca++ Na+ Ca++

Cl- Cl- K+ Cl- K+ Cl- K+ Cl-

Ca++ Na+ Ca++ Na+ Ca++

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!

CARDIAC ANATOMY and PHYSIOLOGY "101"

THIS (OF COURSE) IS KNOW AS . . .

DEPOLARIZATION

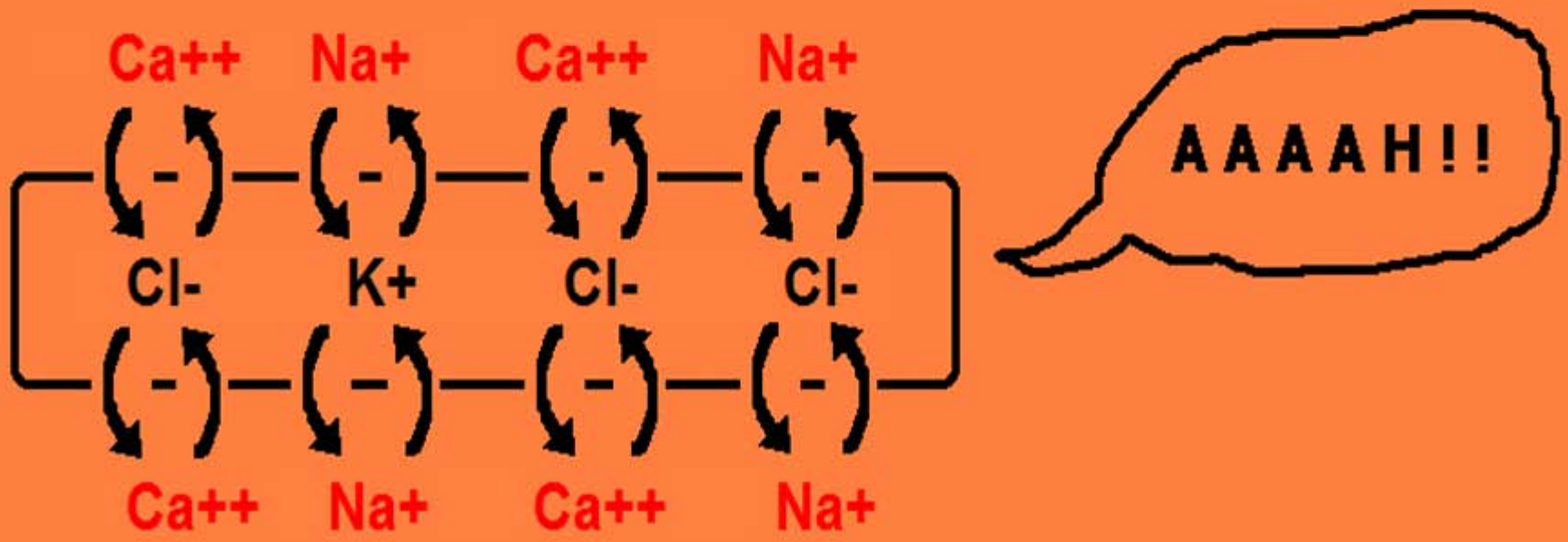
WHEN EVERYTHING IS WORKING PROPERLY, THE WAVE OF DEPOLARIZING CELLS CAUSES THE HEART TO CONTRACT, AND PUMP BLOOD TO THE LUNGS AND THE SYSTEMIC CIRCULATION

CARDIAC ANATOMY and PHYSIOLOGY "101"

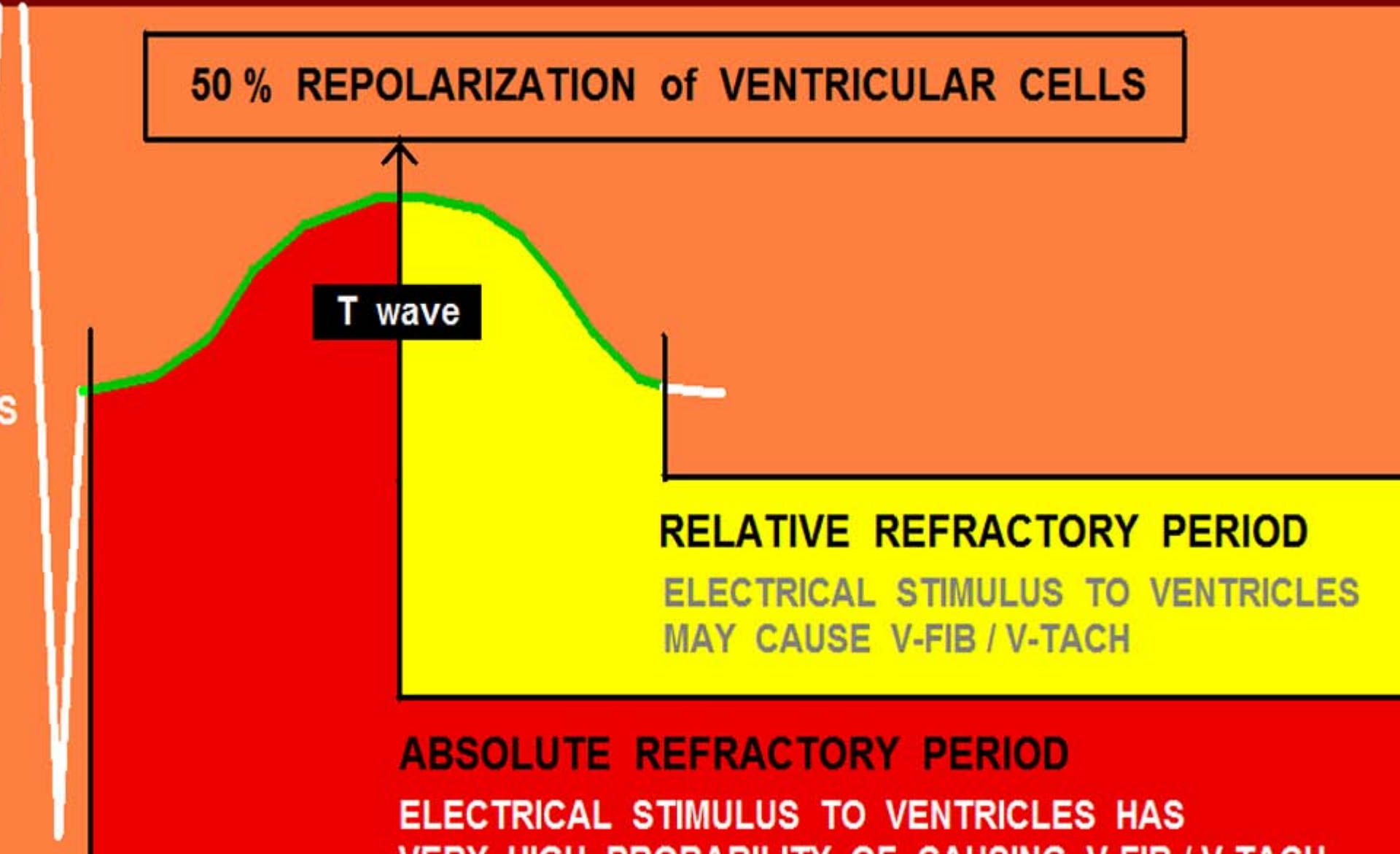
AFTER DEPOLARIZATION, THE CELLS RELAX.

THE IONS RETURN TO THEIR ORIGINAL POSITIONS --

THIS PROCESS IS KNOWN AS REPOLARIZATION



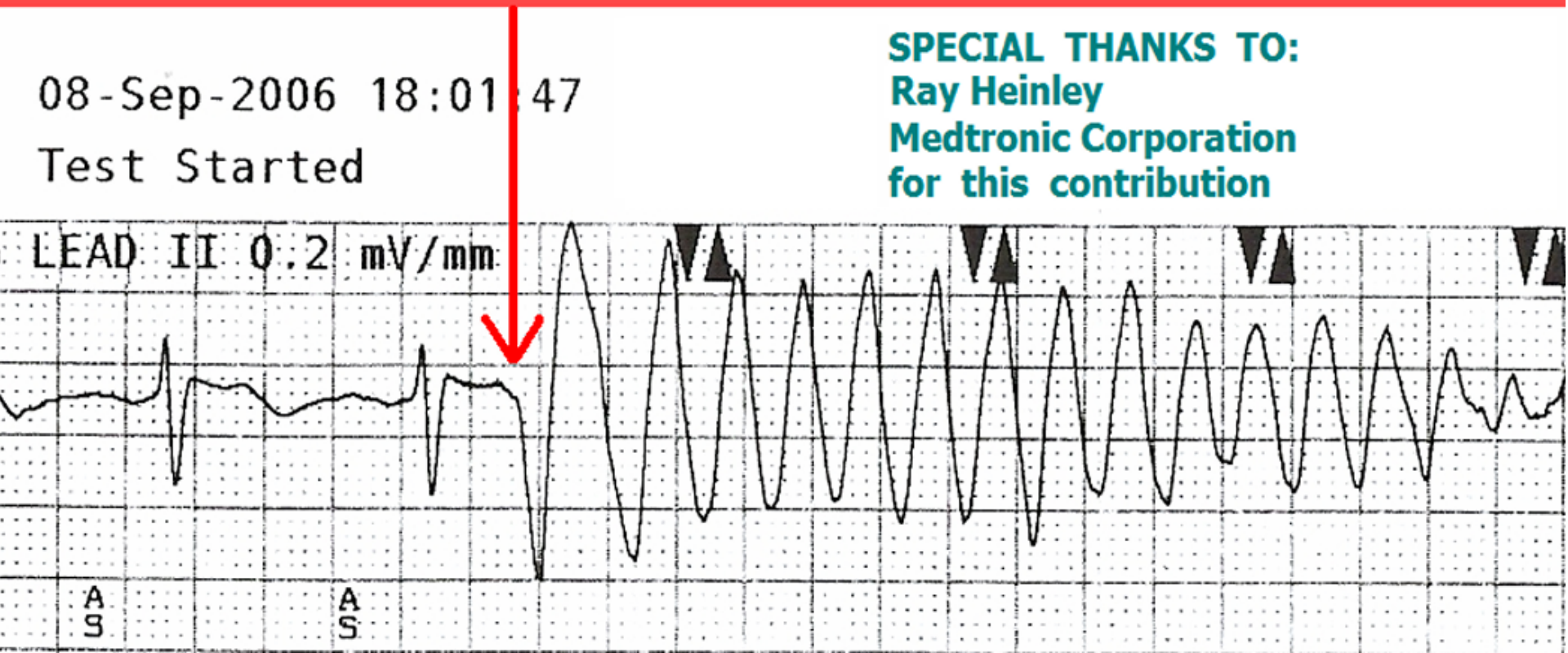
CARDIAC ANATOMY and PHYSIOLOGY "101"



ROUTINE TEST OF ICD

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

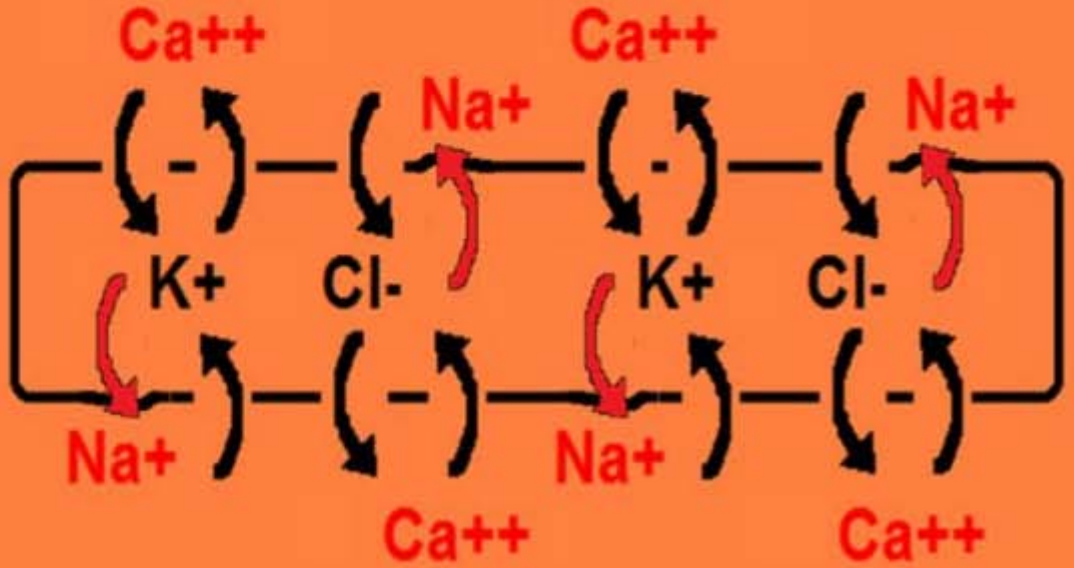
SPECIAL THANKS TO:
Ray Heinley
Medtronic Corporation
for this contribution



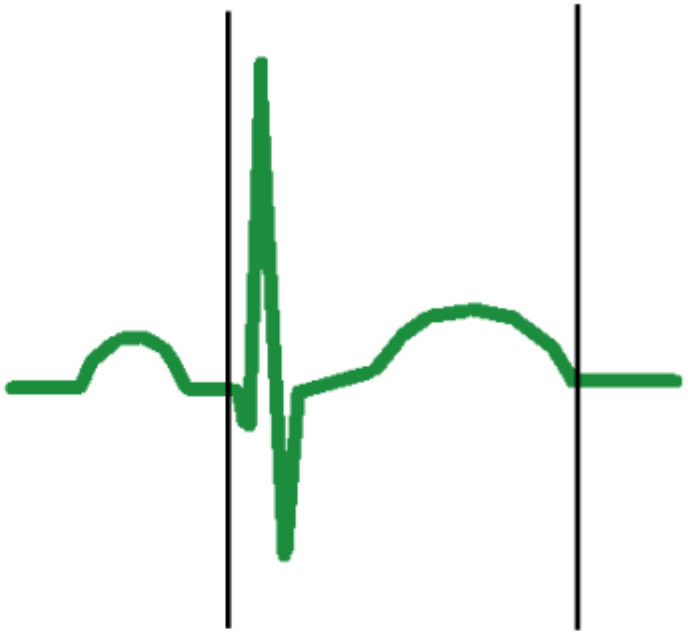
CARDIAC ANATOMY and PHYSIOLOGY "101"

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

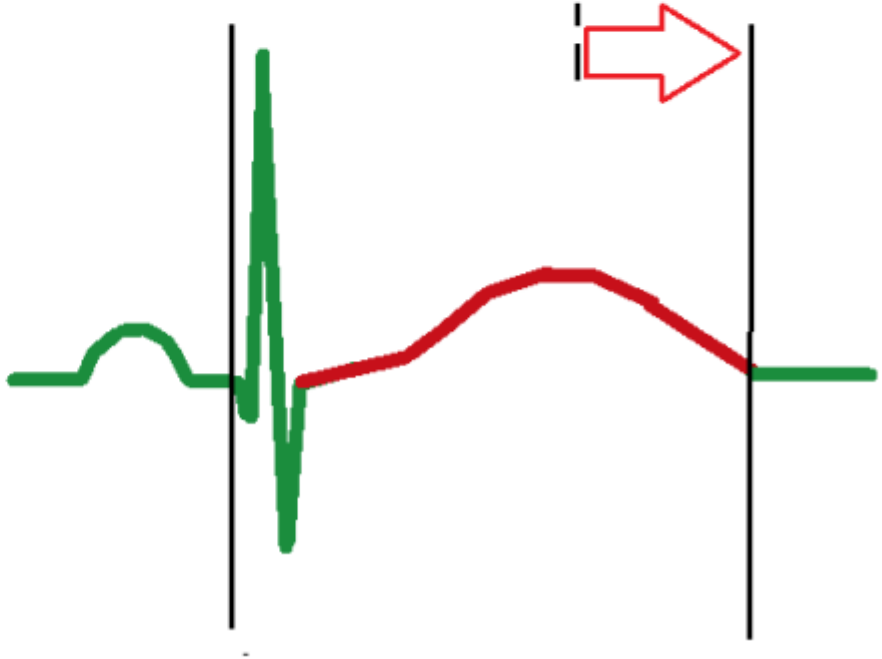
. . . . this can DELAY REPOLARIZATION, which will show on the ECG as "QT Prolongation"



Normal
QT Interval



ABNORMAL
(prolonged)
QT Interval



CARDIAC ANATOMY and PHYSIOLOGY "101"

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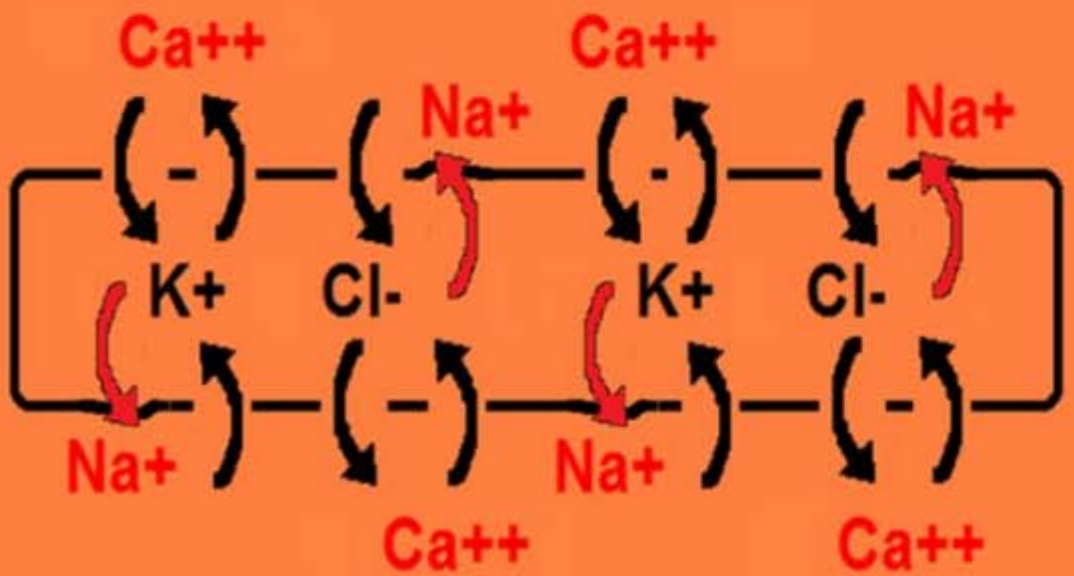


which can lead to Torsades . . . Cardiac Arrest . . . and

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**

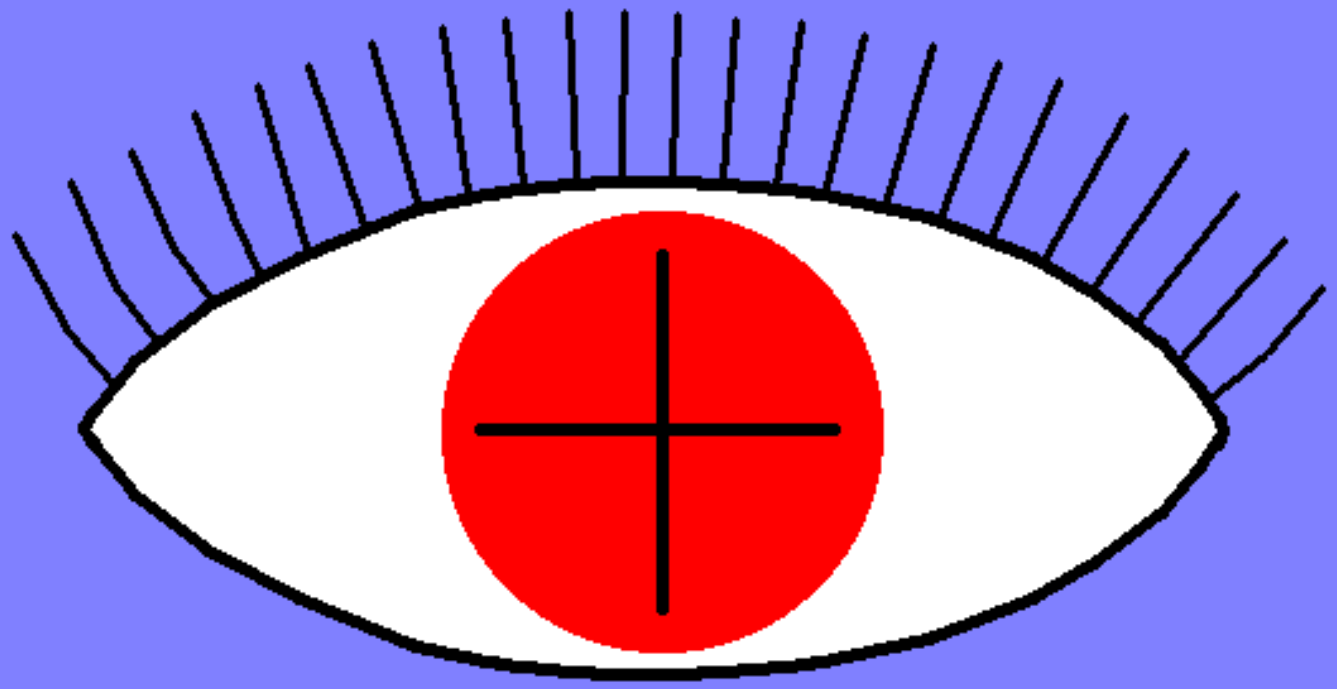
THE EKG MACHINE

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

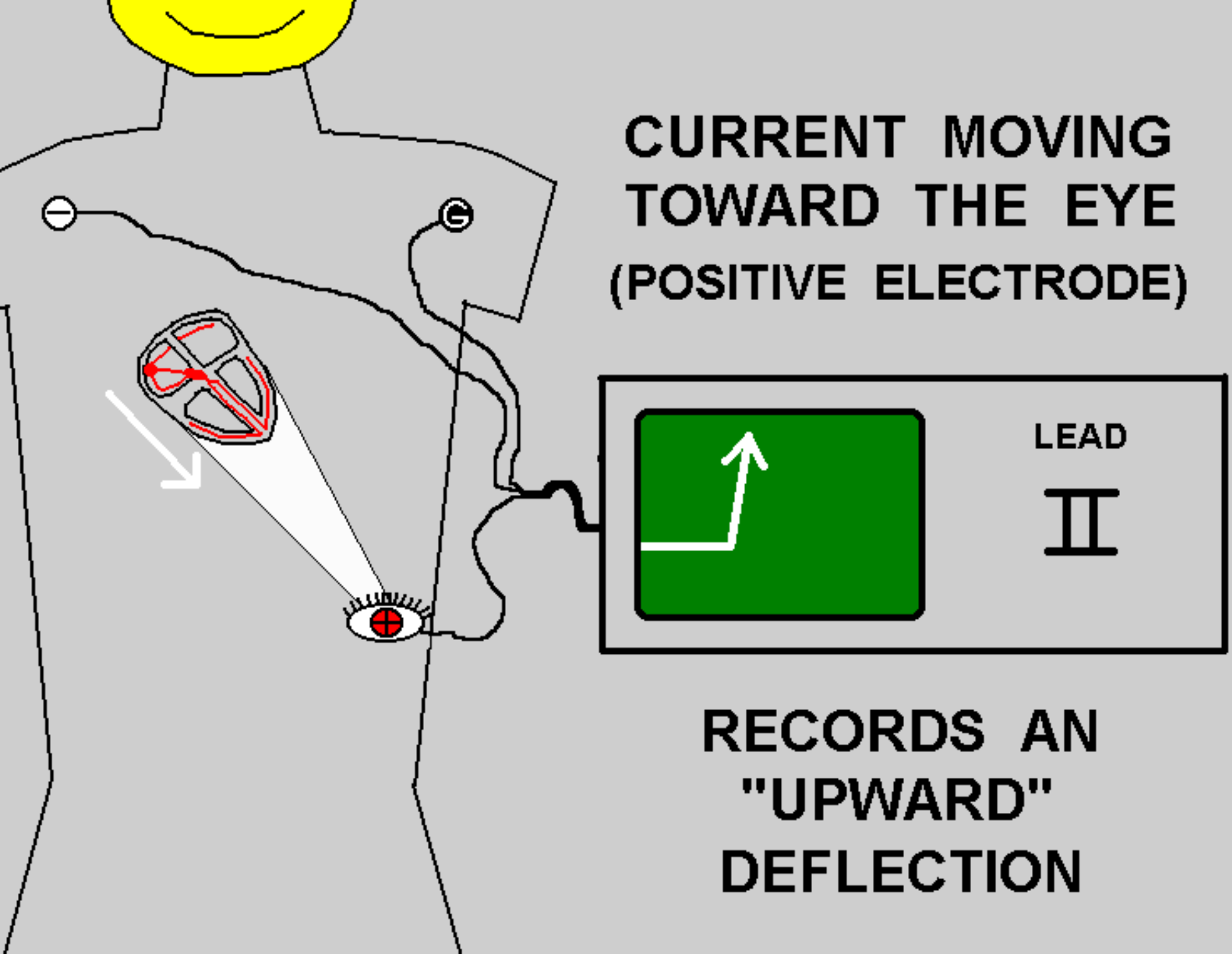
- I, II, III, and V1, V2, V3, V4, V5, V6
EACH CONSIST OF:

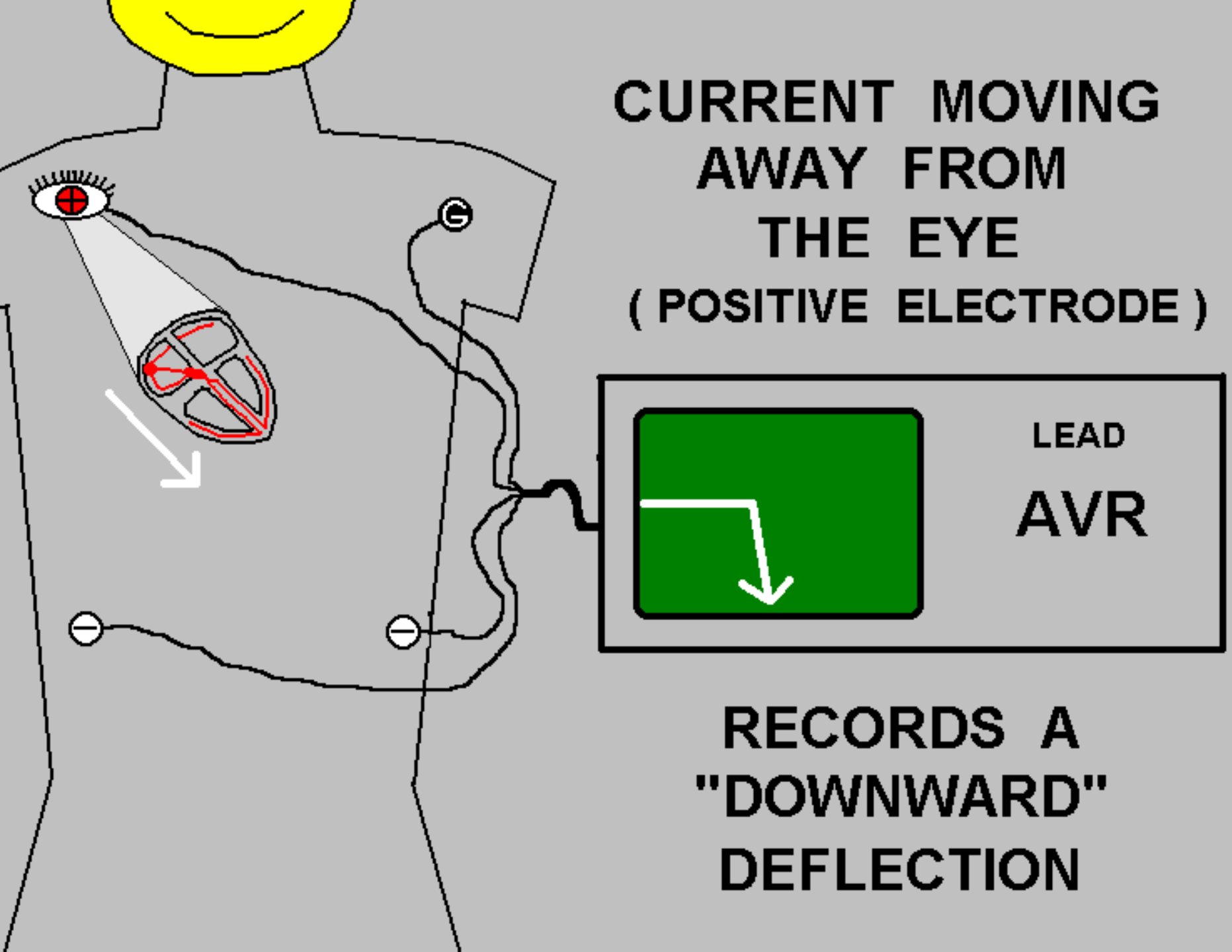
1 POSITIVE ELECTRODE
1 NEGATIVE ELECTRODE
1 GROUND ELECTRODE

THE POSITIVE ELECTRODE

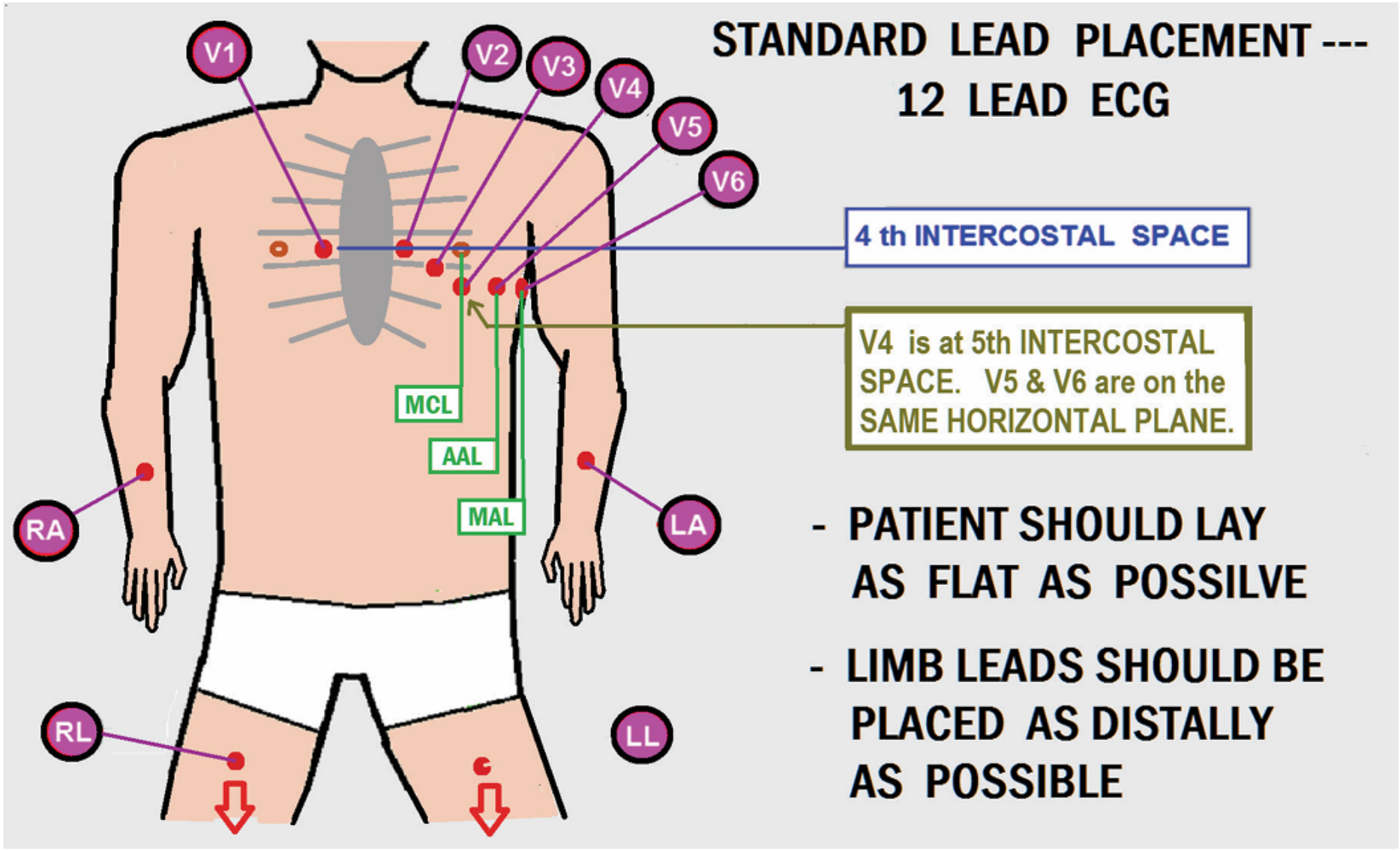


IS THE "EYE" . . .

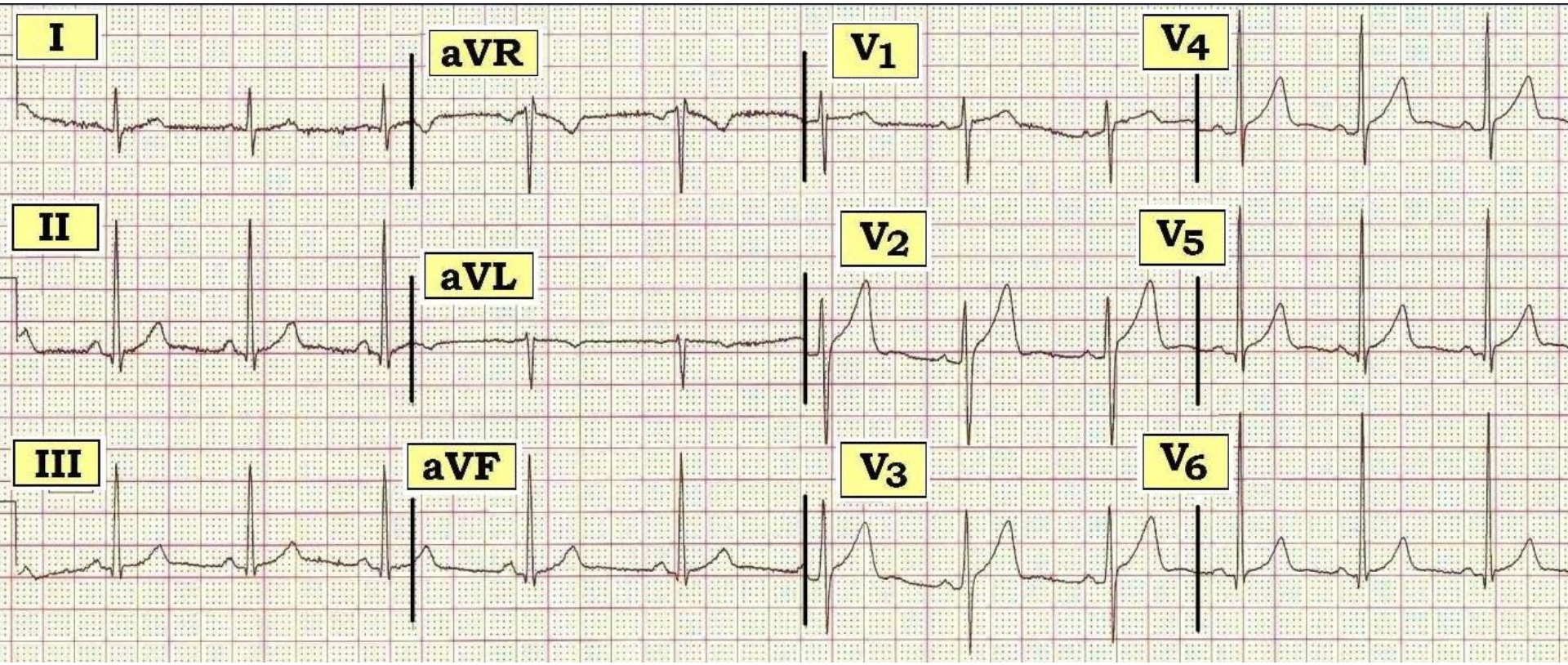

CURRENT MOVING
TOWARD THE EYE
(POSITIVE ELECTRODE)
LEAD
II
RECORDS AN
"UPWARD"
DEFLECTION


CURRENT MOVING AWAY FROM THE EYE
(POSITIVE ELECTRODE)
LEAD
AVR
RECORDS A "DOWNWARD" DEFLECTION

GUIDELINES FOR OBTAINING 12 LEAD ECG:

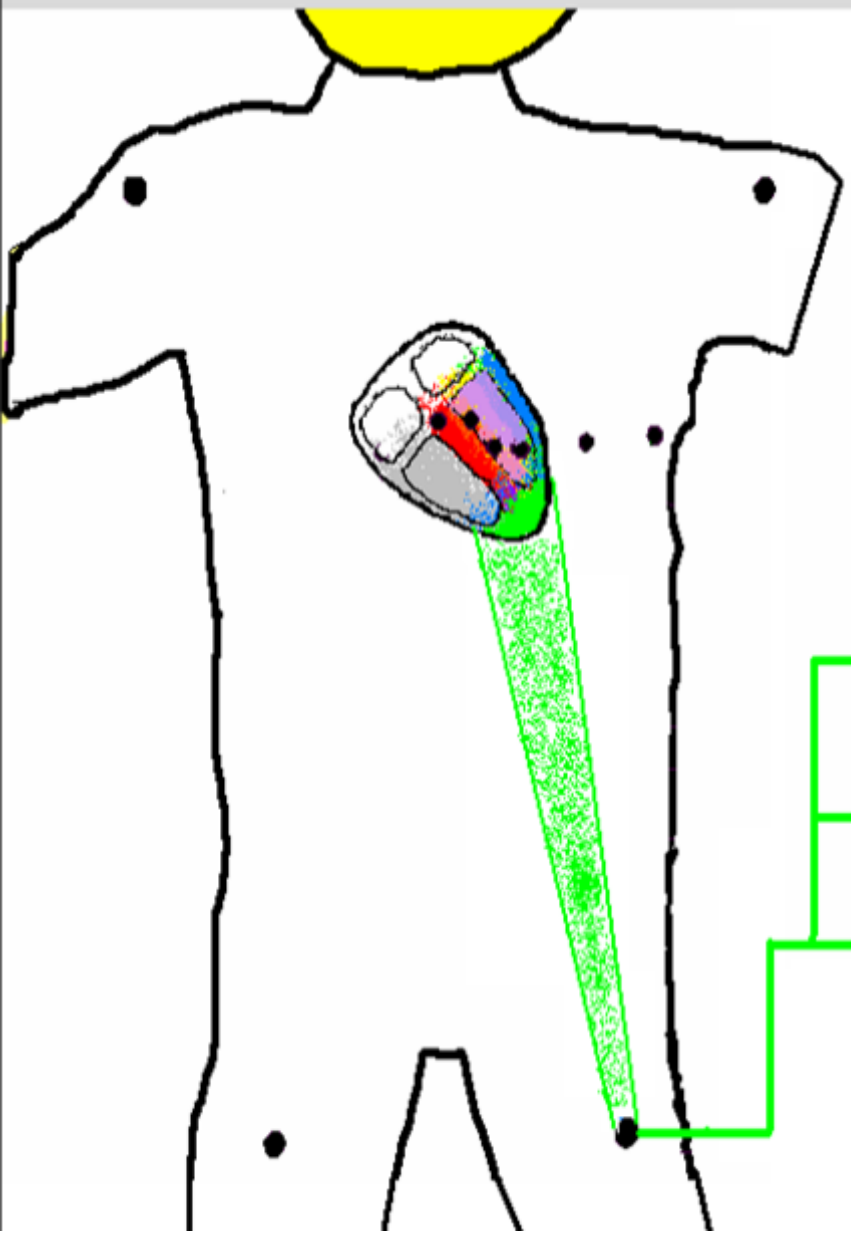


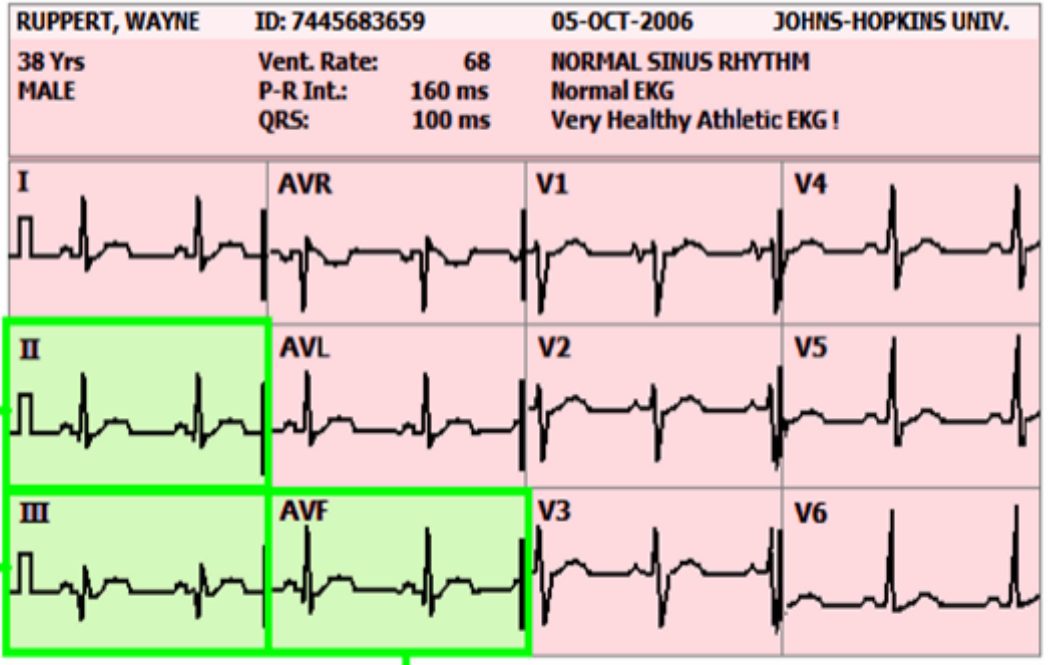
Normal 12 Lead ECG



(stolen off the internet, lol)!

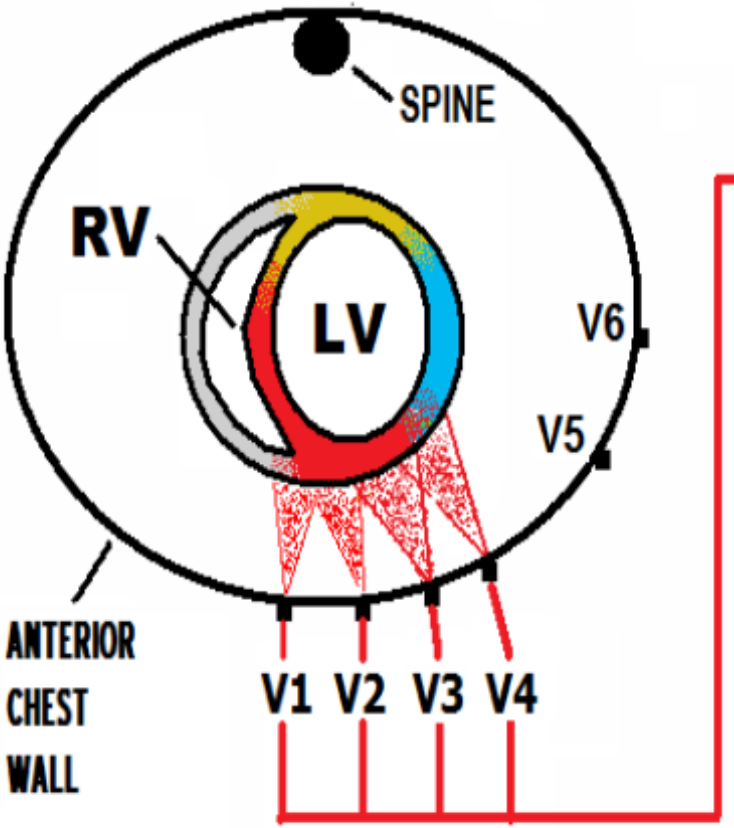
LEADS II, III, and aVF VIEW
INFERIOR WALL of the LEFT VENTRICLE





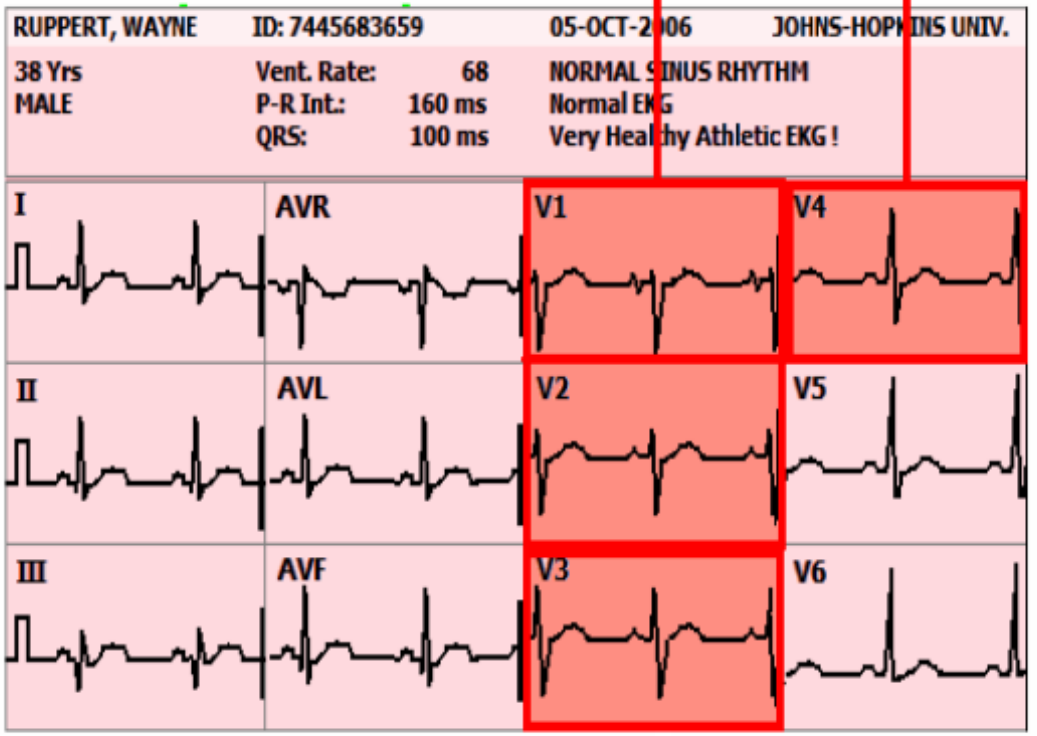
V1 - V4 VIEW THE ANTERIOR-SEPTAL WALL

of the LEFT VENTRICLE

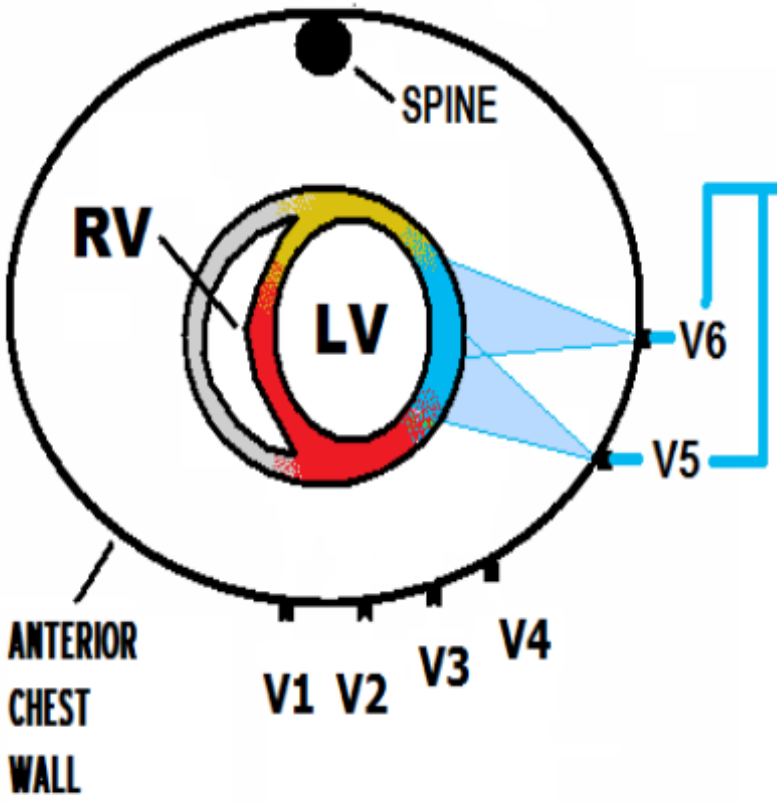


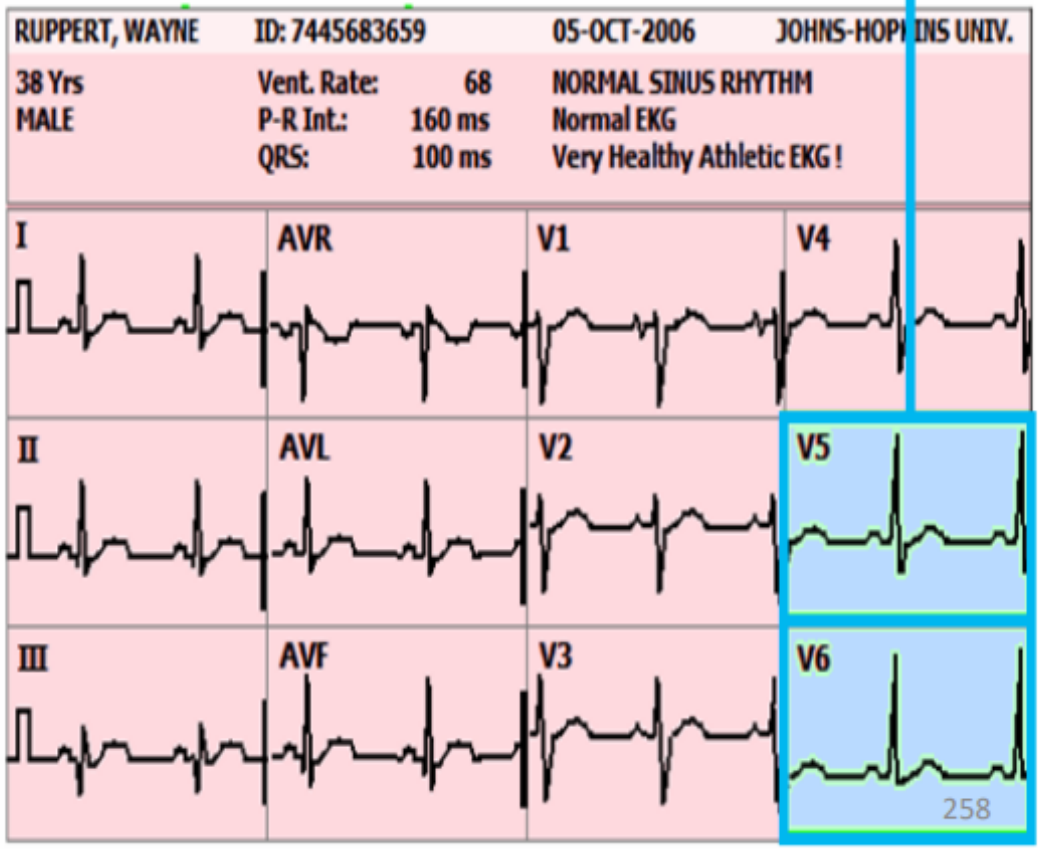
V1, V2 - ANTERIOR / SEPTAL

V3, V4 - ANTERIOR

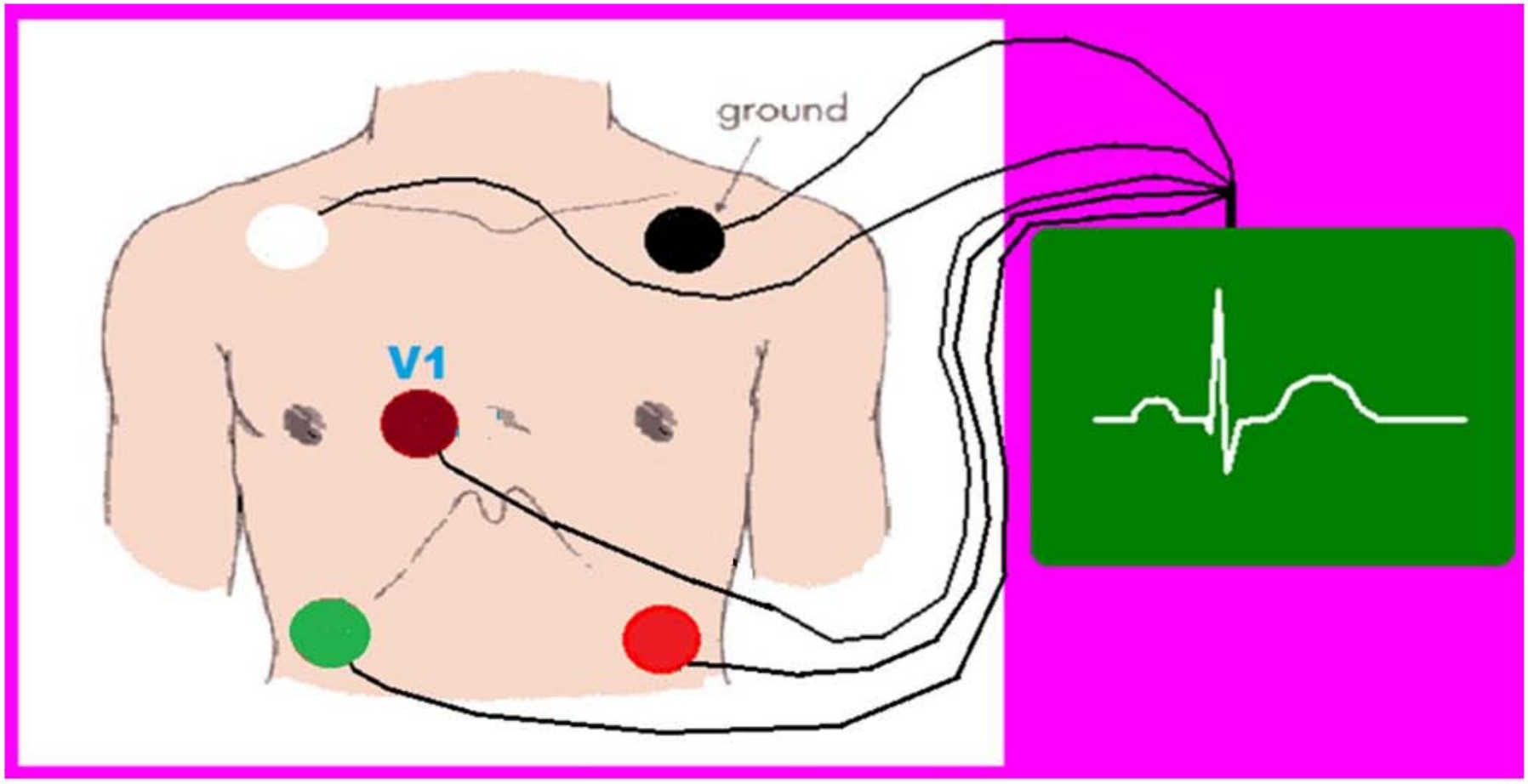


V5 - V6 VIEW THE LATERAL WALL
of the LEFT VENTRICLE

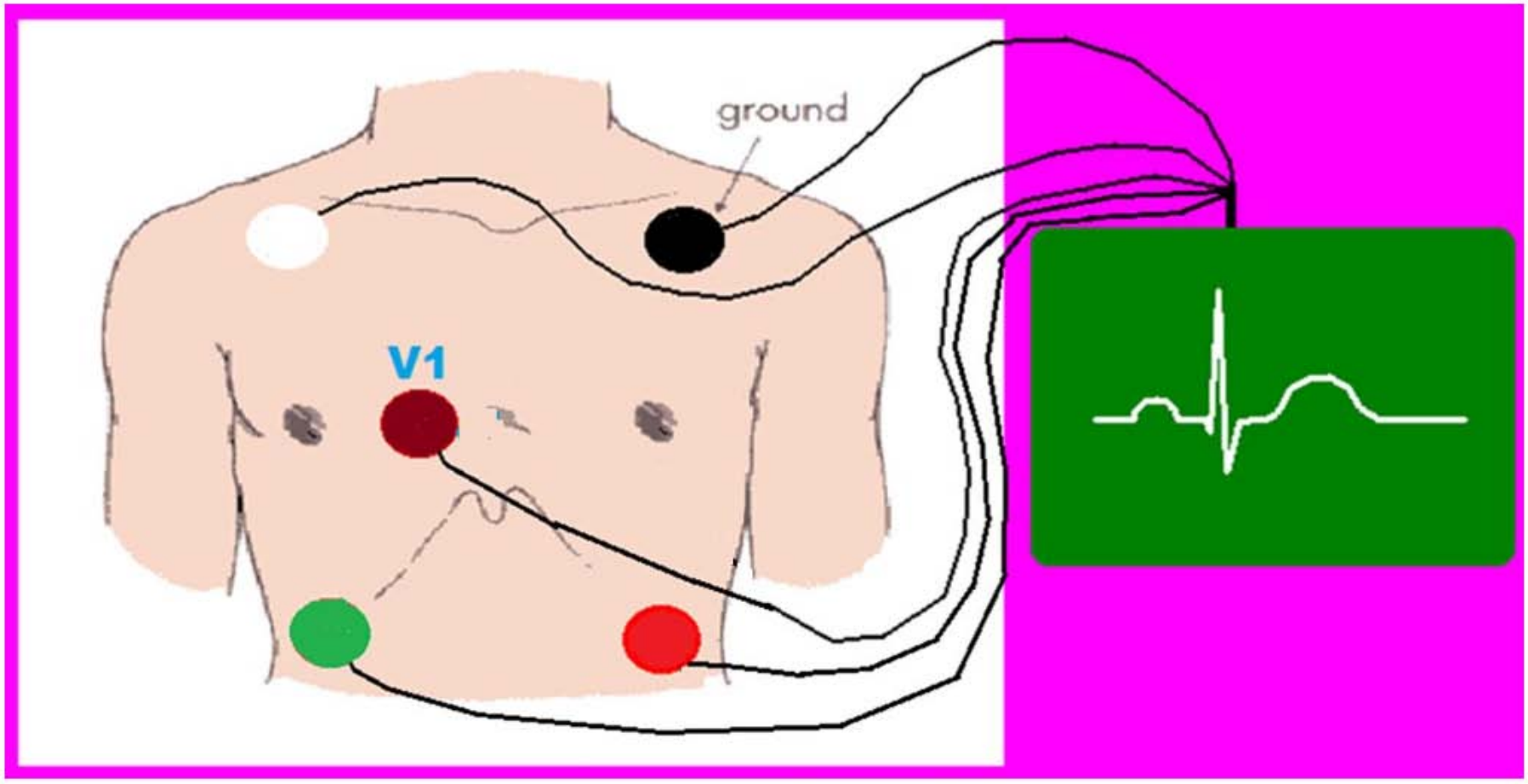




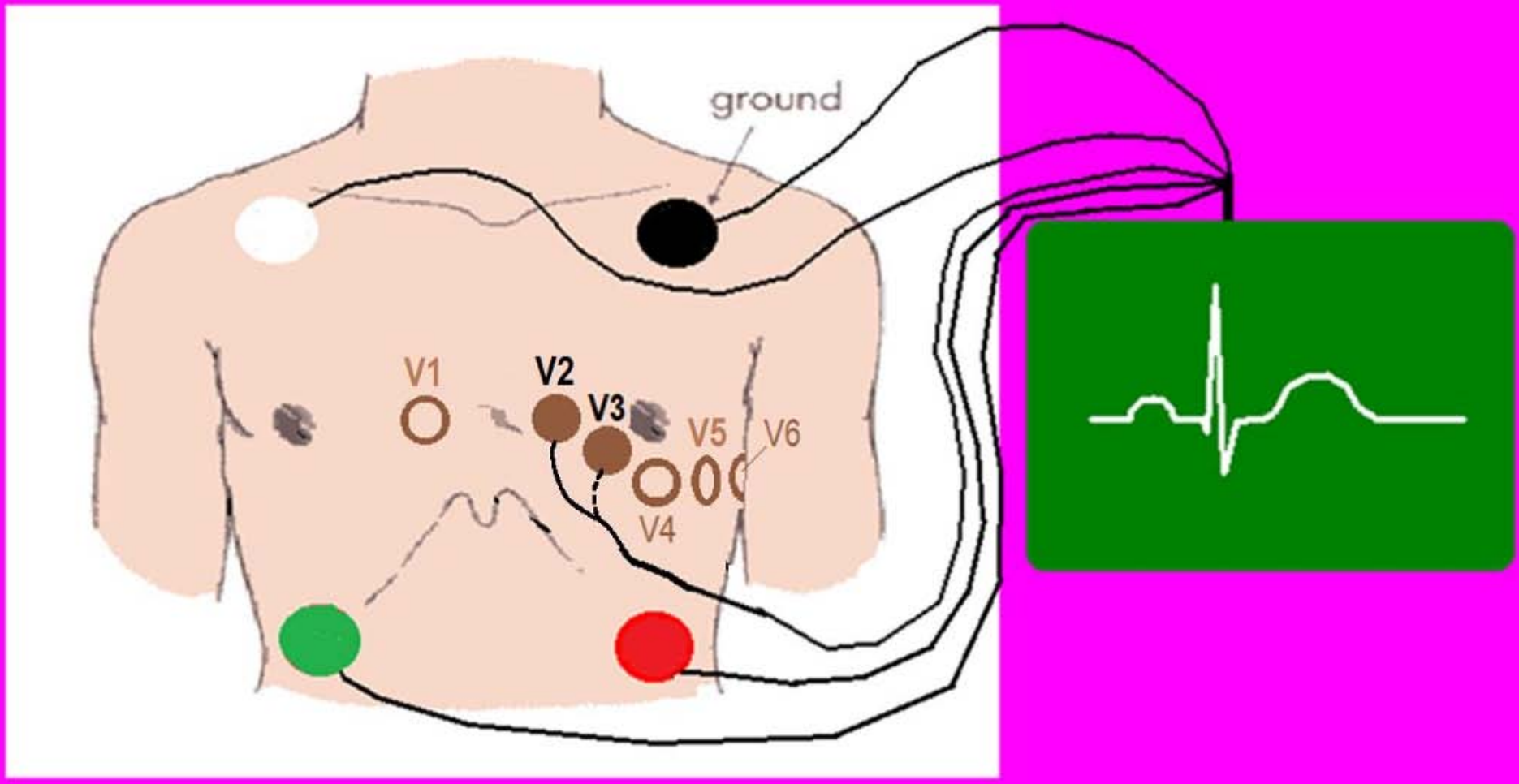
TRADITIONAL 5 LEAD ECG CONFIGURATION



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

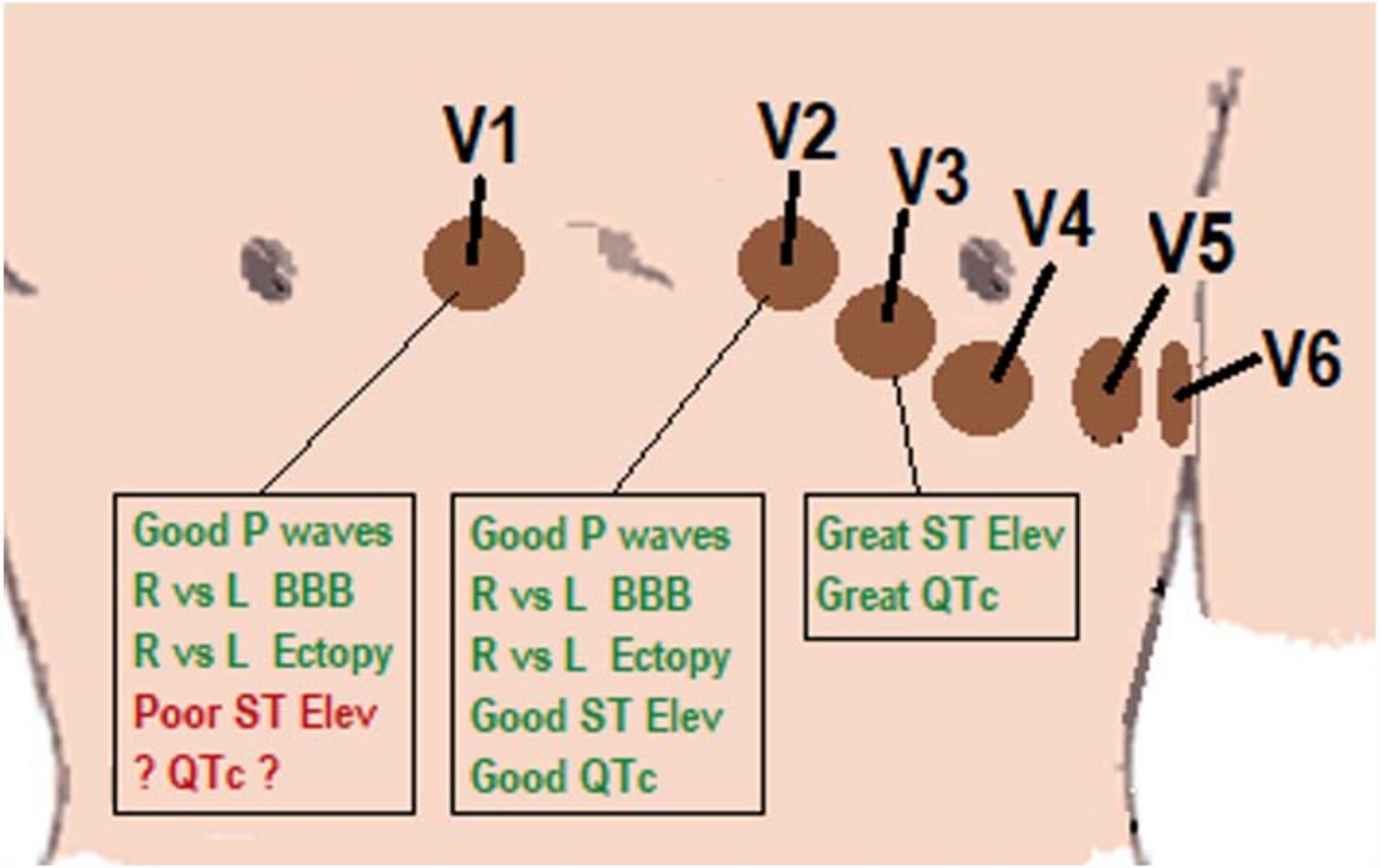


LEAD PLACEMENT

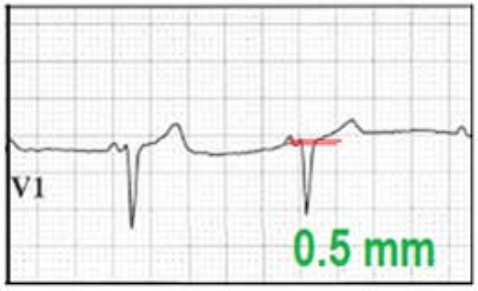


5 WIRE TELEMETRY UNIT

Lead V2 – GOOD Choice……



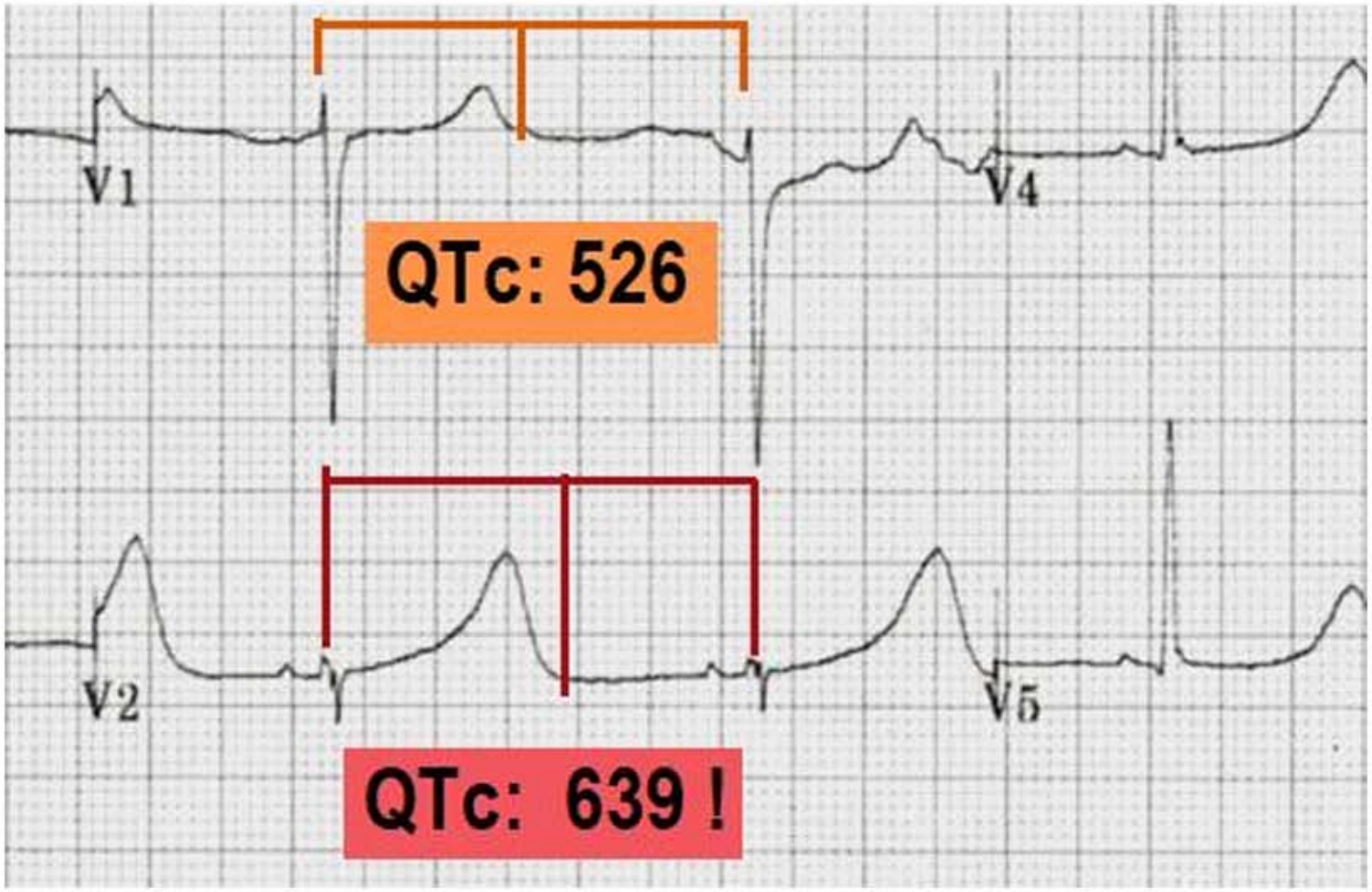
Why not V1 ?



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 ! !***

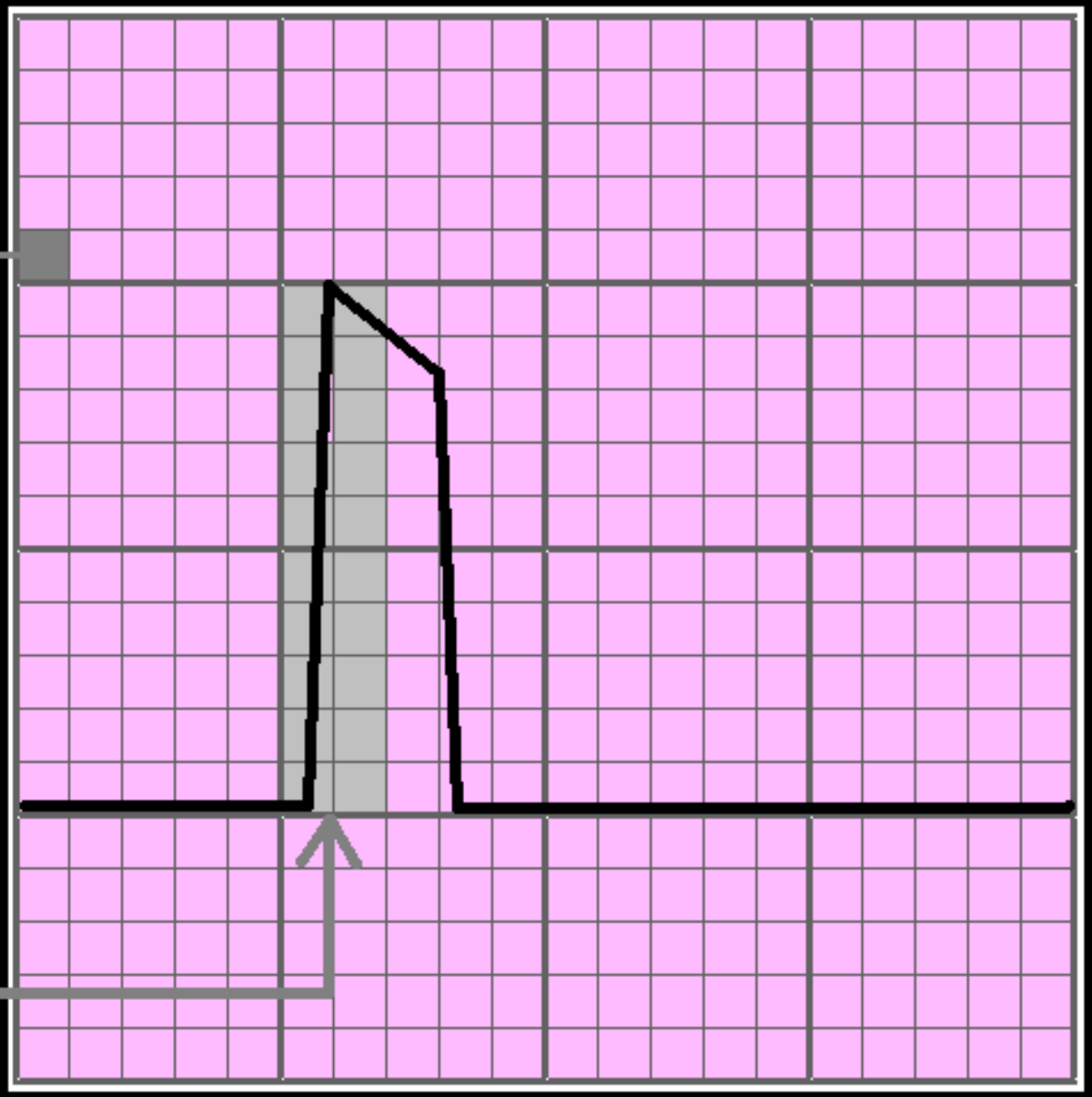
Why not V1 ? (may not detect critical QTc)




MEDFLEET-39615815
LP-8
LIFEPAK 15 MONITOR/DEFIBRILLATOR
ON
CPR
ANALYZE
CHARGE
LEAD
SIZE
SYNC
NIBP
ALARMS
OPTIONS
EVENT
PACER
RATE
CURRENT
PAUSE
SPEED DIAL
12-LEAD
TRANSMIT
PRINT

EKG PAPER - THE VERTICAL AXIS:

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



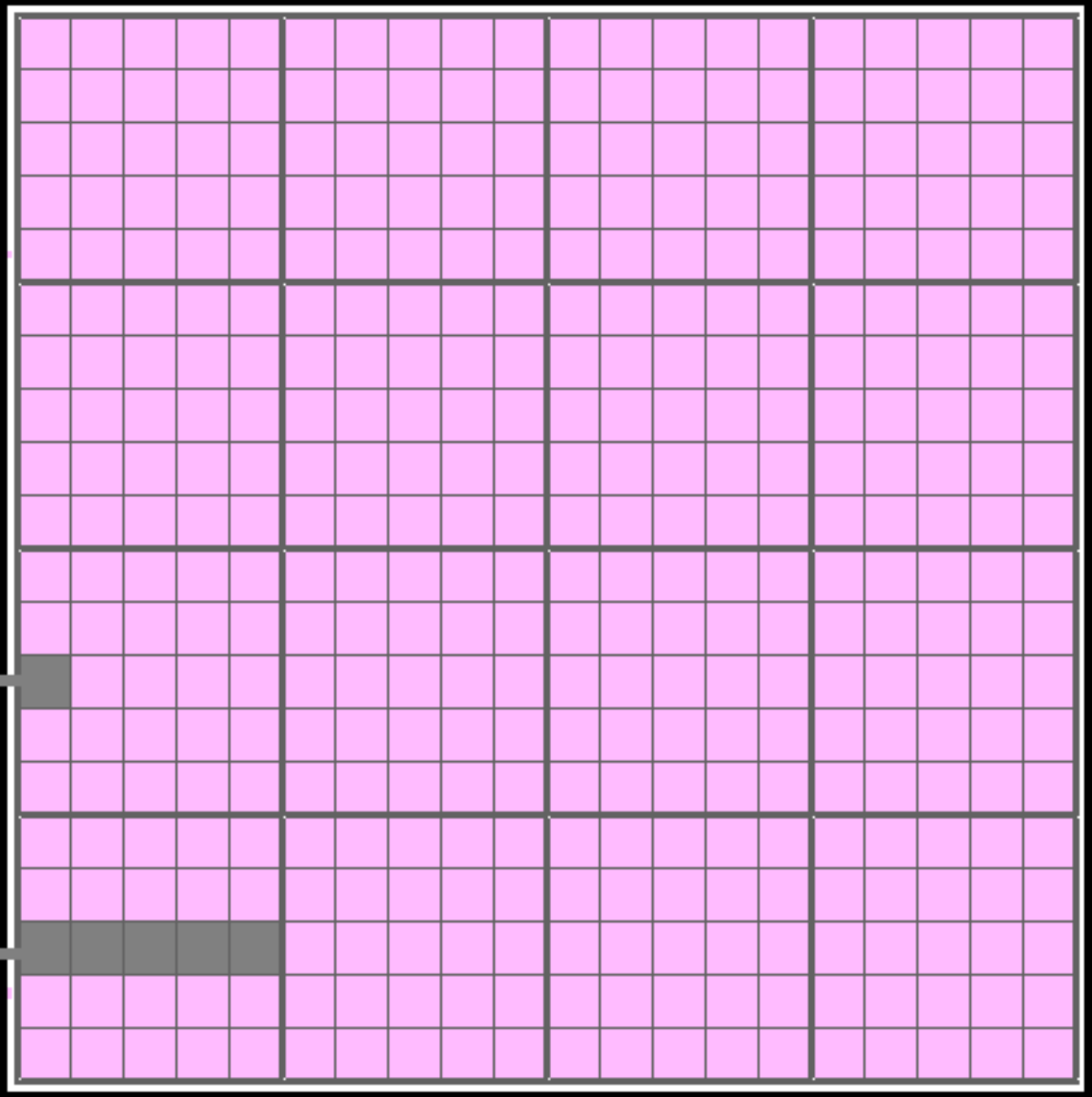
EKG PAPER - THE HORIZONTAL AXIS:

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)

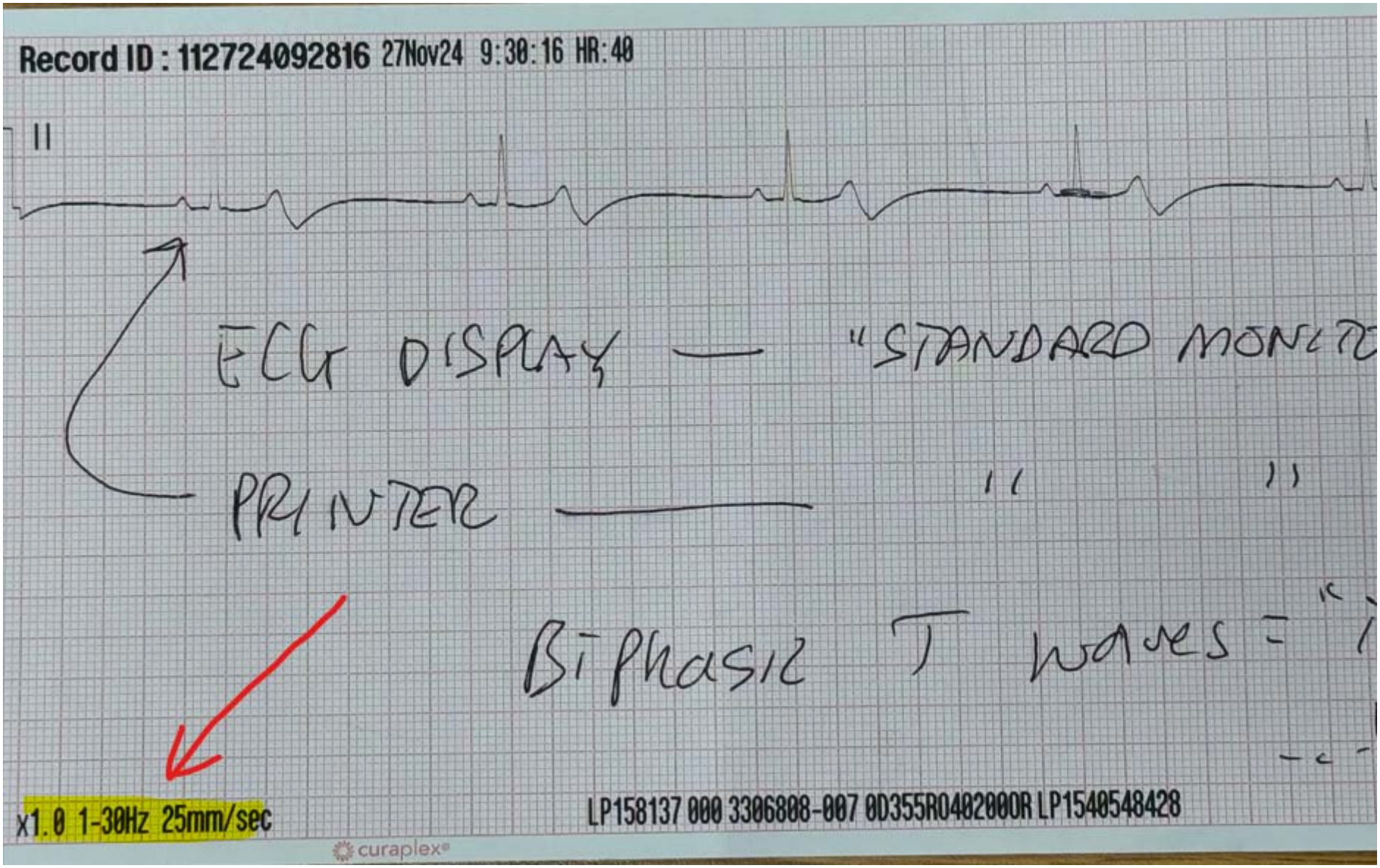


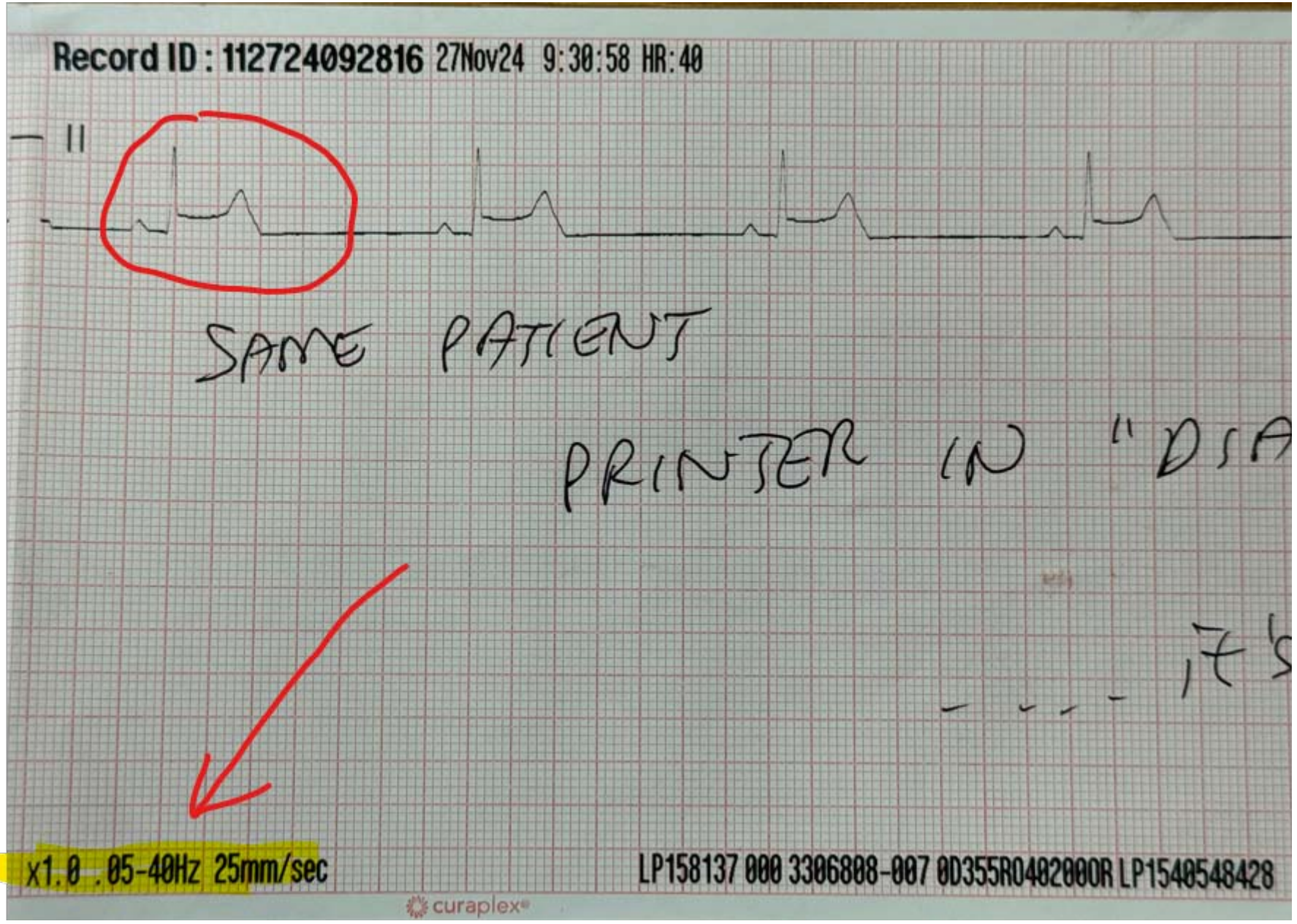
If you're going to use your ECG monitor to evaluate the patient's:

- 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
II
ECG DISPLAY — "STANDARD MONITO
PRINTER —— " "
BIPHASIC T WAVES = "
x1.0 1-30Hz 25mm/sec
LP158137 000 3306808-007 0D355R0402000R LP1540548428
curaplex


Record ID : 112724092816 27Nov24 9:30:58 HR:40
II
SAME PATIENT
PRINTER IN "DSA
x1.0 .05-40Hz 25mm/sec
LP158137 000 3306808-007 0D355R0402000R LP1540548428
curaplex

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.....

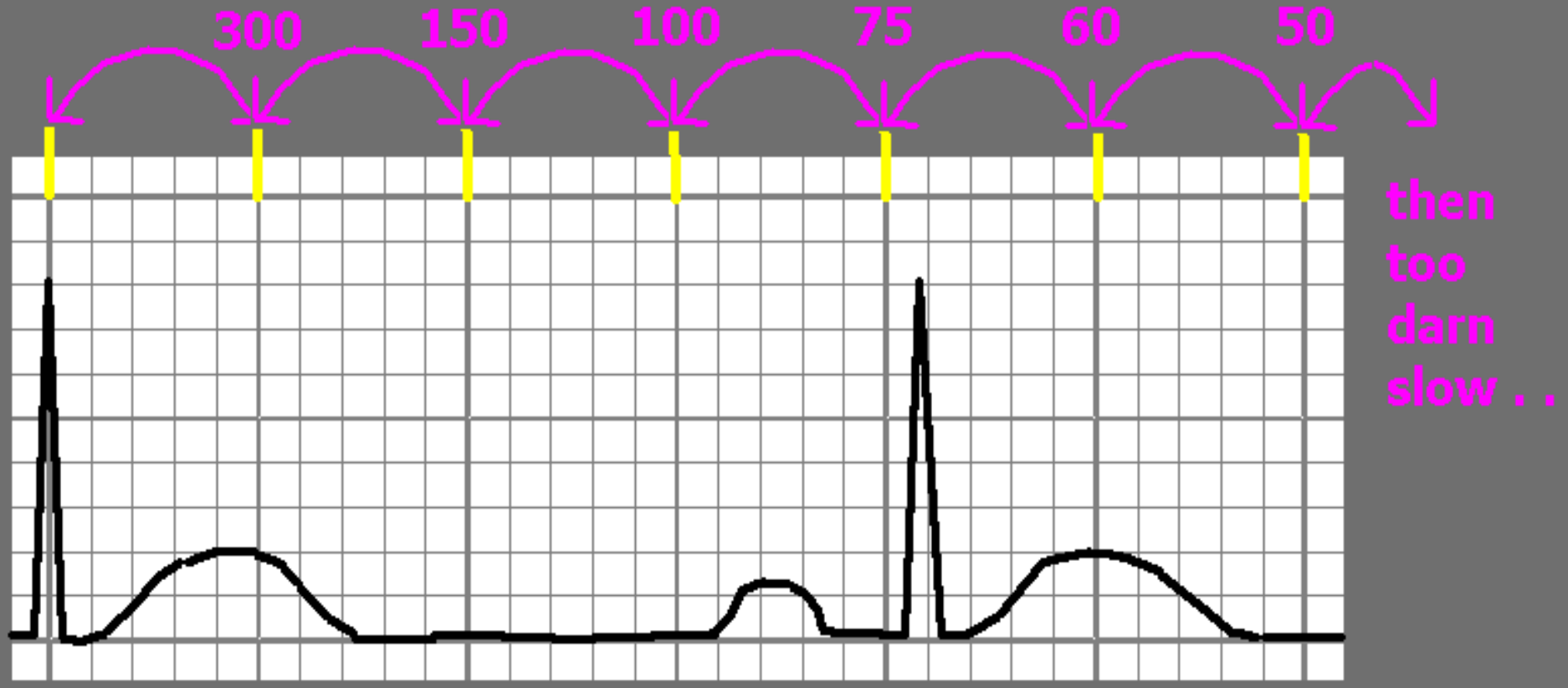
- ☐ RATE
- ☐ RHYTHM
- ☐ INTERVALS
- ☐ P:QRS RATIO

ESTABLISH YOUR ROUTINE ECG EVALUATION.....

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

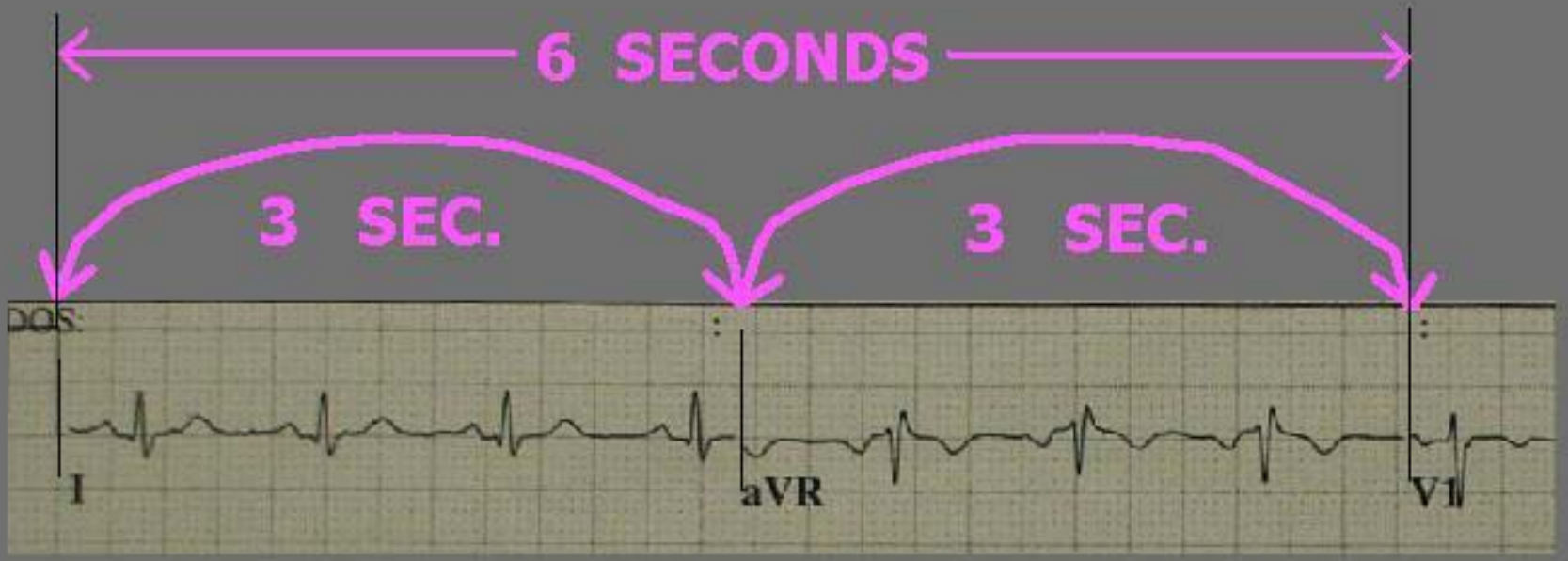
DETERMINE HEART RATE

METHOD 1:
(regular rhythm)



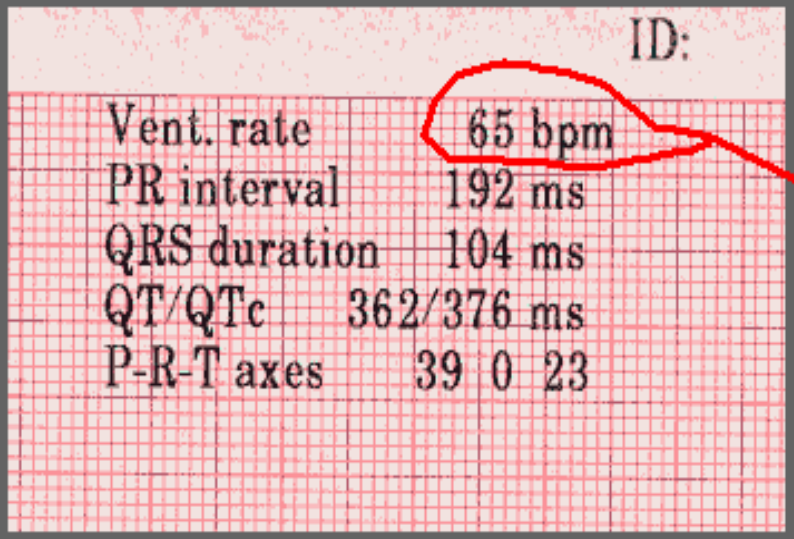
DETERMINE HEART RATE:

METHOD 2:



HR = 70

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



" HEART RATE IS SIXTY- FIVE ! "

THE CONCERNS OF ACLS

IS THE

VENTRICULAR RATE :

THE CONCERNS OF ACLS

IS THE

VENTRICULAR RATE :

- TOO SLOW

THE CONCERNS OF ACLS

IS THE

VENTRICULAR RATE :

- TOO SLOW
- TOO FAST

THE CONCERNS OF ACLS

IS THE

VENTRICULAR RATE :

- TOO SLOW
- 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

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

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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- PSYCHOGENIC (sudden fear – self-correcting)
- NEUROLOGICAL (spinal injury)
- 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.....

- [x] RATE
- [ ] RHYTHM
- [ ] INTERVALS
- [ ] P:QRS RATIO

DETERMINE RHYTHM

" WHEN YOUR R - R INTERVALS . . . "

REGULAR

" ARE ALWAYS CONSISTENT "

REGULARLY IRREGULAR

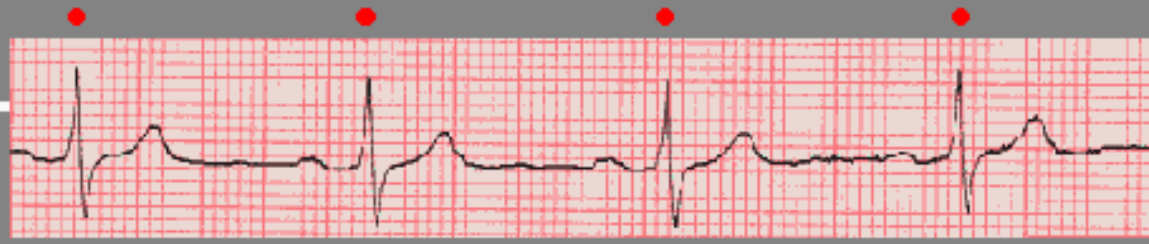
" FOLLOW A PATTERN "

IRREGULARLY IRREGULAR

" ARE TOTALLY CHAOTIC "

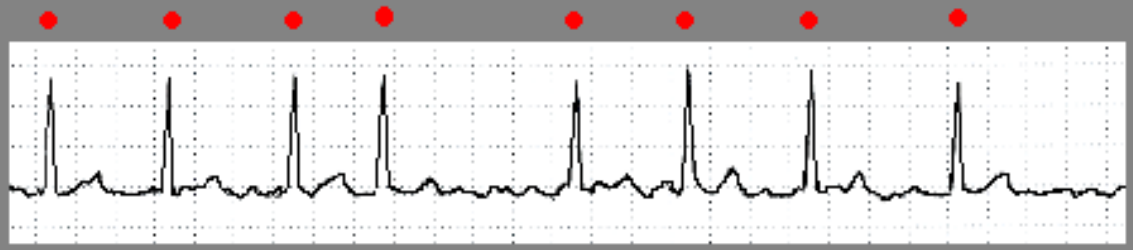
DETERMINE RHYTHM

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

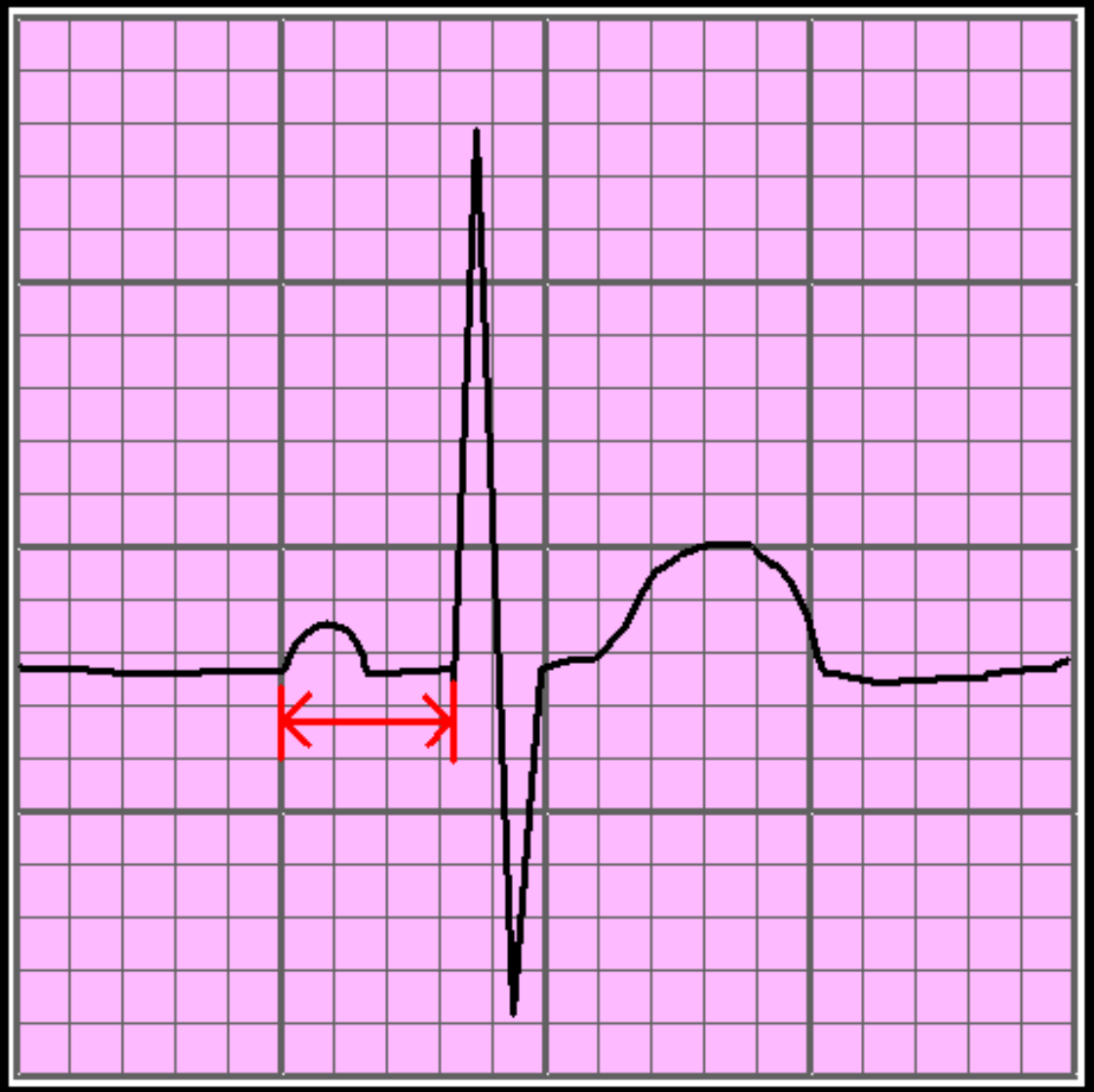
ESTABLISH YOUR ROUTINE ECG EVALUATION.....

- [x] RATE
- [x] 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

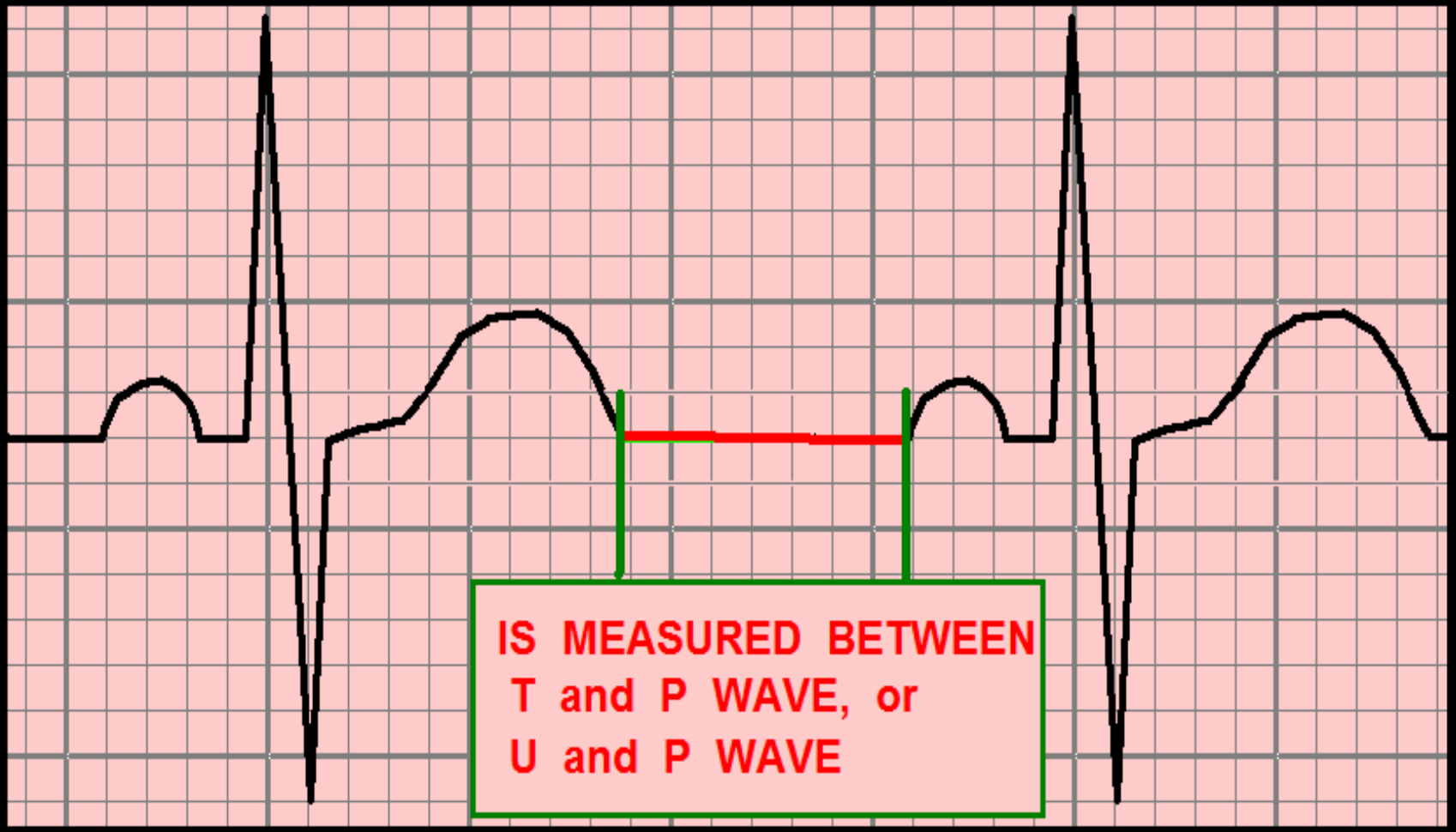
P - R INTERVAL INCONSISTENT
(VARIES FROM BEAT TO BEAT)

THINK:

- 2° TYPE 1 HEART BLOCK
(WENKEBACH)

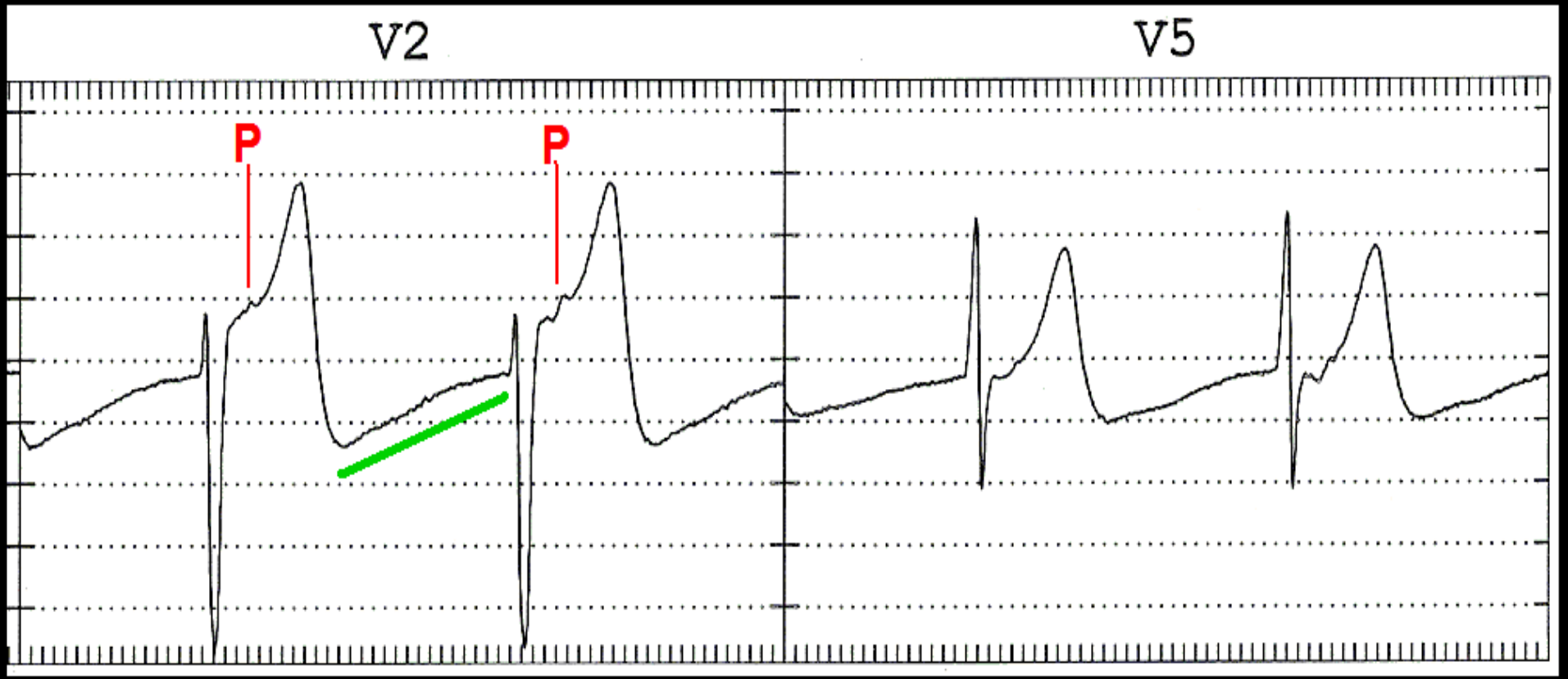
- 3° HEART BLOCK
(COMPLETE HEART BLOCK)

THE ISOELECTRIC LINE



THE ISOELECTRIC LINE

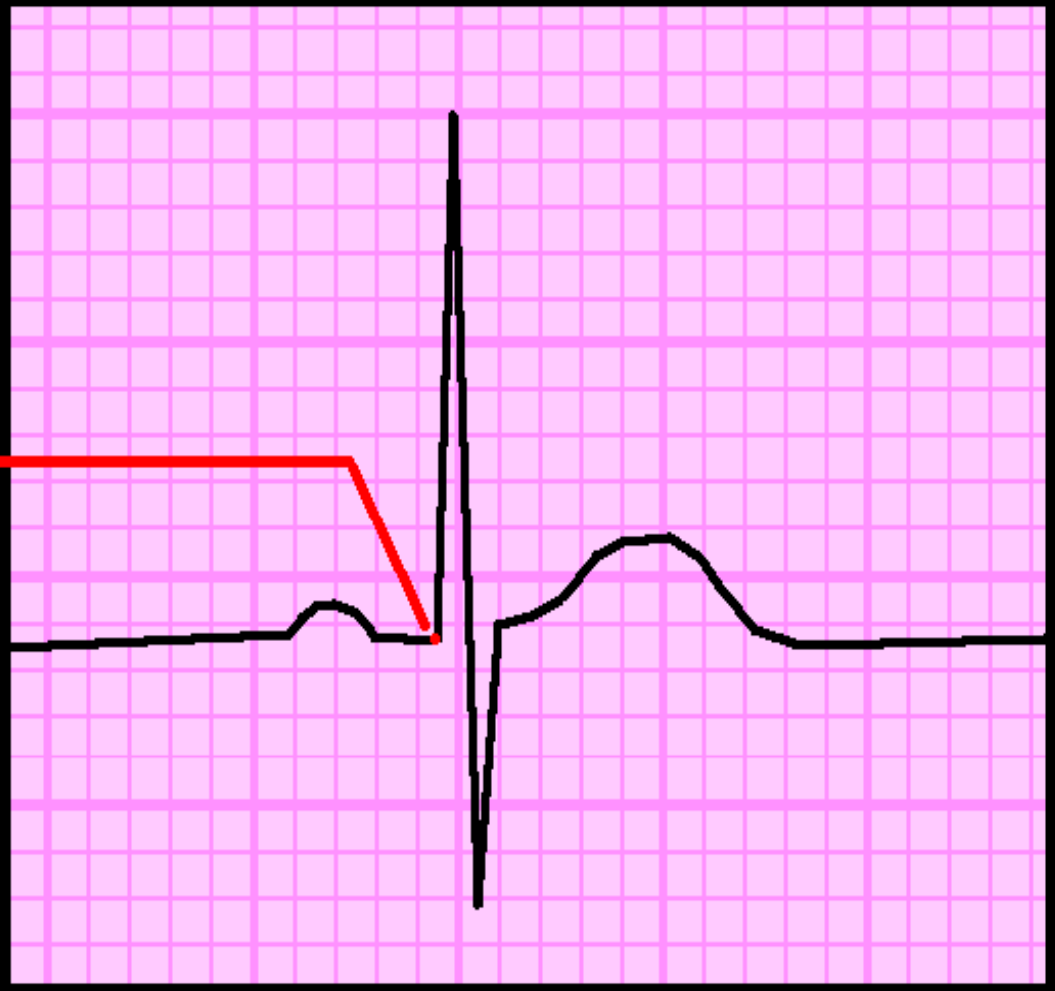
EKG from 13 y/o girl in ACCELERATED JUNCTIONAL RHYTHM.
note: upsloping T-P interval, and P buried in T waves.



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 COMPEX (ES)
- PACED RHYTHM
- L VENTRICULAR HYPERTROPHY
- ELECTROLYTE IMBAL. (↑K^+ ↓Ca^{++})
- DELTA WAVE (PRE-EXCITATION)

When the QRS is TOO WIDE (>3mm -or- 120ms) …..

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

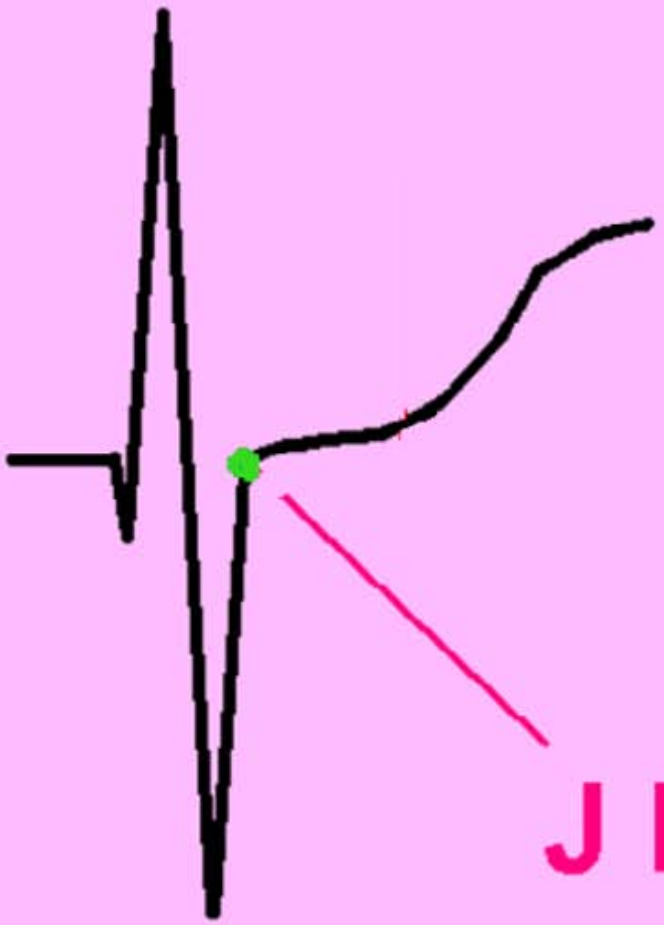
- ISCHEMIA
- INFARCTION

MORE ON THIS TOPIC COMING UP in a few minutes.

For now . . . .

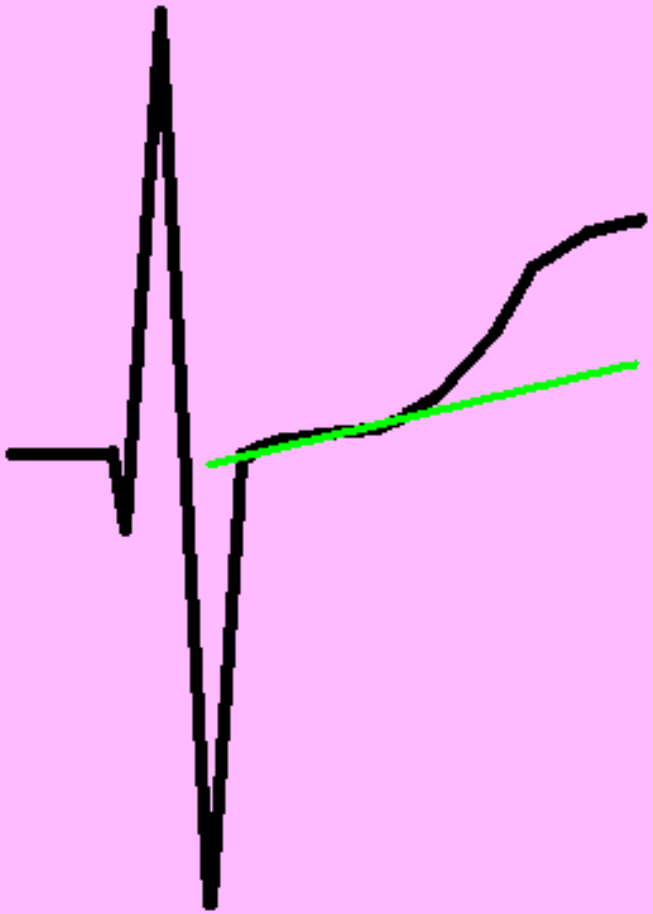
“hold that thought” . . . . . .

THE J POINT



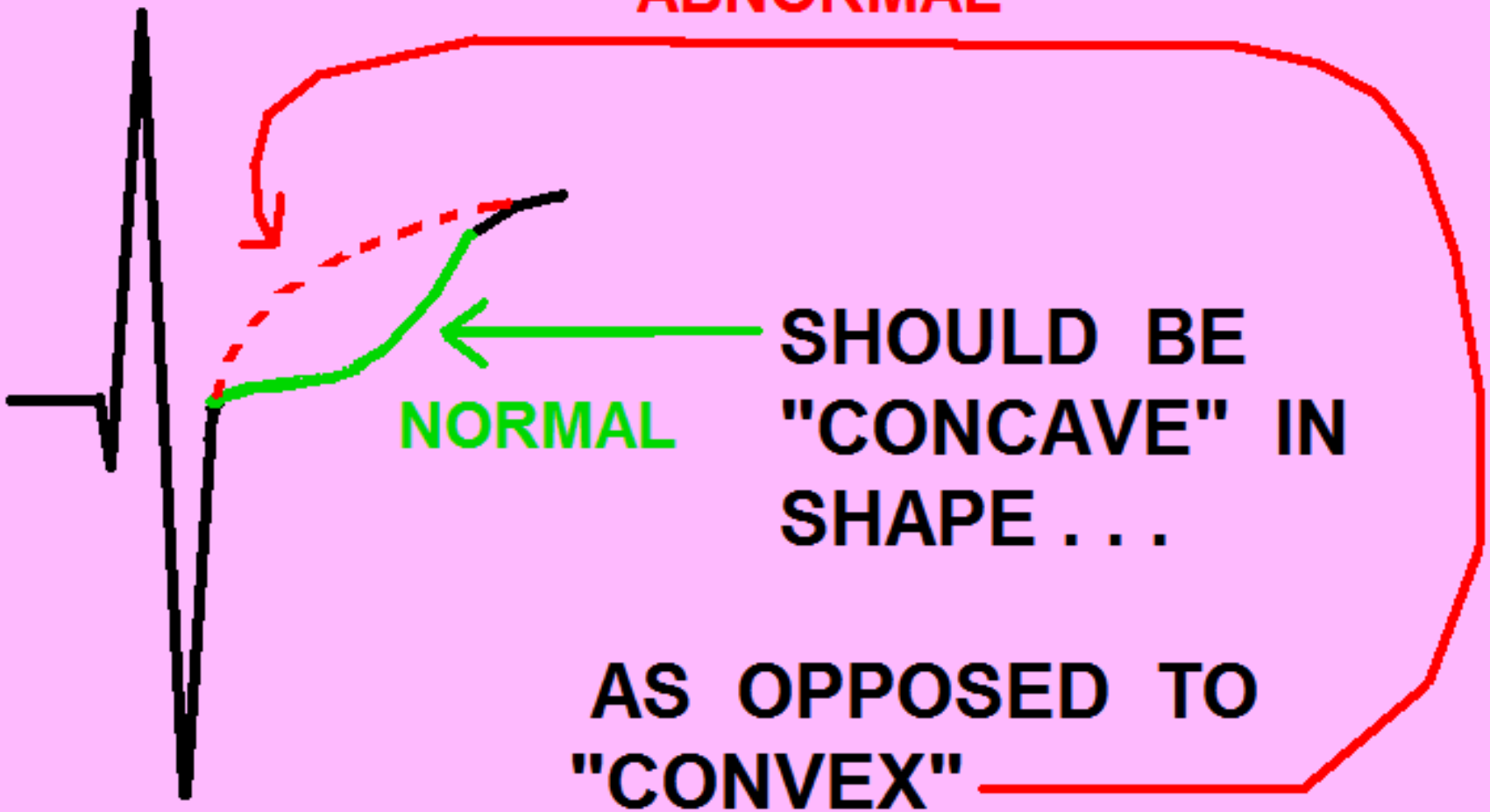
is where the QRS complex ends and the S-T Segment begins.

THE S-T SEGMENT

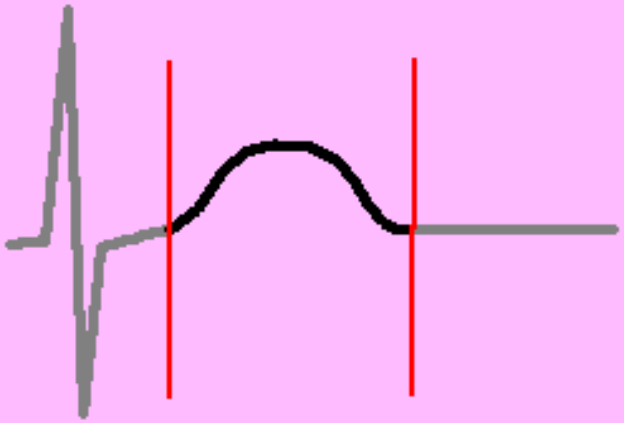


SHOULD HAVE
A "SLIGHT POSITIVE"
INCLINATION

THE S-T SEGMENT



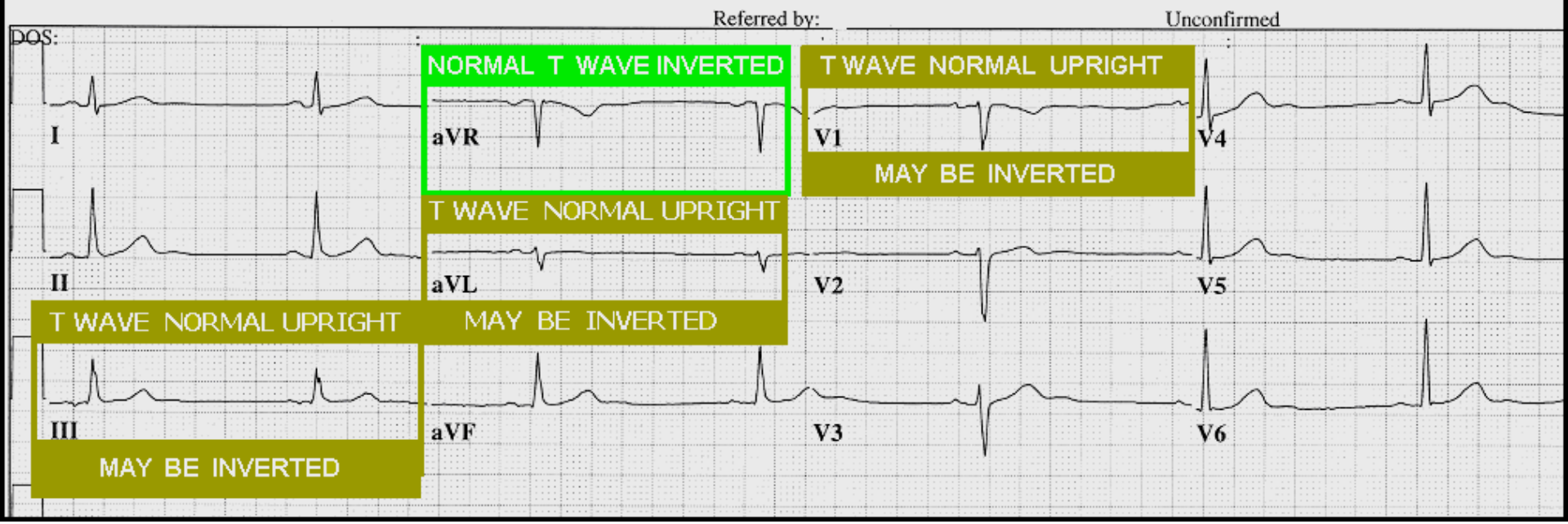
THE T WAVE



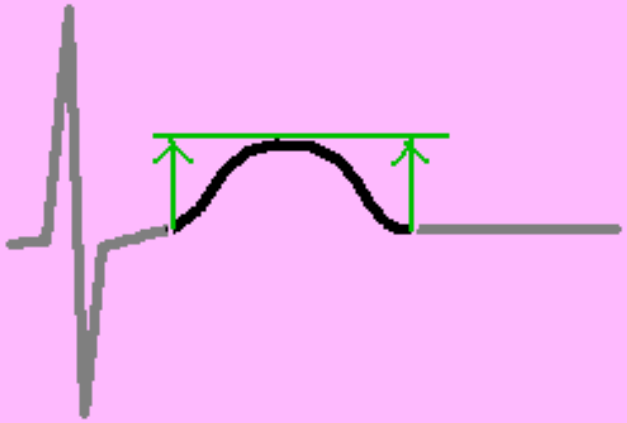
- SHOULD BE A "NICE," ROUNDED, CONVEX SHAPE

- 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:

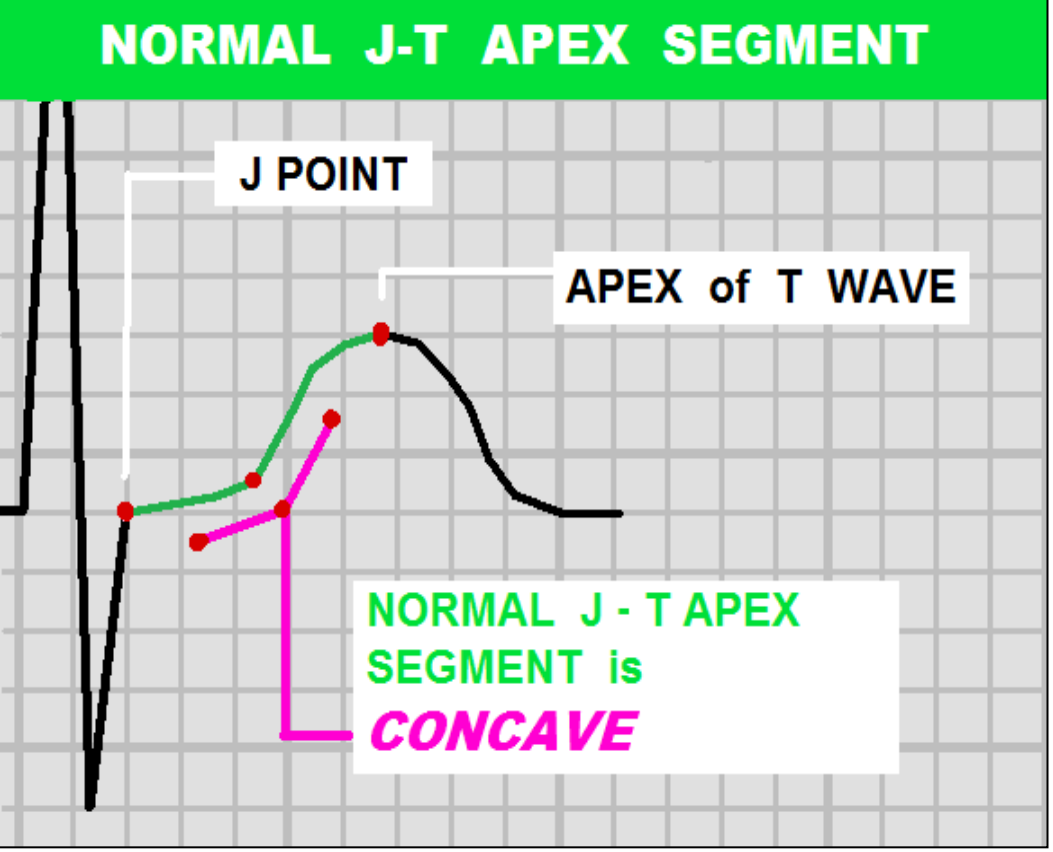


THE T WAVE



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.



J-T APEX SEGMENT CONSISTS OF:

- ST SEGMENT (J POINT - BEGINNING of T WAVE)
- FIRST ½ 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.

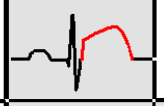
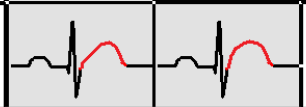
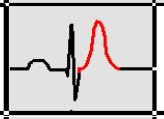
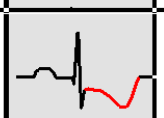
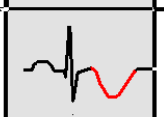
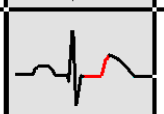
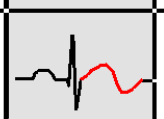
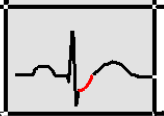
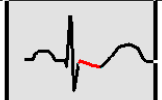
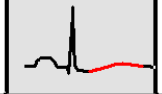
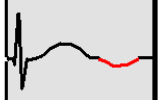
"IF IT'S NOT

NORMAL, it's

ABNORMAL !

EKG PATTERNS of ACS & ISCHEMIA

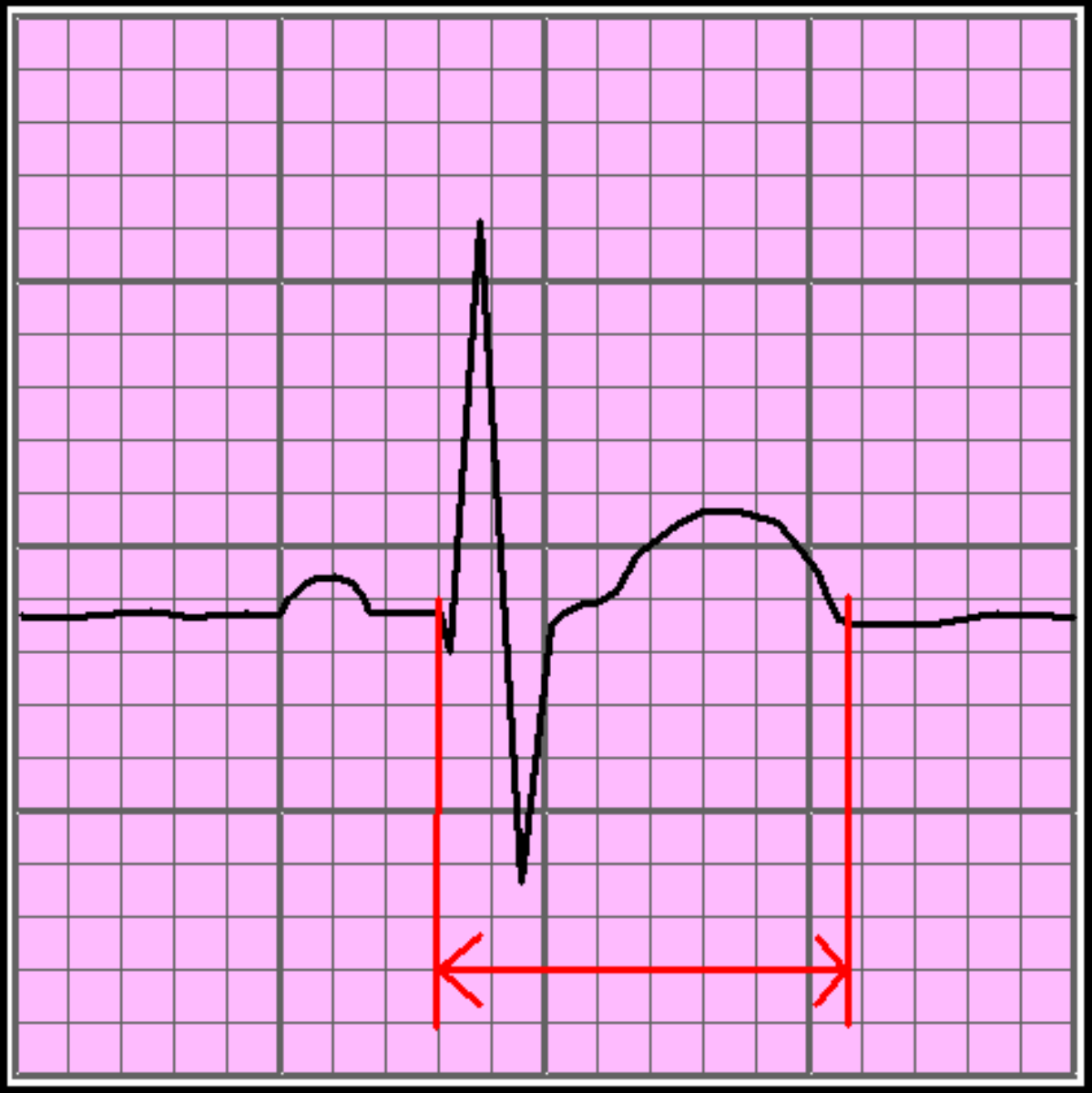
-- J POINT, ST SEGMENT, and T WAVE ABNORMALITIES --

!	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

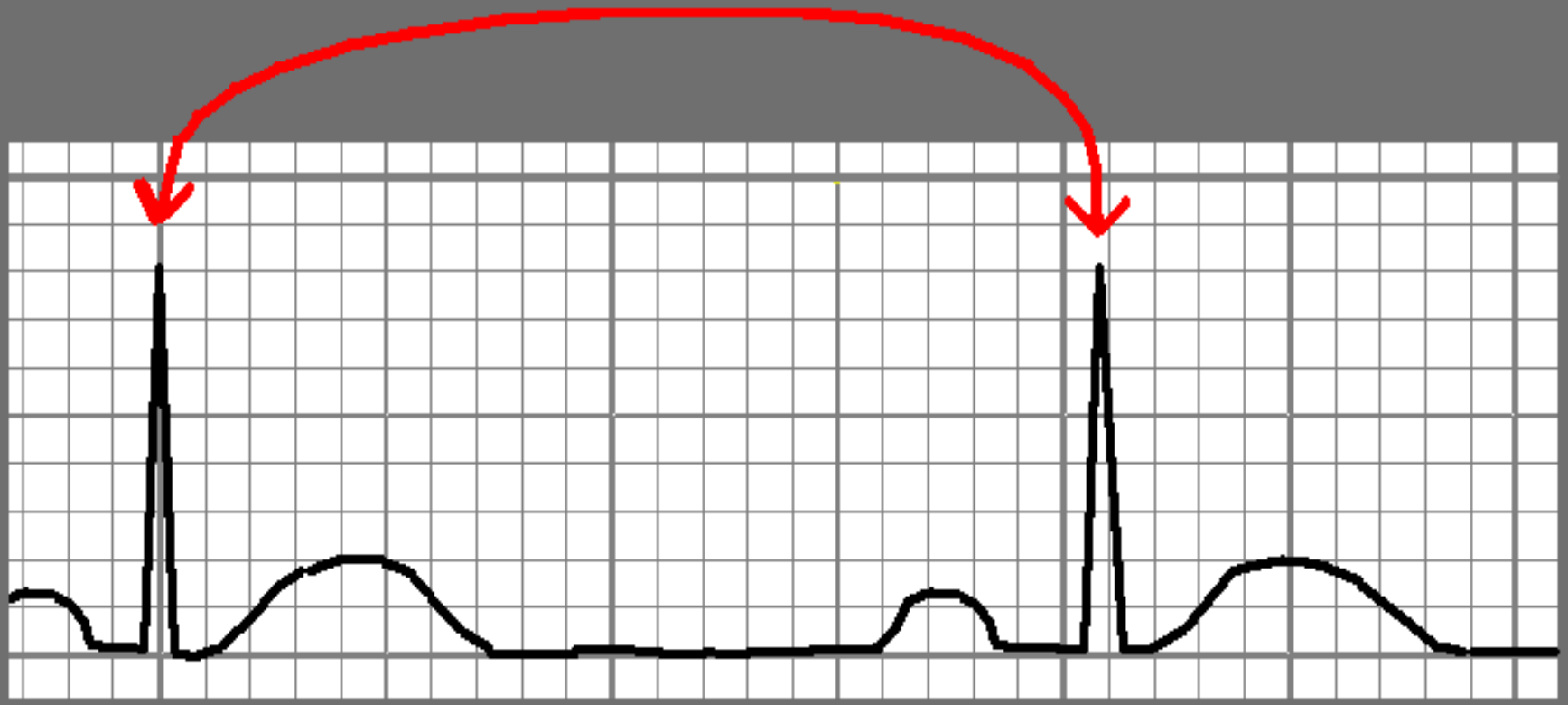
- FOR NORMAL HEART RATES: SHOULD BE < 1/2 R - R INTERVAL



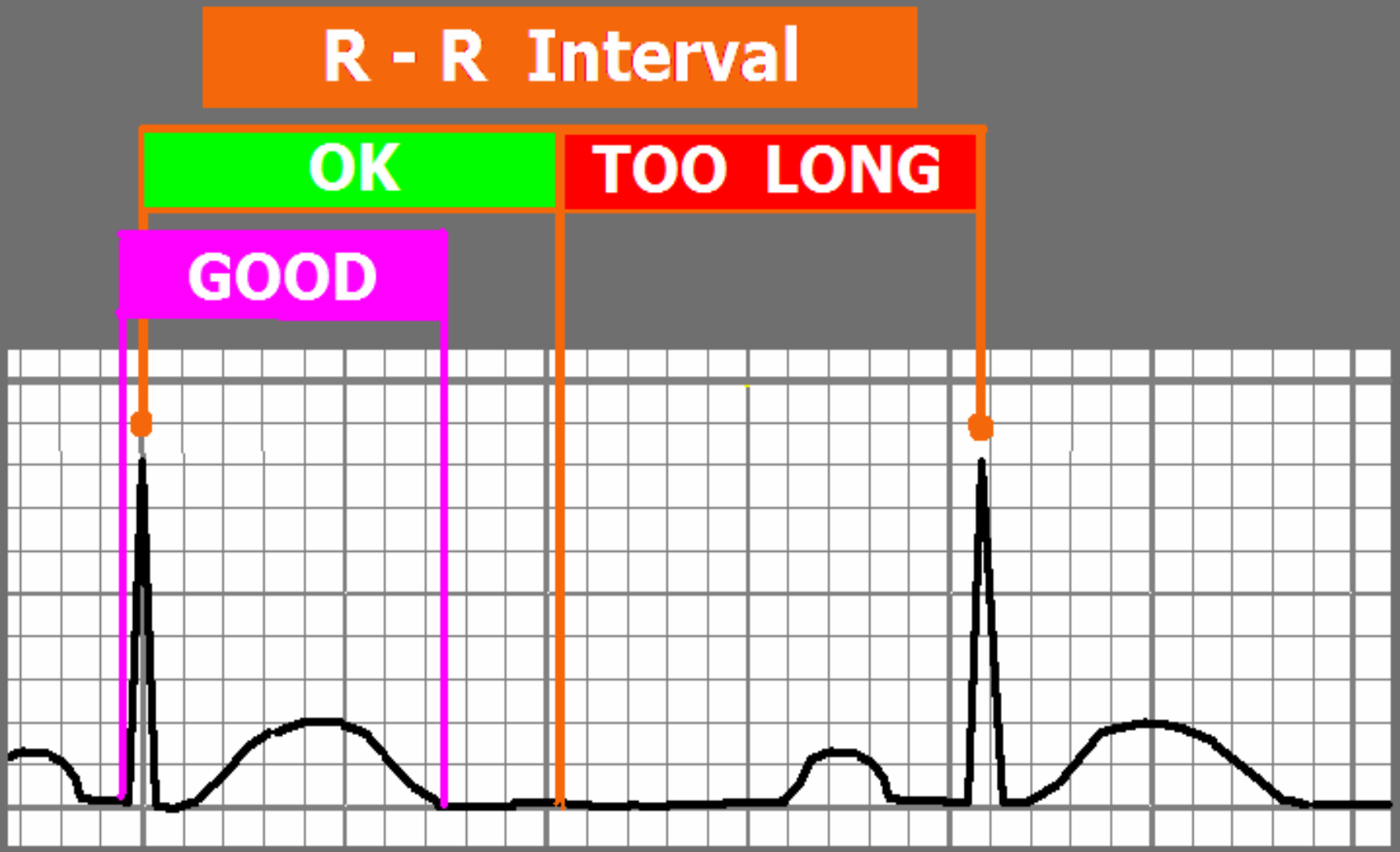
DETERMINING Q-T INTERVAL LIMITS

THE "QUICK PEEK" METHOD

(for Heart Rates 60 - 100)



The Q - T Interval should be LESS THAN 1/2 the



The Q - T Interval should be LESS THAN 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)***

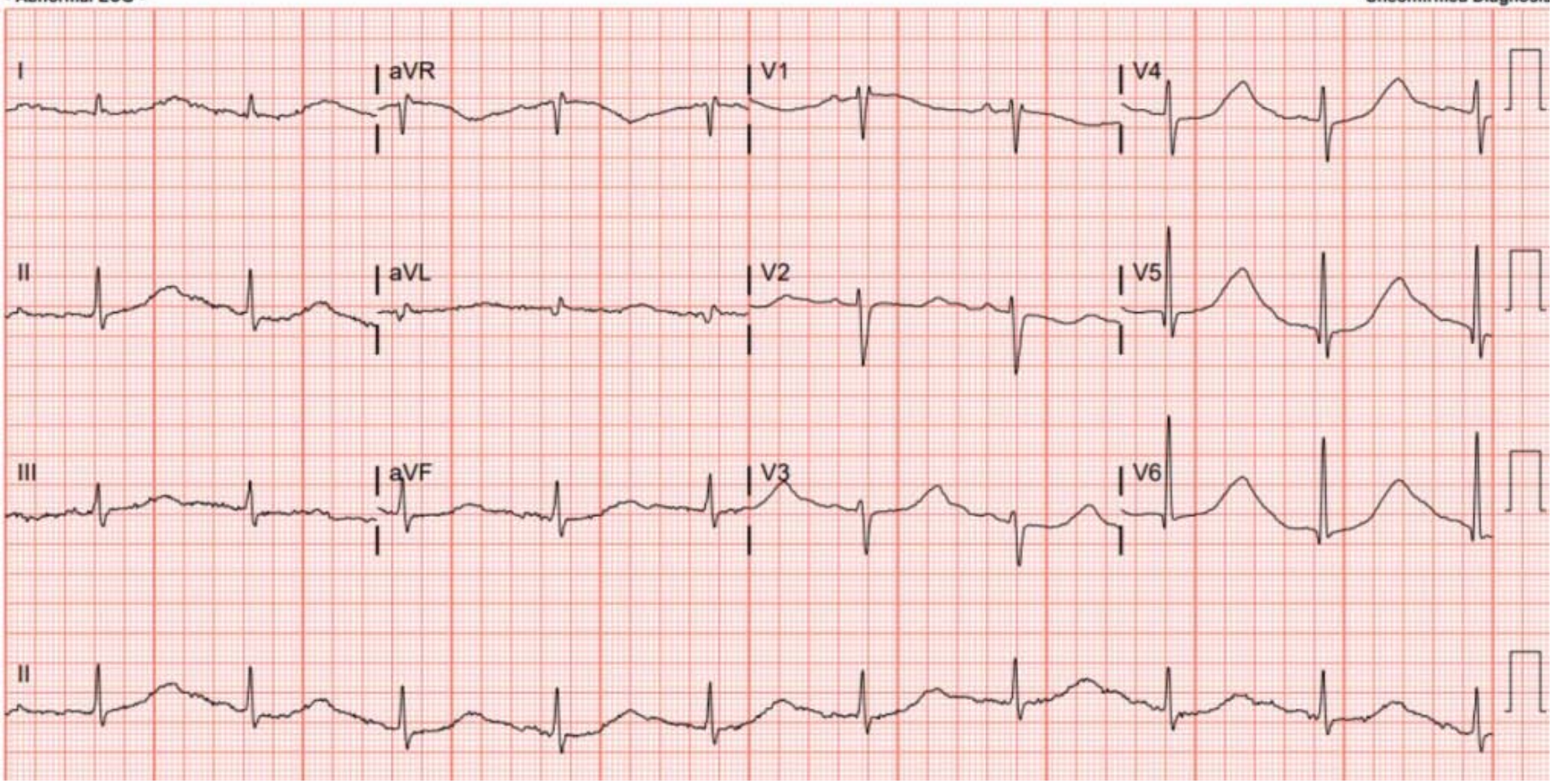
Rate	58
PR	185
QRSd	126
QT	668
QTc	657
--Axis--	
P	107
QRS	61
T	45

Sinus rhythm
IVCD, consider atypical RBBB
Baseline wander in lead(s) V2,V3,V4,V6
COMPARED TO ECG 07/22/2020 16:56:59
SINUS RHYTHM NOW PRESENT

Req Provider: Rafael Santiago-A

- Abnormal ECG -

Unconfirmed Diagnosis

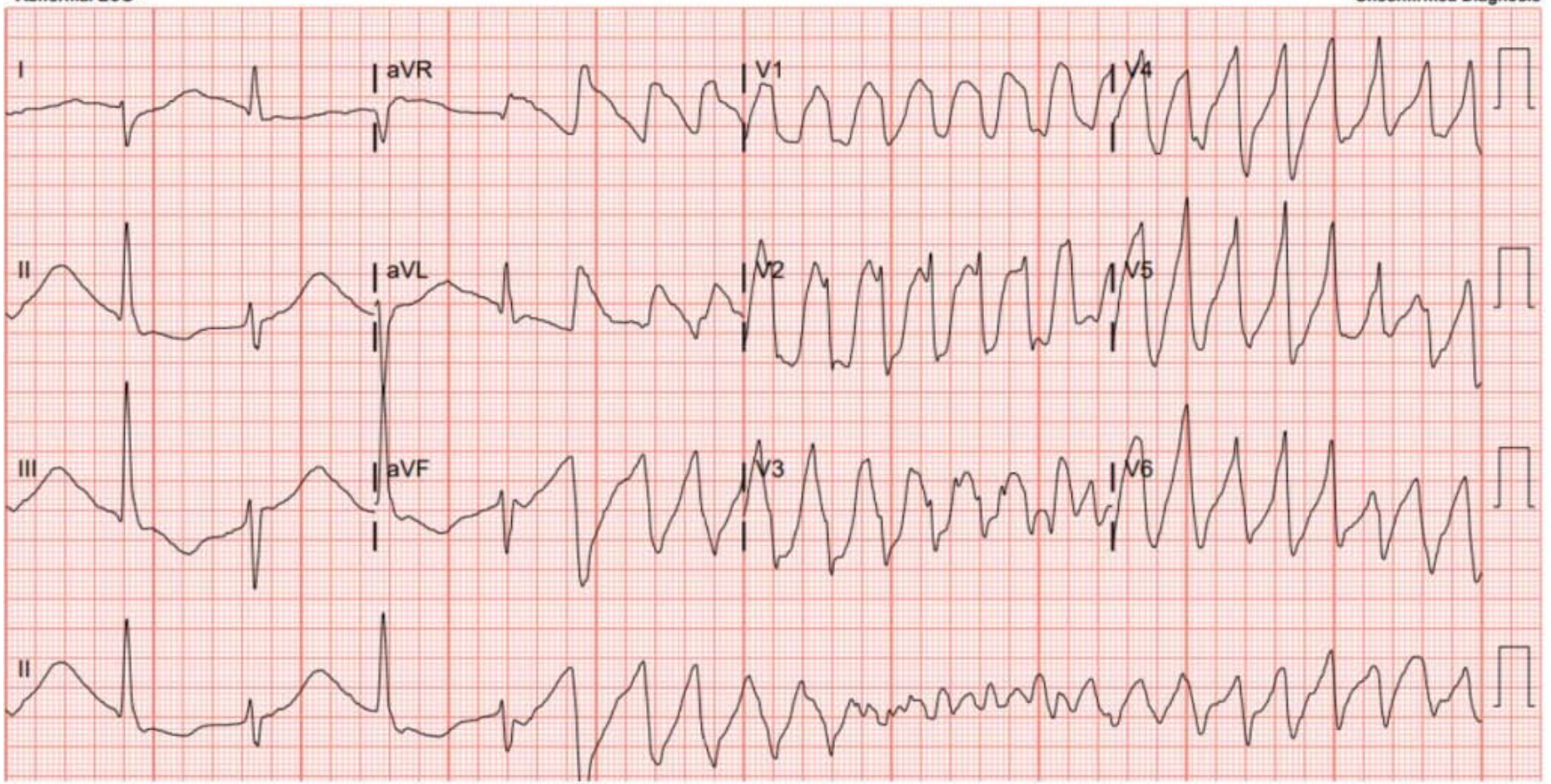


Rate	156	Atrial fibrillation
PR		Ventricular tachycardia, unsustained
QRSd	138	RBBB and LPFB
QT	456	Repol abnrm suggests ischemia, diffuse leads
QTc	735	Baseline wander in lead(s) II,III,aVR,aVF,V1,V2,V3,V4
--Axis--		COMPARED TO ECG 07/22/2020 15:32:52
P		ATRIAL FIBRILLATION NOW PRESENT
QRS	102	VENTRICULAR 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-Ap

- 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 SYNCOPE 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 . . . . .

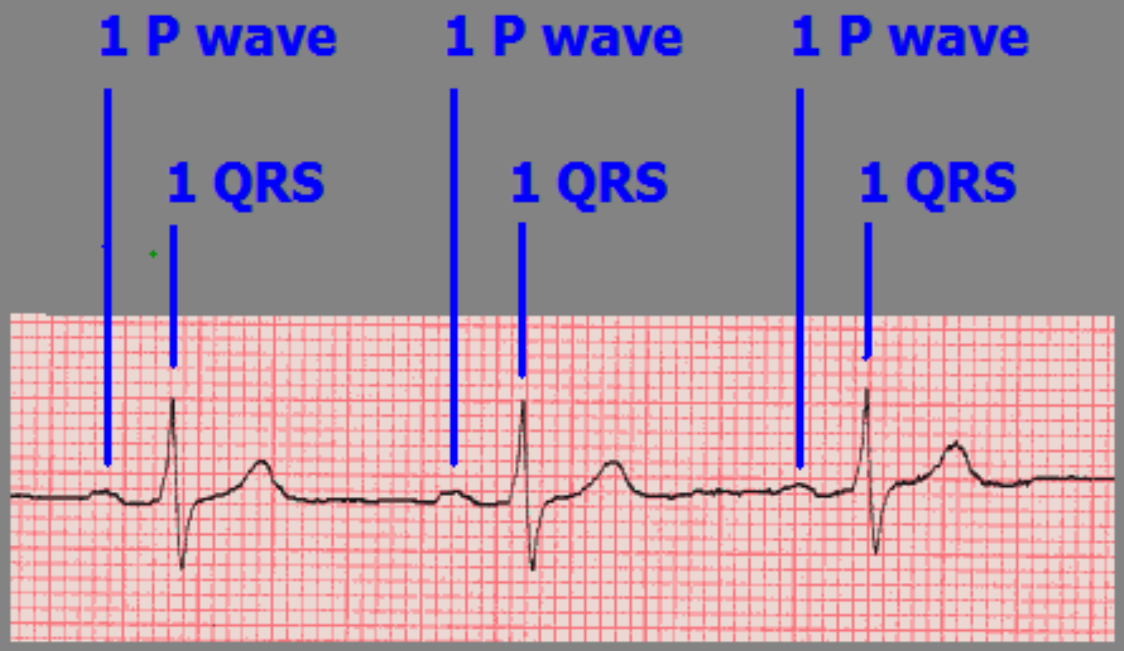
a piece of Twisted Ribbon !

ESTABLISH YOUR ROUTINE ECG EVALUATION. . . . .

- [x] RATE
- [x] RHYTHM
- [x] INTERVALS
- [ ] P:QRS RATIO

DETERMINE P : QRS RATIO

SIMPLY STATED, SHOULD ALWAYS BE 1 : 1



P : QRS RATIO

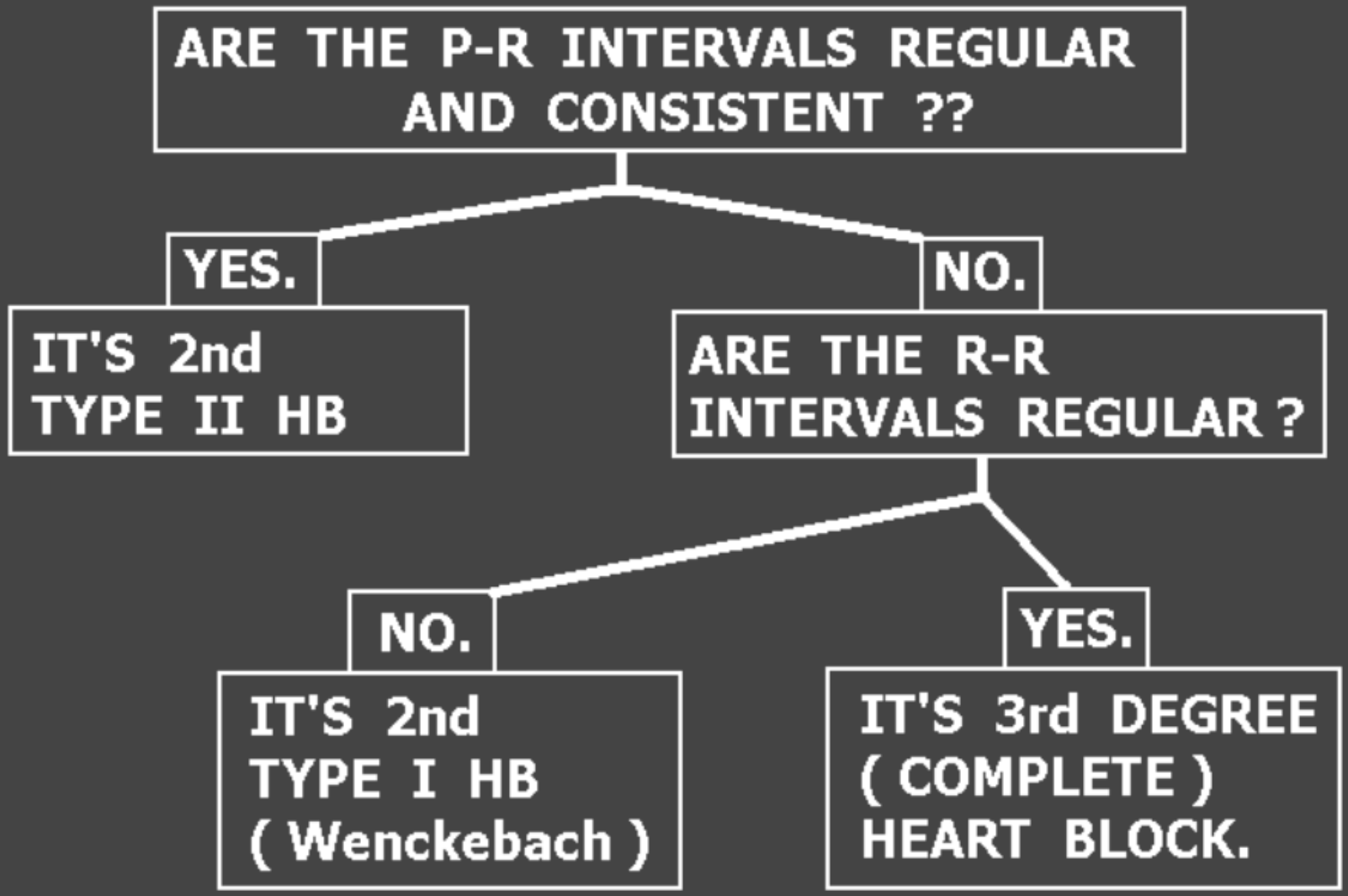
IF GREATER THAN 1 : 1

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

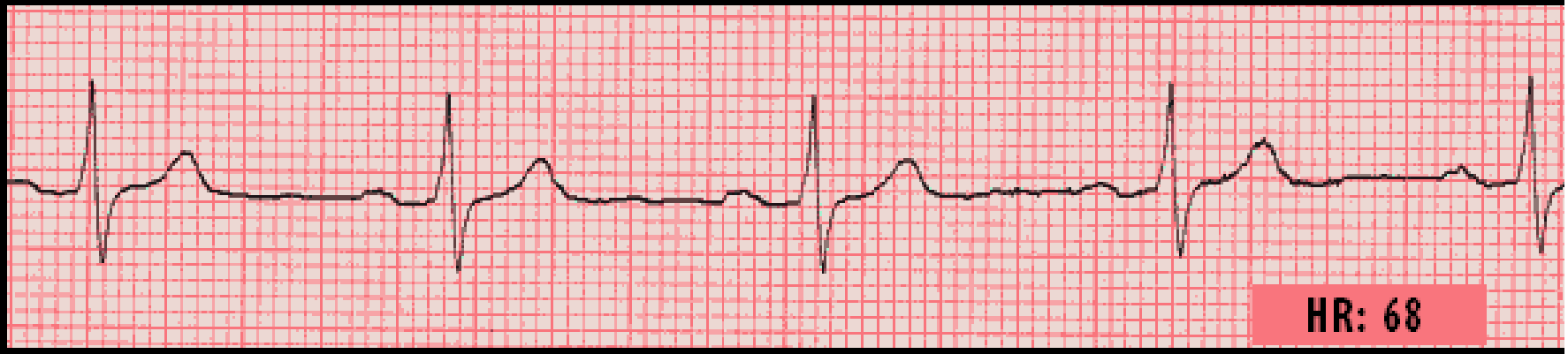
2

3

ESTABLISH YOUR ROUTINE ECG EVALUATION.....

- [x] RATE
- [x] RHYTHM
- [x] INTERVALS
- [x] P:QRS RATIO

THIS RHYTHM IS:

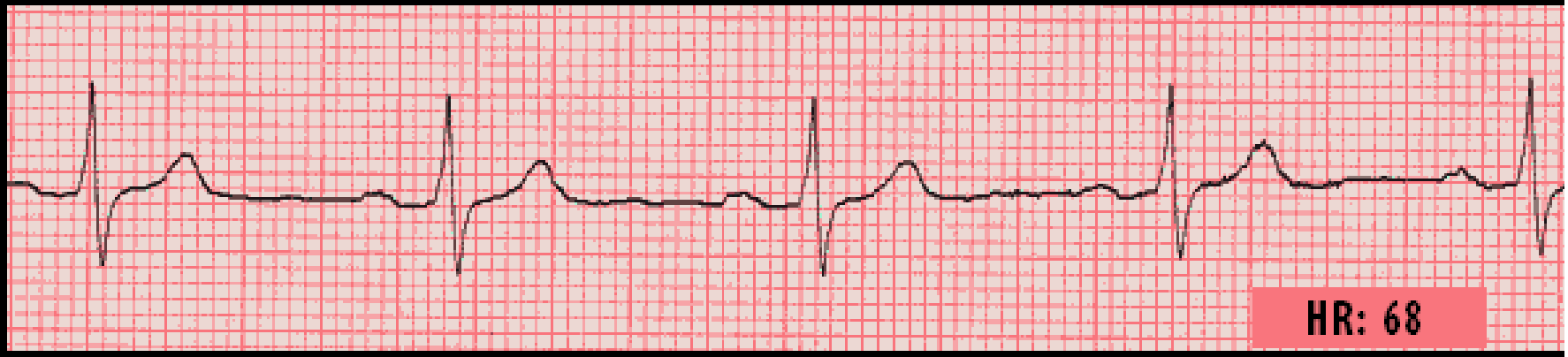


MAIN IDENTIFICATION CHARACTERISTIC(S):

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

POTENTIAL PROBLEM(S):

THIS RHYTHM IS: NORMAL SINUS RHYTHM

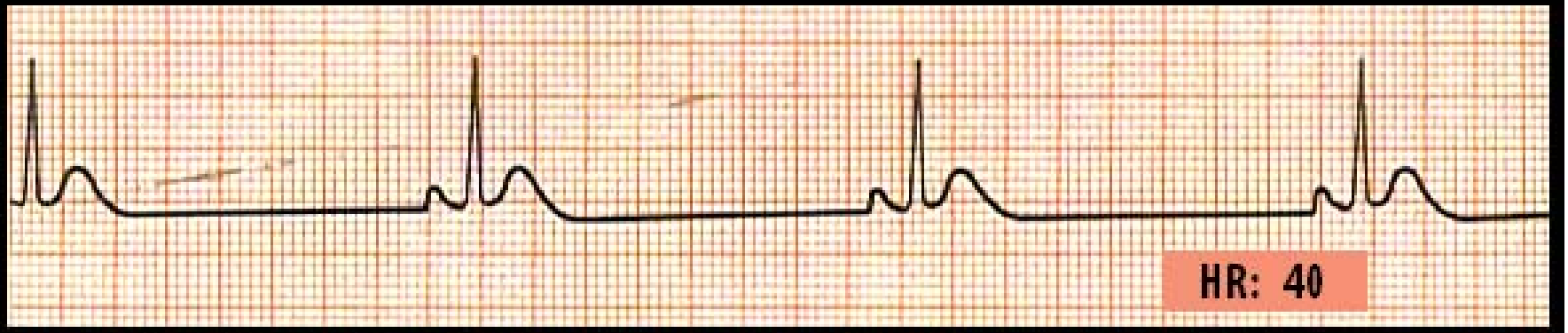


MAIN IDENTIFICATION CHARACTERISTIC(S): PERFECTLY NORMAL IN EVERY WAY!

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!

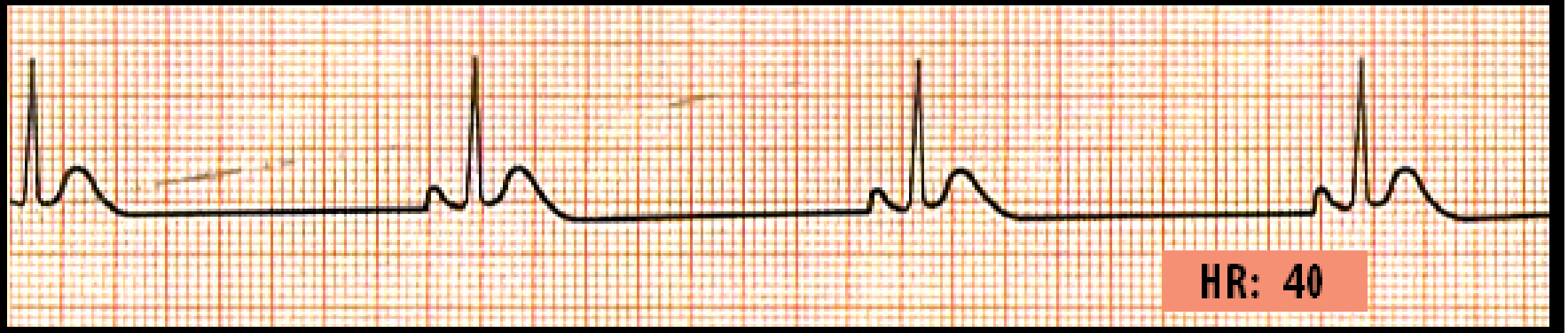
THIS RHYTHM IS:



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

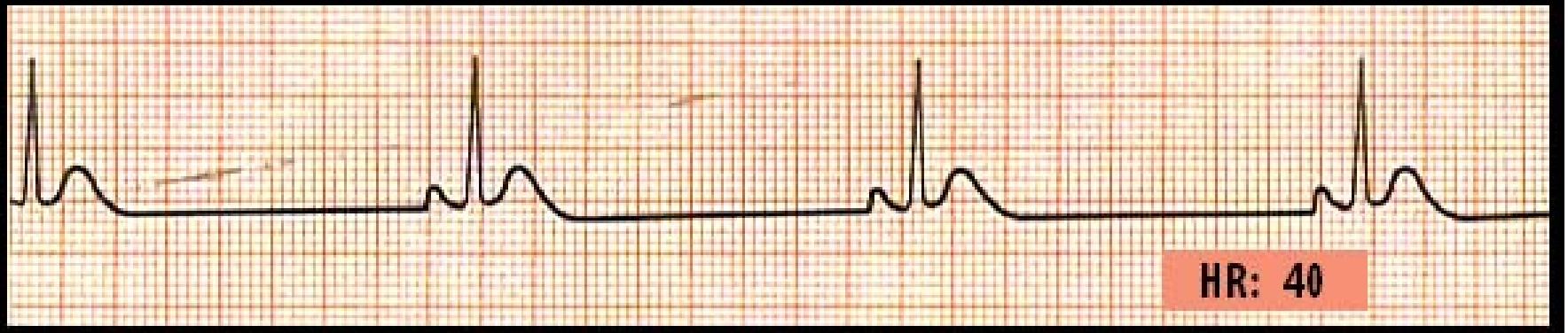
THIS RHYTHM IS: SINUS BRADYCARDIA



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

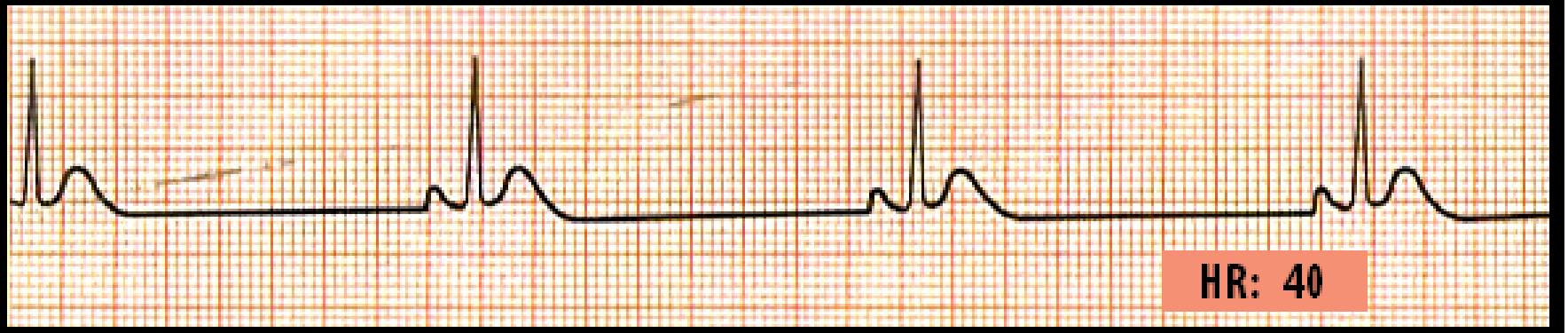


MAIN IDENTIFICATION CHARACTERISTIC(S): HEART RATE IS LESS THAN NORMAL.

POTENTIAL PROBLEM(S):

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

THIS RHYTHM IS: SINUS BRADYCARDIA



TREATMENT / INTERVENTION(S):

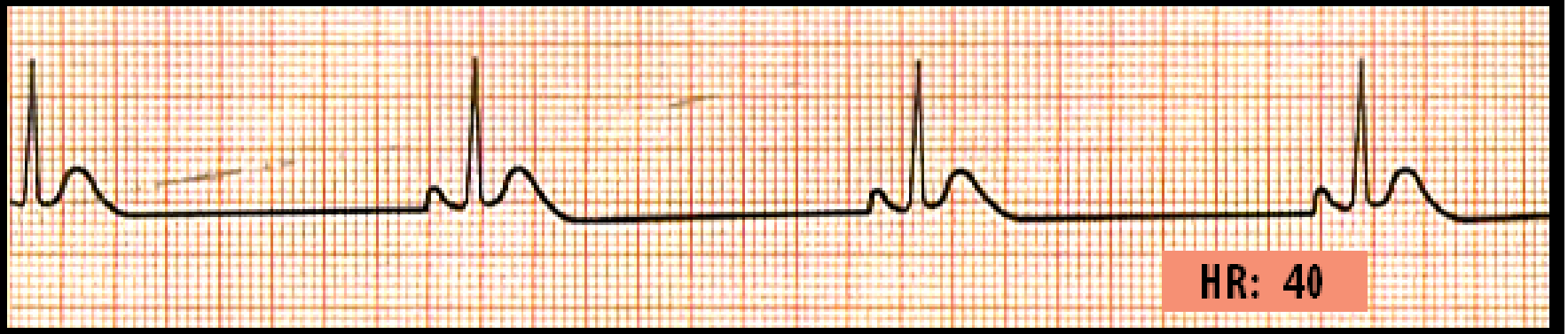
FIRST, ASSESS the PATIENT to determine if the patient is:

- STABLE

or

- UNSTABLE
  (signs of SHOCK/HYPOPERFUSION)

THIS RHYTHM IS: SINUS BRADYCARDIA



WE MUST CONSIDER UNDERLYING CAUSES:		AND TREAT THEM:
INCREASED VAGAL TONE	→	ATROPINE
BLOCKED SA NODAL ARTERY (INFERIOR WALL MI)	→	CARDIAC CATH - PTCA / STENT THROMBOLYTICS
ELECTROLYTE IMBAL. (K+)	→	CORRECT ELECTROLYTES
HYPOTHERMIA	→	WARM PATIENT
ORGANOPHOSPHATE POISONING	→	ATROPINE
ATHLETIC METABOLISM (excellent health!)	→	COMPLIMENT PATIENT!

THIS RHYTHM IS:

MAIN IDENTIFICATION CHARACTERISTIC(S):

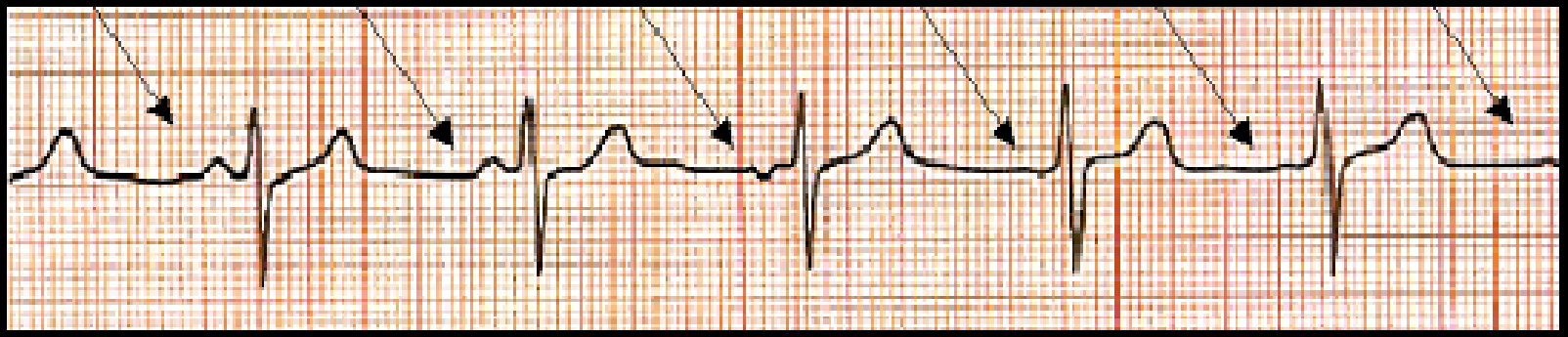
RATE ----------
RHYTHM ----------
P-R INTERVAL ------
P: QRS RATIO -------
QRS INTERVAL -----

THIS RHYTHM IS: WANDERING ATRIAL PACEMAKER

MAIN IDENTIFICATION CHARACTERISTIC(S):

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

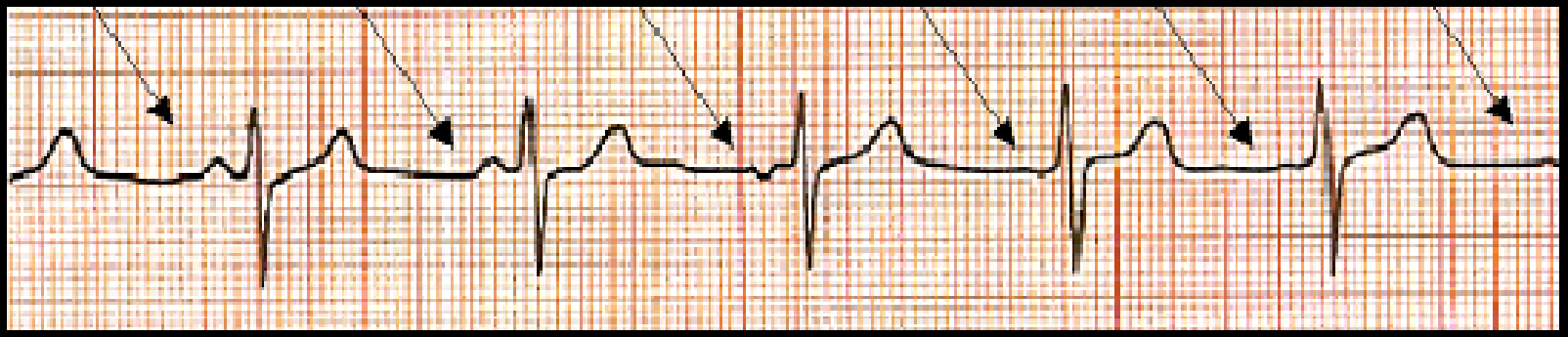
THIS RHYTHM IS: WANDERING ATRIAL PACEMAKER



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

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

THIS RHYTHM IS: WANDERING ATRIAL PACEMAKER

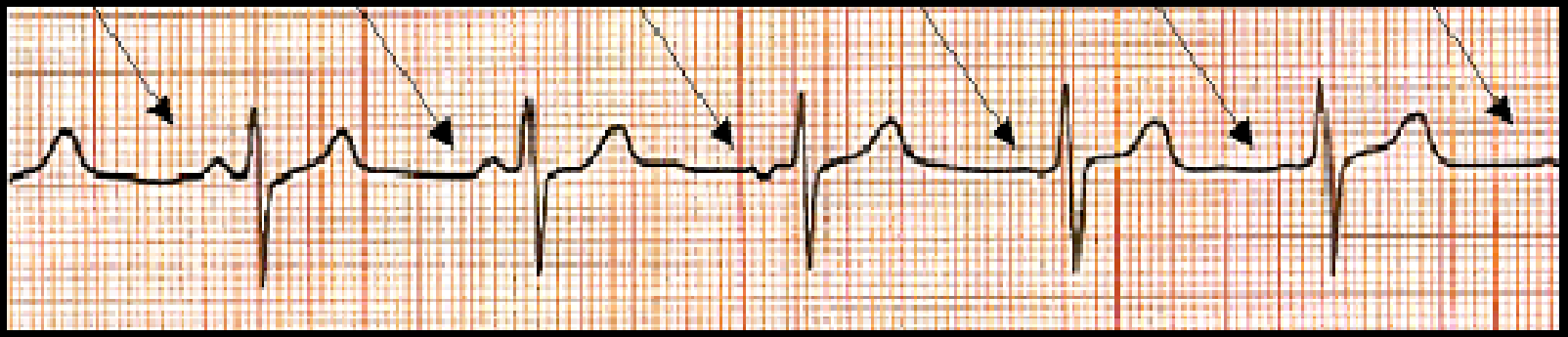


MAIN IDENTIFICATION CHARACTERISTIC(S): P WAVES ARE OF DIFFERENT SIZES, DEFLECTIONS, and P-R INTERVALS SLIGHTLY VARY

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	> 200 mSEC.
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°, 3°) with SLOWER VENTRICULAR RATE

THIS RHYTHM IS:

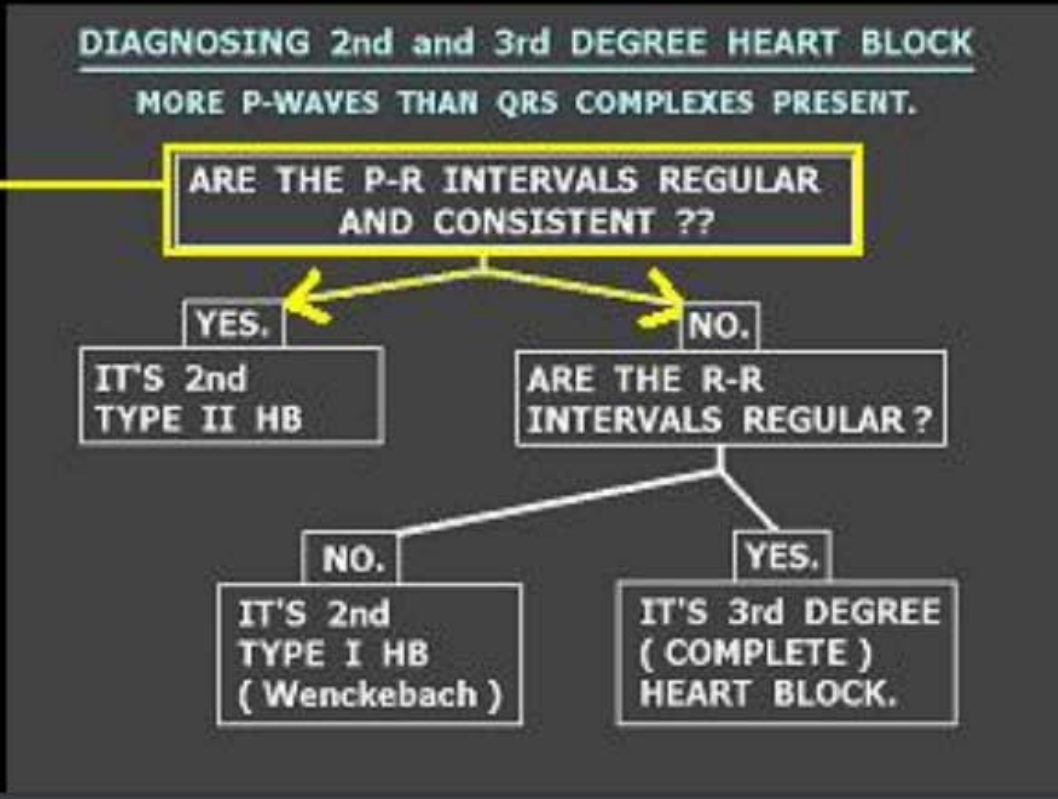
MAIN IDENTIFICATION CHARACTERISTIC(S):

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

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

STEP 1

EVALUATE P-R RELATIONSHIP



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

STEP 1
EVALUATE P - R RELATIONSHIP

STEP 2
EVALUATE R - R INTERVALS

DIAGNOSING 2nd and 3rd DEGREE HEART BLOCK

MORE P-WAVES THAN QRS COMPLEXES PRESENT.

ARE THE P-R INTERVALS REGULAR AND CONSISTENT ??

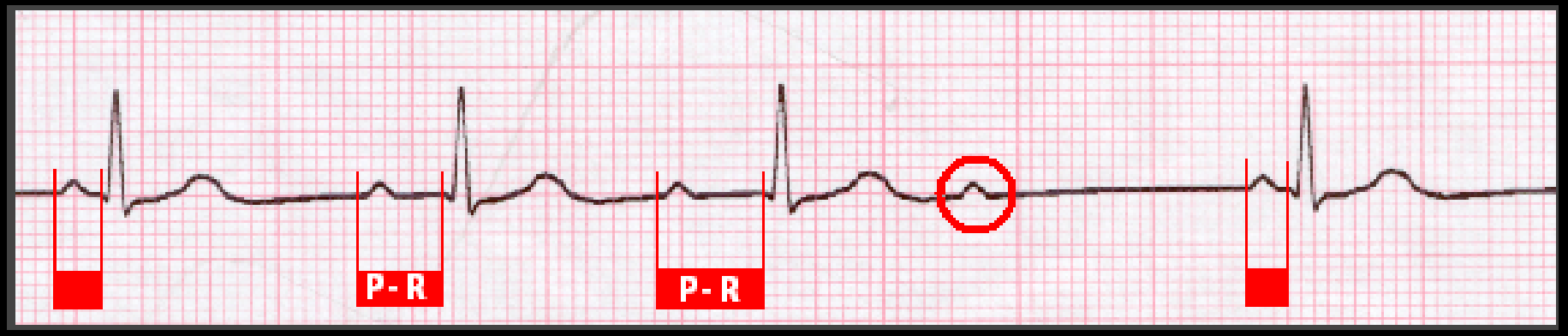
- YES. → IT'S 2nd TYPE II HB
- NO. → ARE THE R-R INTERVALS REGULAR ?
  - NO. → IT'S 2nd TYPE I HB (Wenckebach)
  - YES. → IT'S 3rd DEGREE (COMPLETE) HEART BLOCK.

THIS RHYTHM IS: 2nd° TYPE I HB (Wenckebach)

MAIN IDENTIFICATION CHARACTERISTIC(S):

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

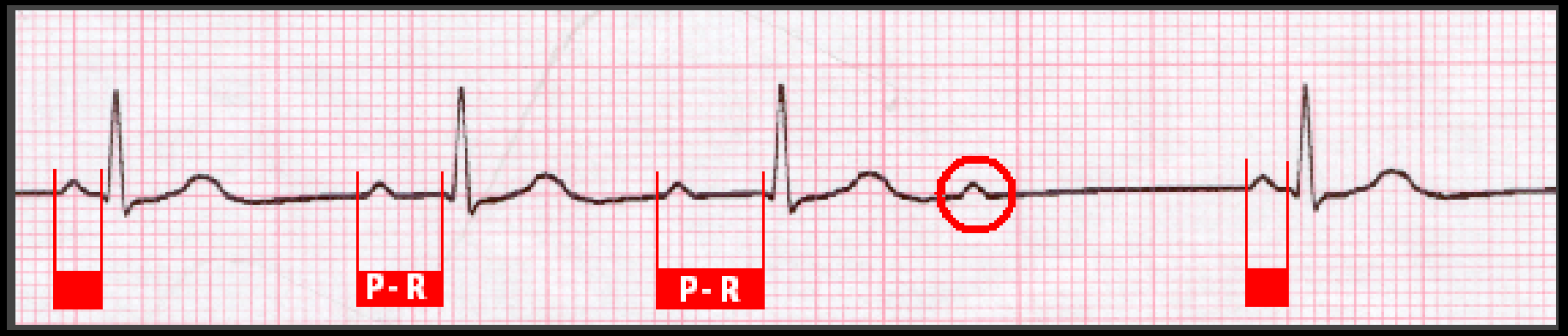
THIS RHYTHM IS: 2nd° TYPE I HB (Wenckebach)



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 -----

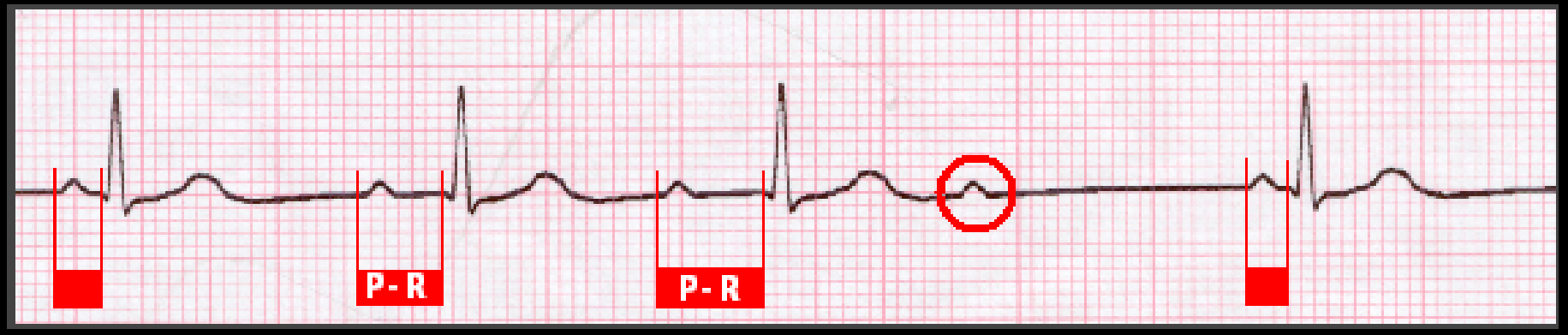
THIS RHYTHM IS: 2nd° TYPE I HB (Wenckebach)



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	VARIES (regularly irregular)
P:QRS RATIO	VAIRES (usually 1:1 and 2:1)
QRS INTERVAL	NORMAL

THIS RHYTHM IS: 2nd° 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° type II, 3°) with SLOWER VENTRICULAR RATE
- PT MAY BE SYMPTOMATIC (SHOCK) FROM ↓ CARDIAC OUTPUT

THIS RHYTHM IS:

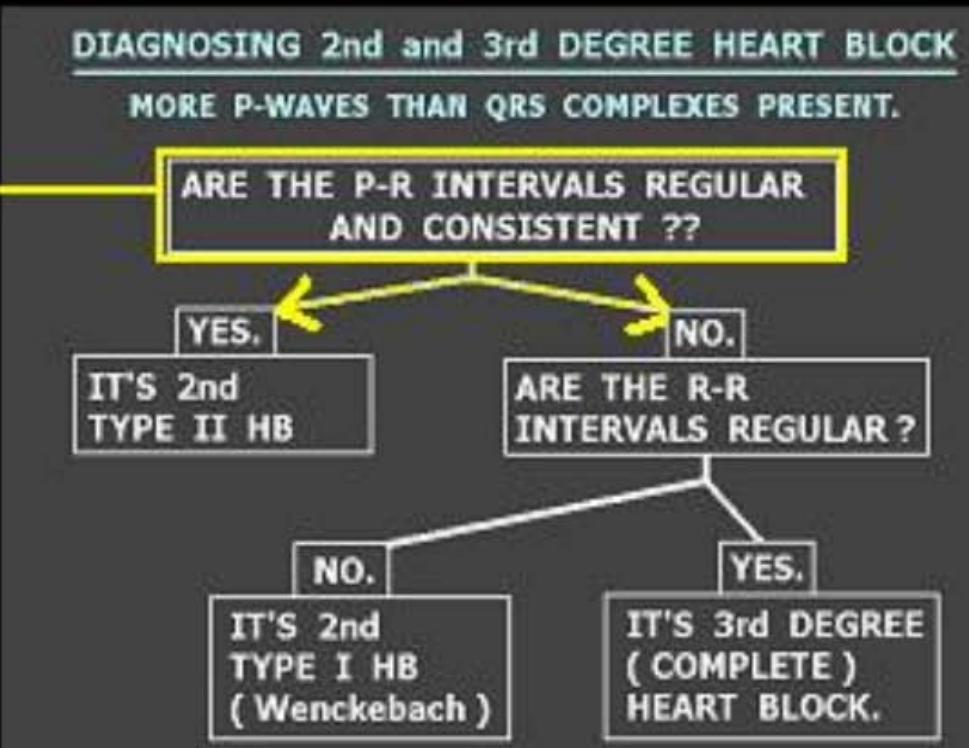
MAIN IDENTIFICATION CHARACTERISTIC(S):

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

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

STEP 1

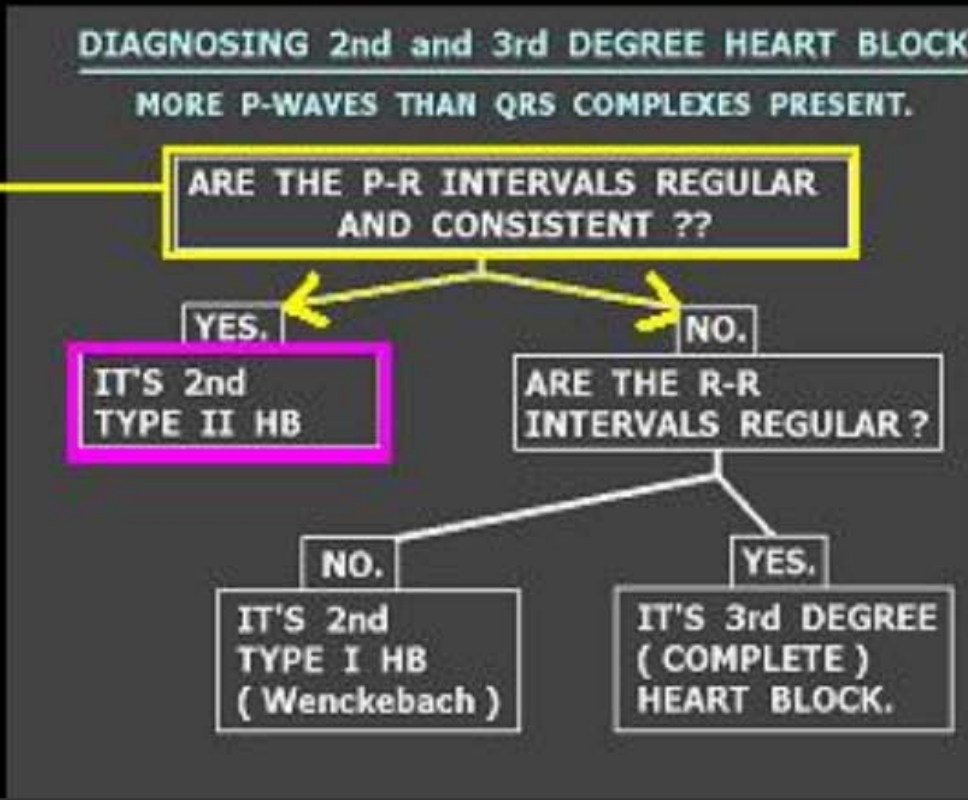
EVALUATE P-R RELATIONSHIP



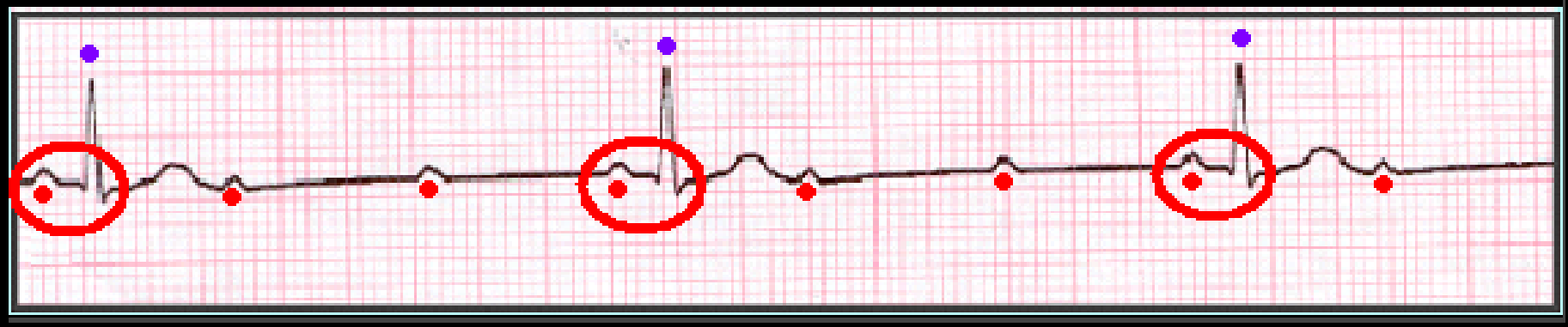
WHEN YOU SEE "EXTRA P WAVES"....

STEP 1

EVALUATE P-R RELATIONSHIP



THIS RHYTHM IS: 2nd° 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

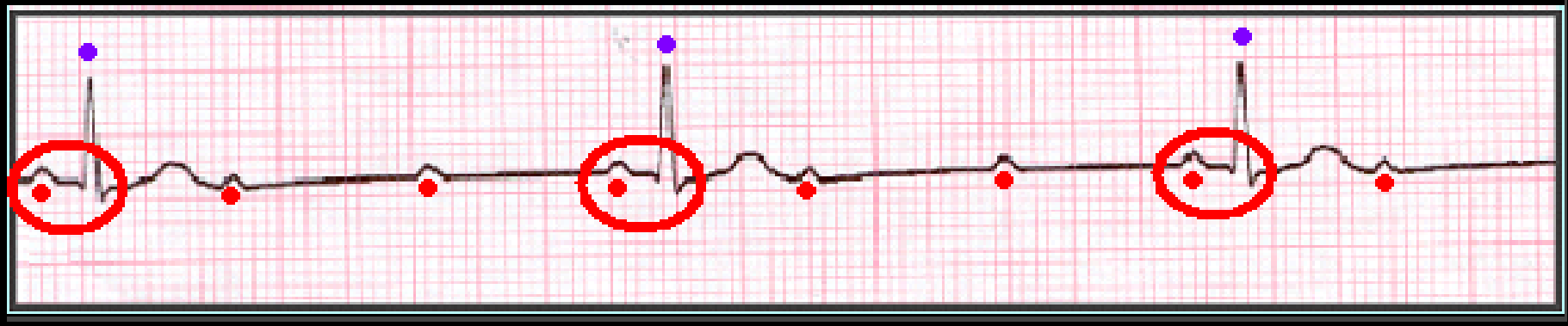
RATE	USUALLY BRADYCARDIC
RHYTHM	USUALLY REGULAR (can be irregular)
P-R INTERVAL	NORMAL and CONSISTENT
P:QRS RATIO	≥ 2:1
QRS INTERVAL	NORMAL

THIS RHYTHM IS: 2nd° 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: 2nd° TYPE II HEART BLOCK

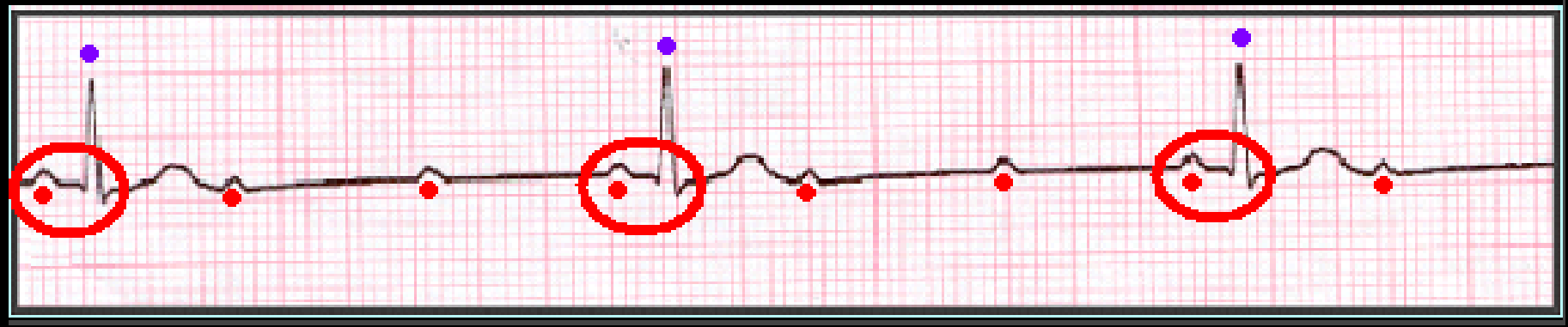


MAIN IDENTIFICATION CHARACTERISTIC(S): MORE THAN ONE P WAVE FOR EACH QRS -- BUT EVERY QRS HAS A NORMAL, CONSISTENT P-R INTERVAL

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 (3rd°) HEART BLOCK

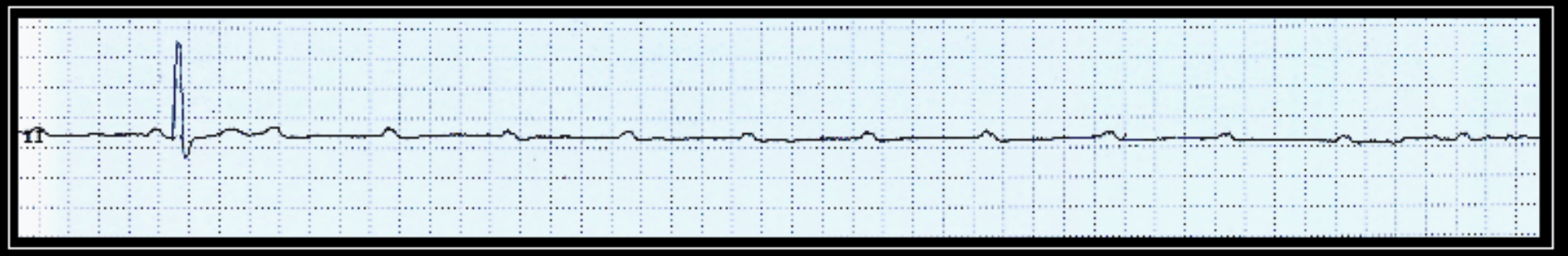
THIS RHYTHM IS: 2nd° TYPE II HEART BLOCK



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, 2nd° TYPE II HB can be more dangerous than 3rd° HB (at least 3rd° Heart Block has an ESCAPE RHYTHM)

ADAMS - STOKES SYNDROME



CASE HISTORY:

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

TX: CPR, Atropine, Transvenous Pacemaker, followed by Permanent Pacemaker Implanation. 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.

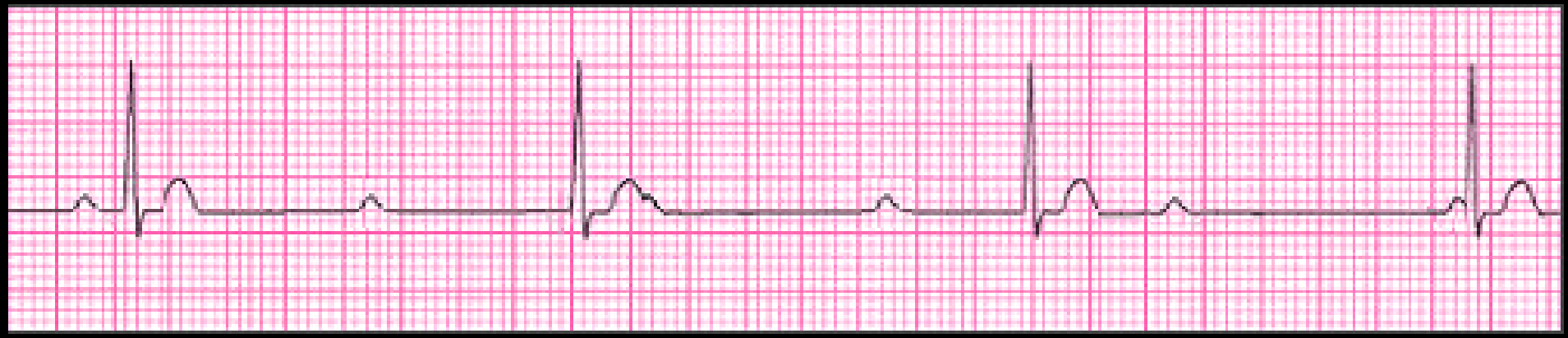
- ARE THE P-R INTERVALS REGULAR AND CONSISTENT ??
  - YES. → IT'S 2nd TYPE II HB
  - NO. → ARE THE R-R INTERVALS REGULAR ?
    - NO. → IT'S 2nd TYPE I HB (Wenckebach)
    - YES. → IT'S 3rd DEGREE (COMPLETE) HEART BLOCK.

THIS RHYTHM IS: 3rd° HB c̄ JUNCTIONAL ESCAPE

MAIN IDENTIFICATION CHARACTERISTIC(S):

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

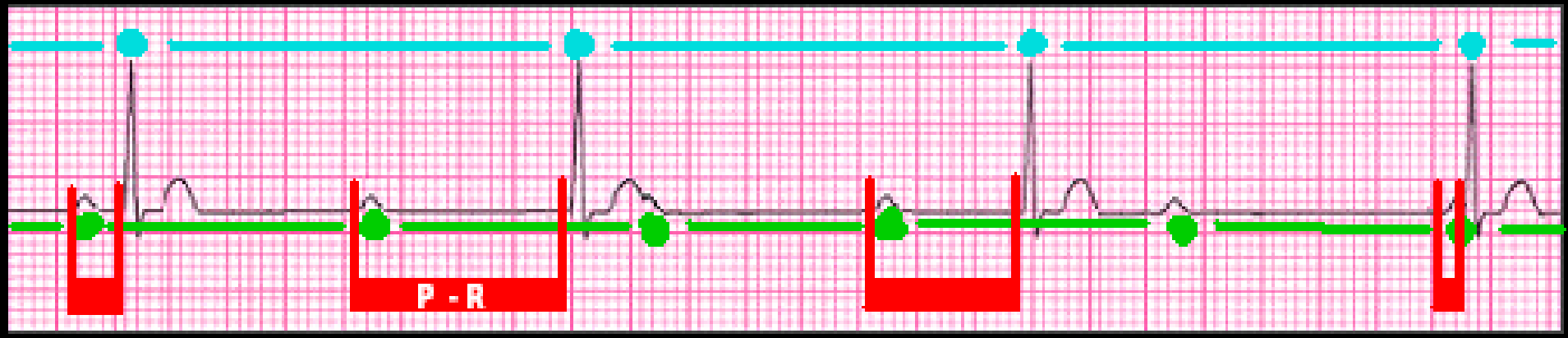
THIS RHYTHM IS: 3rd° HB c JUNCTIONAL ESCAPE



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° HB c̄ JUNCTIONAL ESCAPE



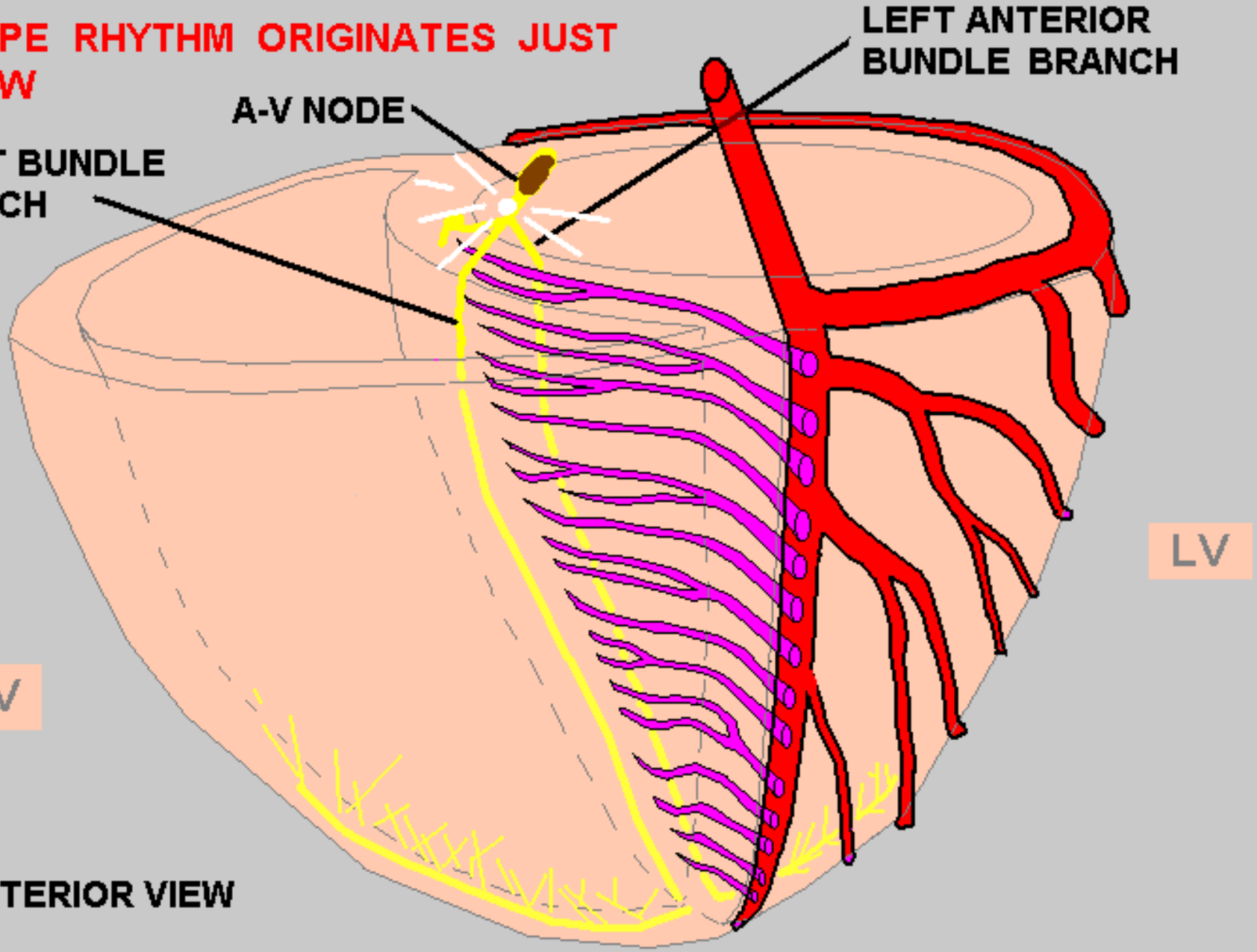
MAIN IDENTIFICATION CHARACTERISTIC(S): P - R INTERVAL INCOSISTENT, P - P INTERVALS REGULAR, R - R INTERVALS REGULAR -- NO RELATIONSHIP BETWEEN P WAVES AND QRS COMPLEXES.

POTENTIAL PROBLEMS:

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

FAILURE AT AV NODE LEVEL

ESCAPE RHYTHM ORIGINATES JUST BELOW



THIS RHYTHM IS:

MAIN IDENTIFICATION CHARACTERISTIC(S):

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

THIS RHYTHM IS: 3rd° HB c̄ IDIOVENTRICULAR ESCAPE

MAIN IDENTIFICATION CHARACTERISTIC(S):

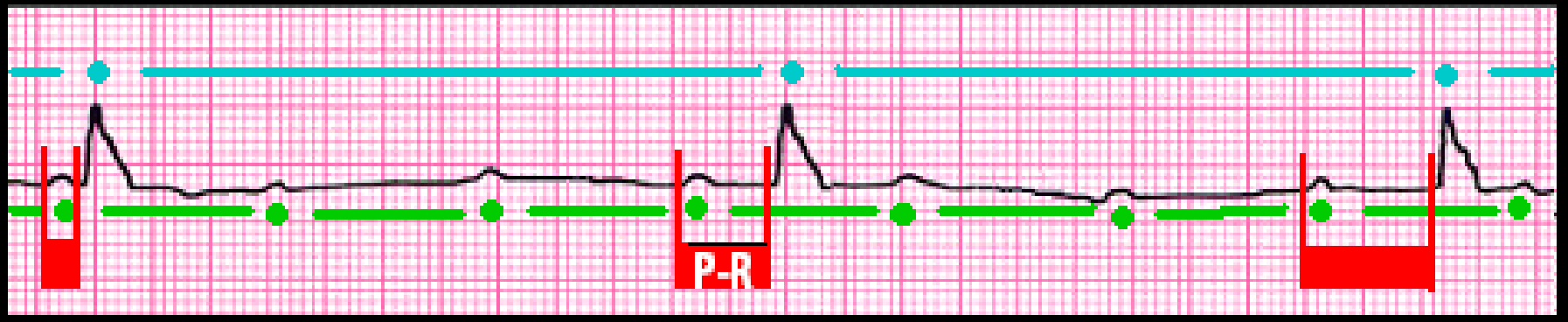
RATE ----------
RHYTHM ----------
P-R INTERVAL -----
P:QRS RATIO -------
QRS INTERVAL -----

THIS RHYTHM IS: 3rd° HB c̄ 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

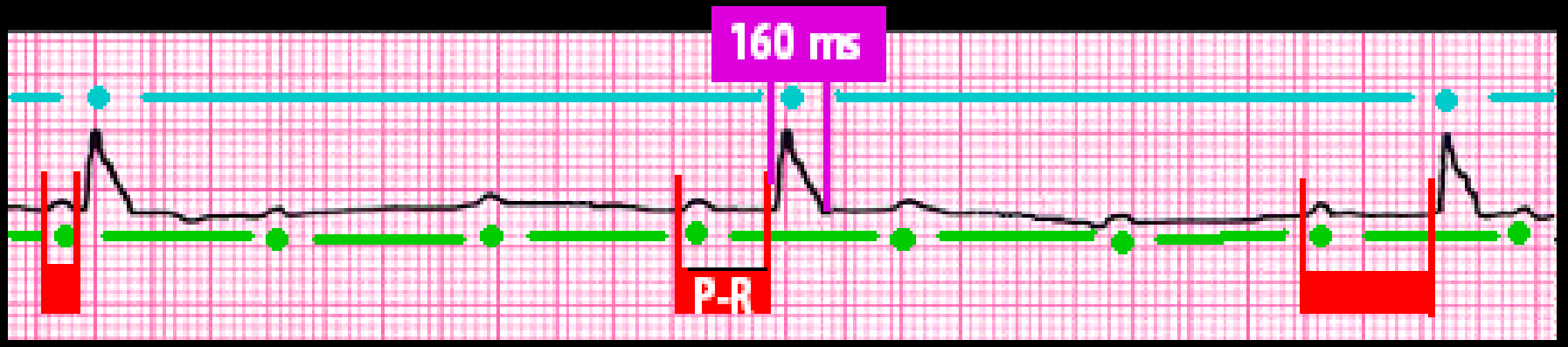
THIS RHYTHM IS: 3rd° HB c IDIOVENTRICULAR ESCAPE



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° HB c IDIOVENTRICULAR ESCAPE



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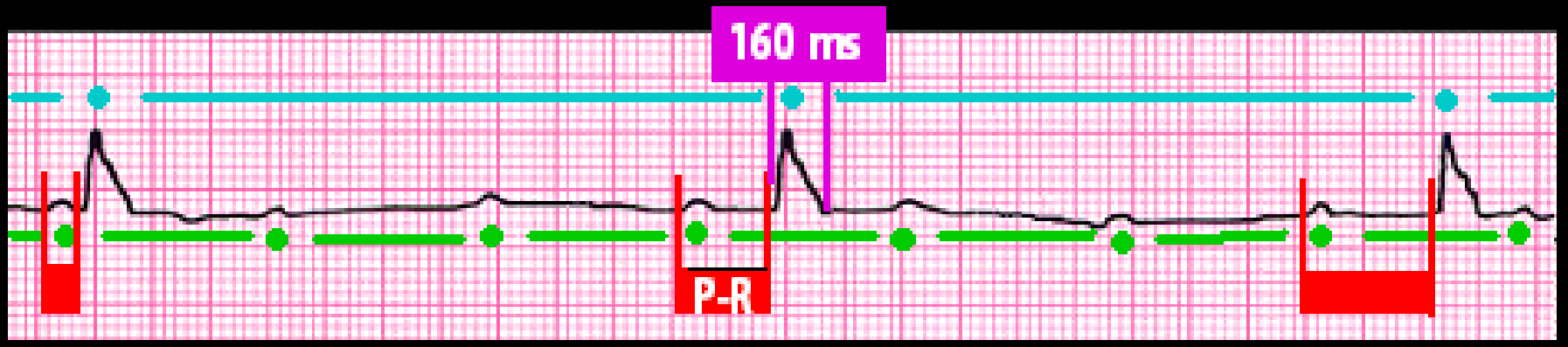
RATE	USUALLY BRADYCARDIC (< 40 VENTRICULAR RATE)
RHYTHM	REGULAR
P-R INTERVAL	INCONSISTENT (irregularly irregular)
P:QRS RATIO	VARIES - USUALLY > 2 : 1
QRS INTERVAL	WIDER THAN 120 ms

THIS RHYTHM IS: 3rd° HB c IDIOVENTRICULAR ESCAPE



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POTENTIAL PROBLEMS:

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

SEP–2006 ST. JOSEPH'S HOSPITAL

95 yr
Female Caucasian

Loc:3 Option:23

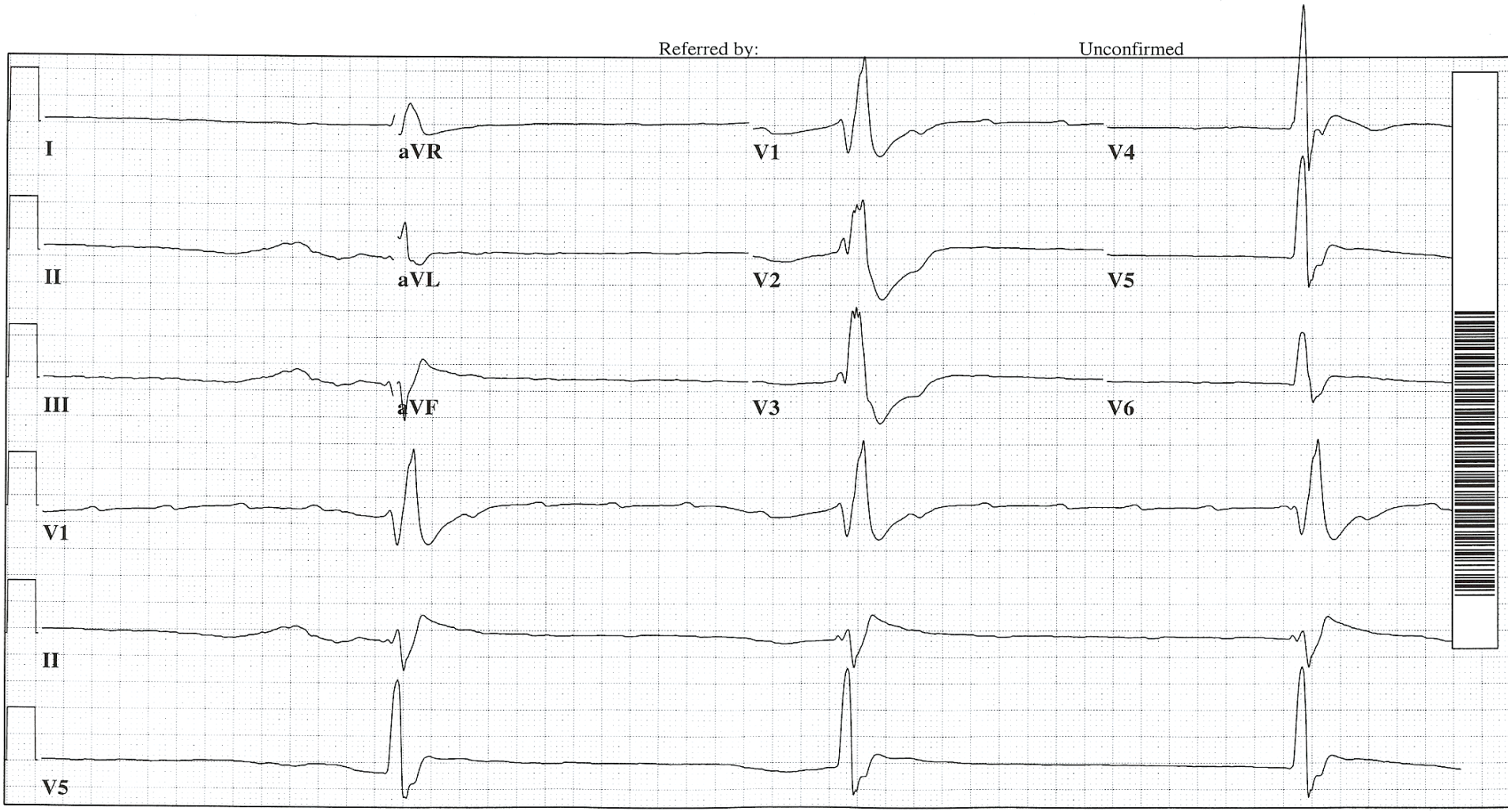
Vent. rate	18	BPM
PR interval	*	ms
QRS duration	226	ms
QT/QTc	706/385	ms
P–R–T axes	* –79	80

*** 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

Technician:

Referred by:

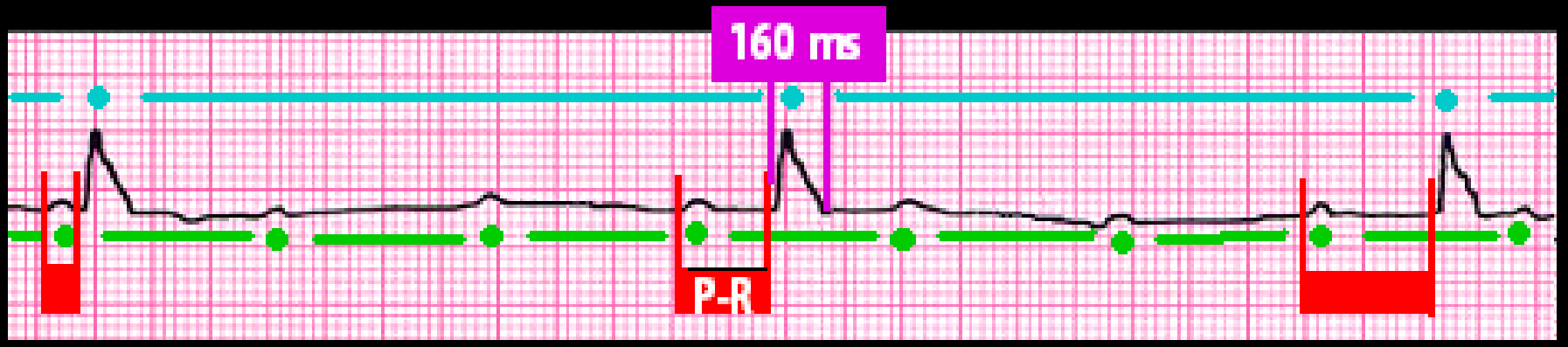
Unconfirmed



25mm/s 10mm/mV 40Hz 005C 12SL 235 CID: 4

EID:Unconfirmed EDT: ORDER:

THIS RHYTHM IS: 3rd° HB c IDIOVENTRICULAR ESCAPE



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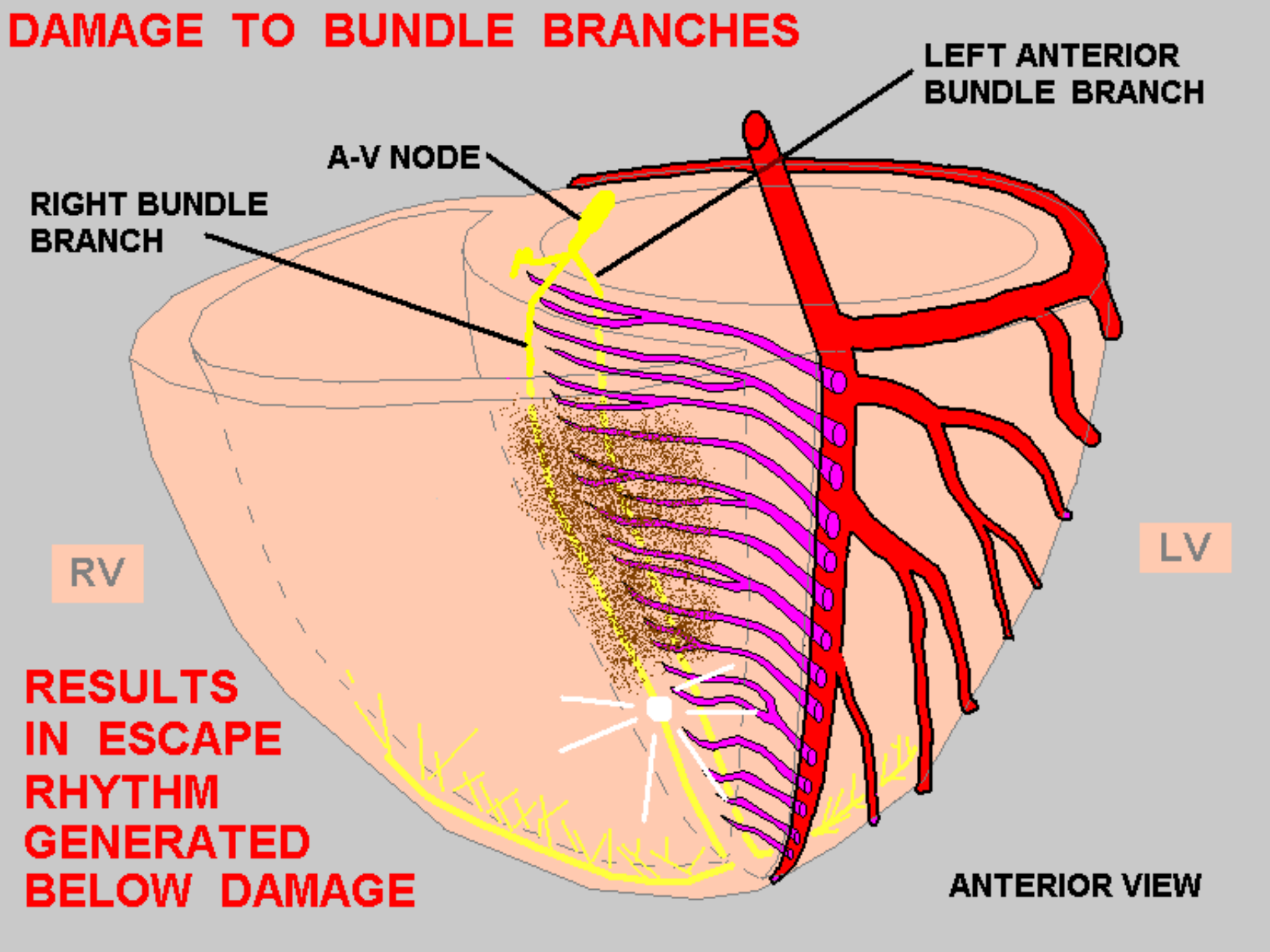
Tx NOTE: PRIMARY EMERGENT TREATMENT IS TRANSCUTANEOUS PACEMAKER. - ATROPINE MOST LIKELY WILL NOT WORK (DUE TO INFRA-HISIAN BLOCK)

DAMAGE TO BUNDLE BRANCHES



RESULTS IN ESCAPE RHYTHM GENERATED BELOW DAMAGE


II

???

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++ CH BLOCKERS
- INFILTRATIVE DISEASE — AMYLOIDOSIS / HEMOCHROMATOSIS
- INFLAMMATORY DISEASE — PERICARDITIS / MYOCARDITIS / RHEUMATIC DISORDERS
- LEV'S DISEASE — LENEGRE'S SYNDROME
- AORTIC / MITRAL ANNULAR CALCIFICATION

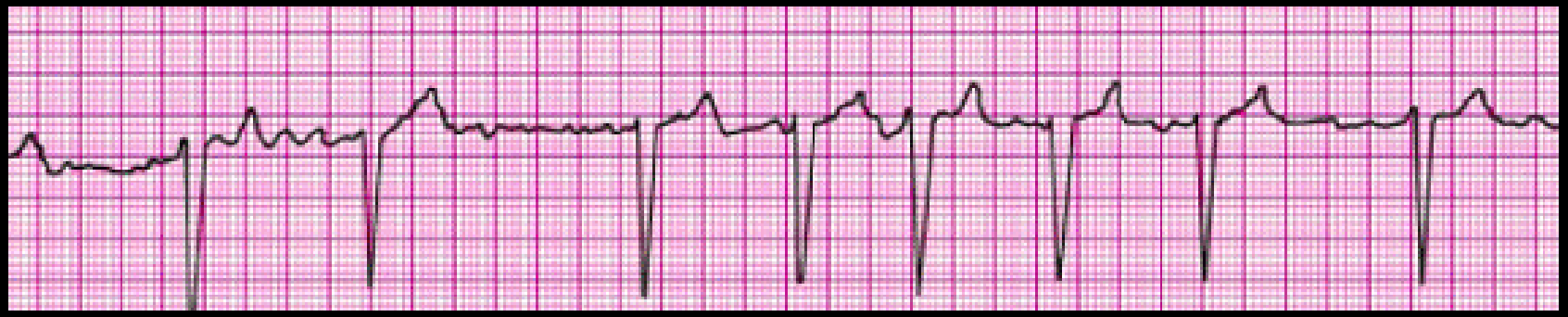
SINUS ARREST.

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

Hemodynamic Concerns: Patient may experience syncope,
cardiac arrest

Treatment: Atropine, CPR, Pacemaker

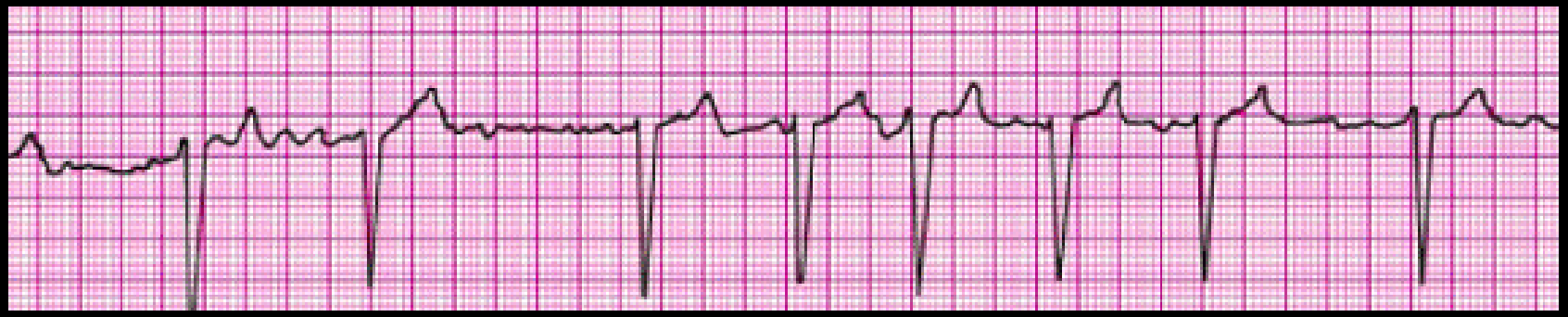
THIS RHYTHM IS:



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

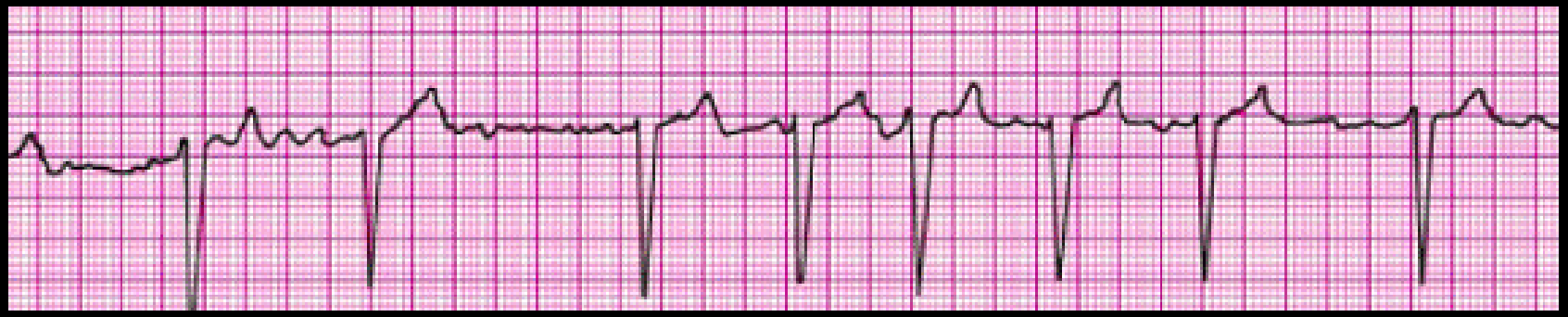
THIS RHYTHM IS: ATRIAL FIBRILLATION



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

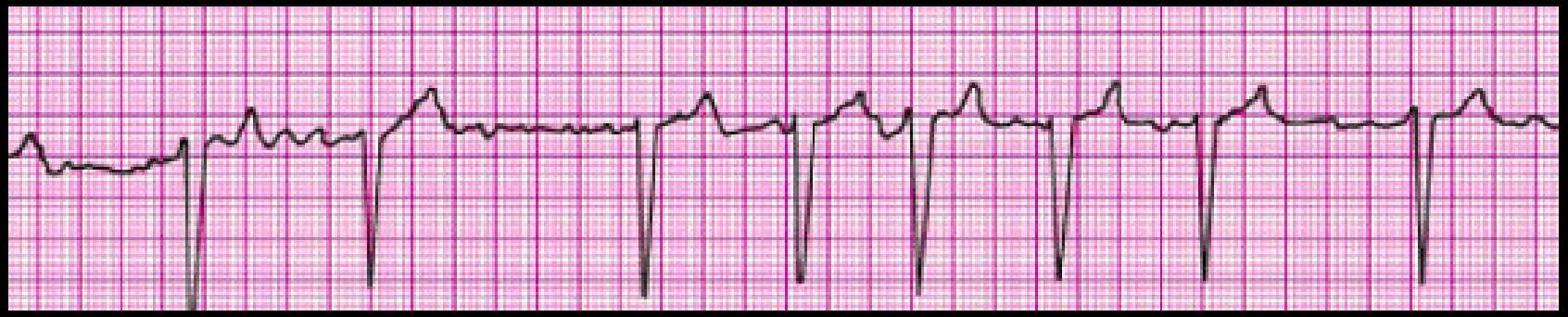
THIS RHYTHM IS: ATRIAL FIBRILLATION



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

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

THIS RHYTHM IS: ATRIAL FIBRILLATION

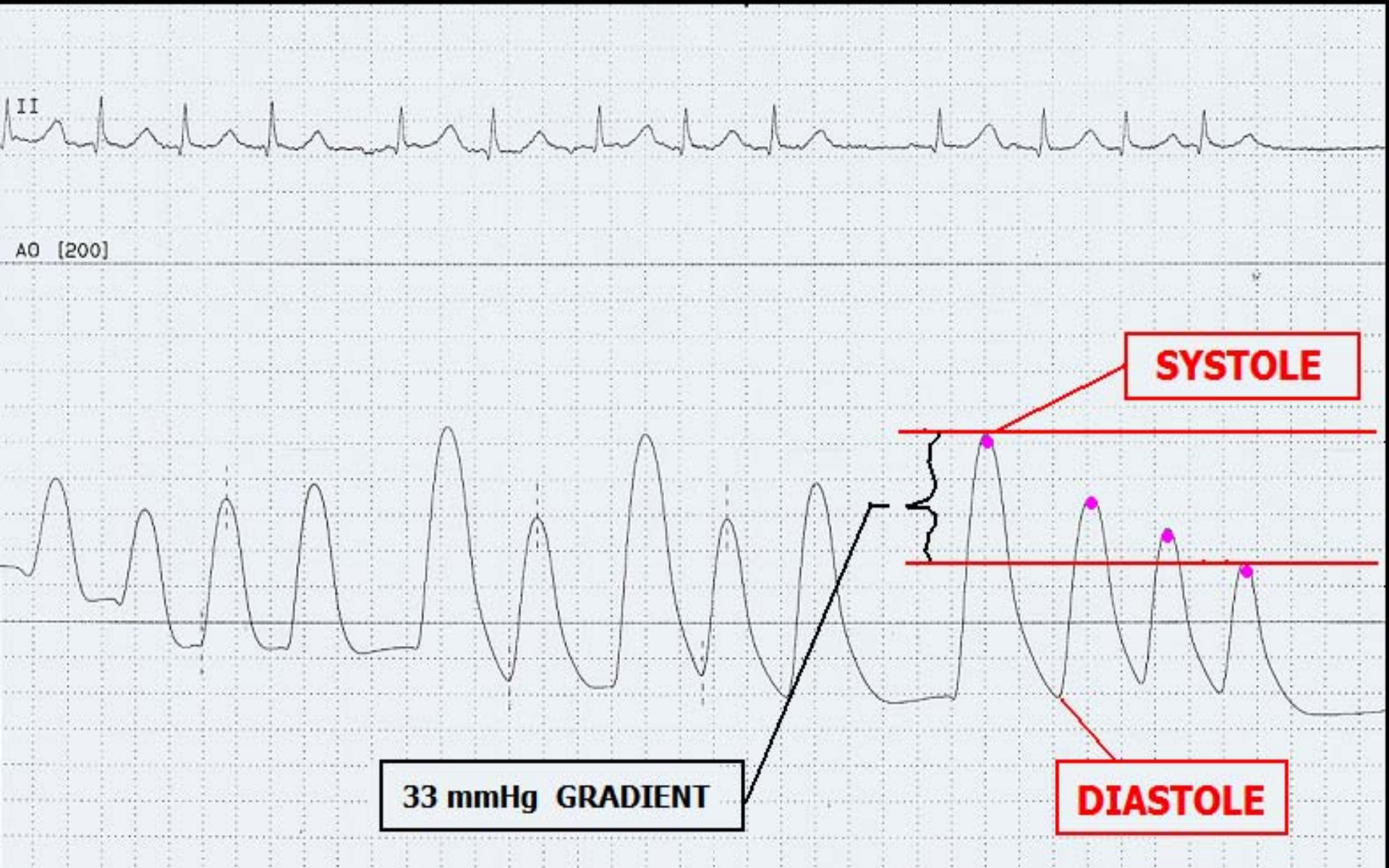


MAIN IDENTIFICATION CHARACTERISTIC(S): **IRREGULARLY IRREGULAR R-R INTERVALS, NO DISCERNABLE P WAVES, FIBRILLATORY BASE-LINE. VARYING SYSTOLIC BLOOD PRESSURE WITH EACH HEART BEAT**

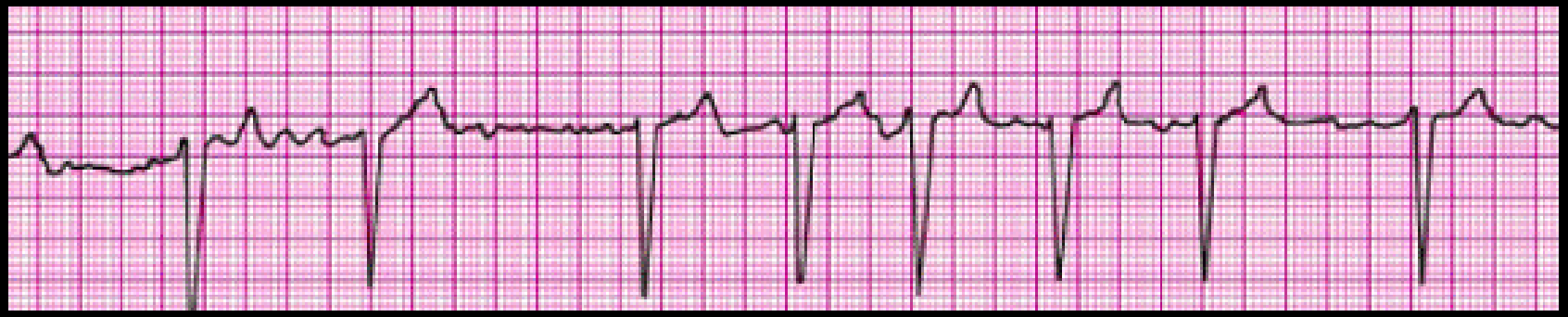
RATE	BRADY, NORMAL, or TACHY
RHYTHM	IRREGULARLY IRREGULAR
P-R INTERVAL	NOT DISCERNABLE
P:QRS RATIO	NOT DISCERNABLE
QRS INTERVAL	NORMAL, (unless BBB present)

The effects of ATRIAL FIBRILLATION on BLOOD PRESSURE

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



THIS RHYTHM IS: ATRIAL FIBRILLATION

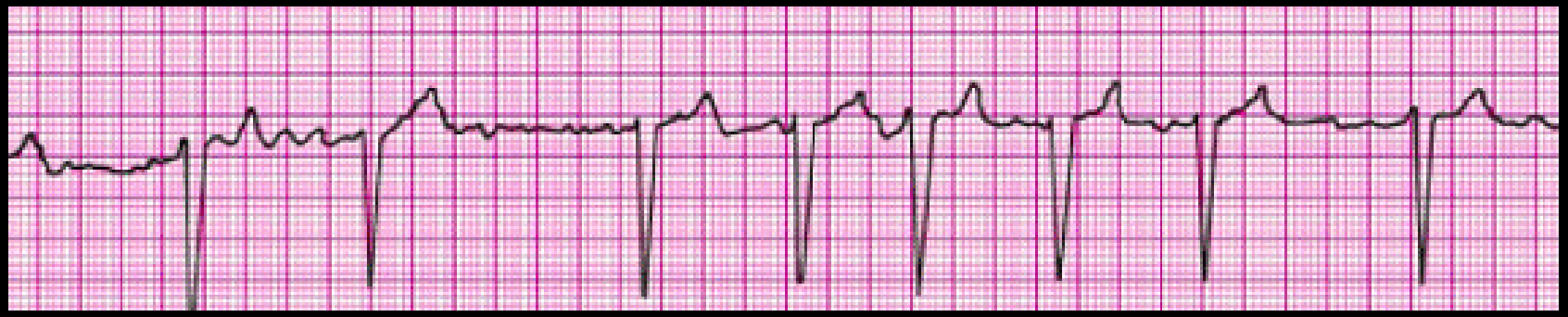


MAIN IDENTIFICATION CHARACTERISTIC(S): **IRREGULARLY IRREGULAR R-R INTERVALS, NO DISCERNABLE P WAVES, FIBRILLATORY BASE-LINE.**

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:

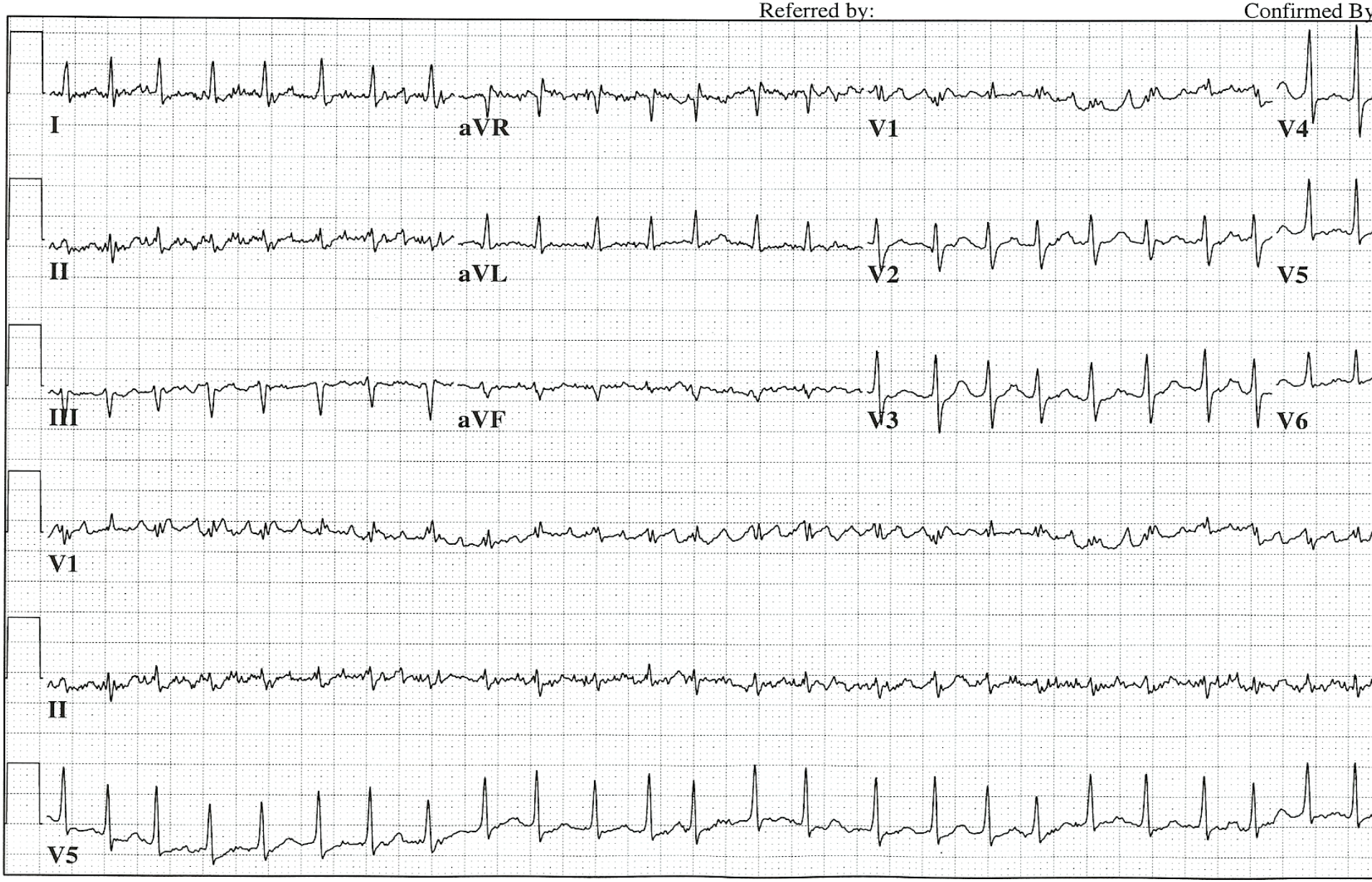
- NEED FOR EMERGENCY INTERVENTION FOR A-FIB IS BASED ON PATIENT'S VENTRICULAR RATE:
  - ☞ TOO SLOW - SYMPTOMATIC BRADYCARDIA ALGORITHM
  - ☞ TOO FAST - TACHYCARDIA ALGORITHM

Technician:

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

Referred by:

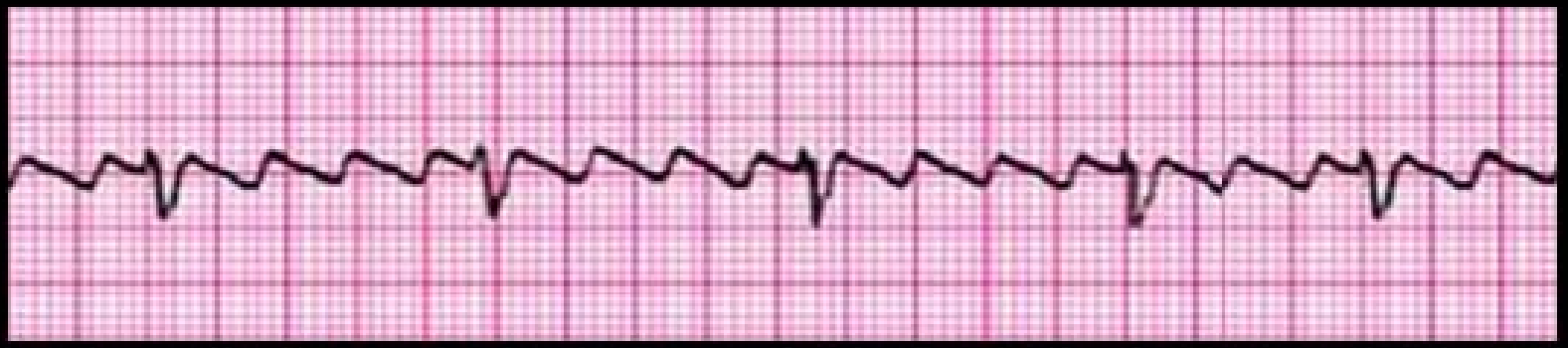
Confirmed By



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

EID:10 ED

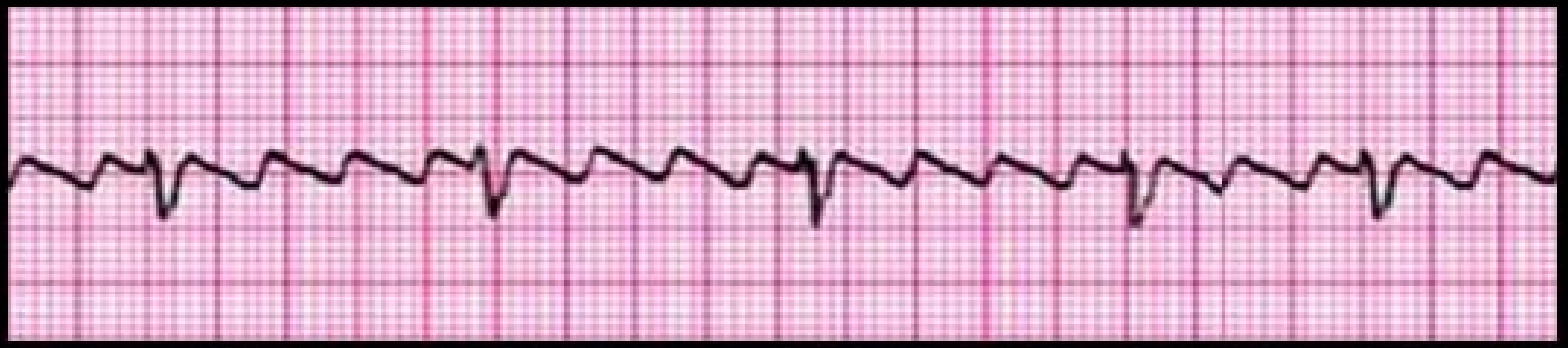
THIS RHYTHM IS:



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

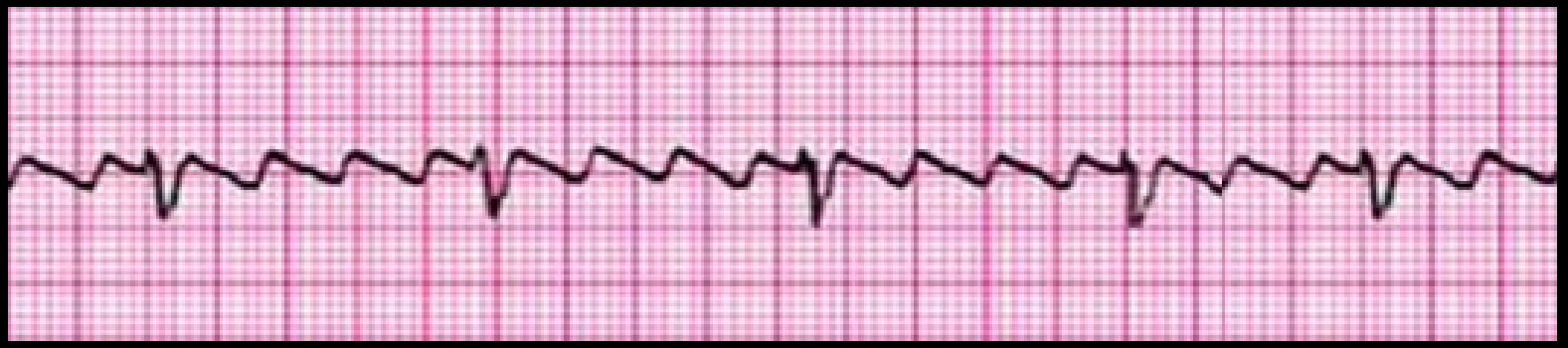
THIS RHYTHM IS: ATRIAL FLUTTER



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

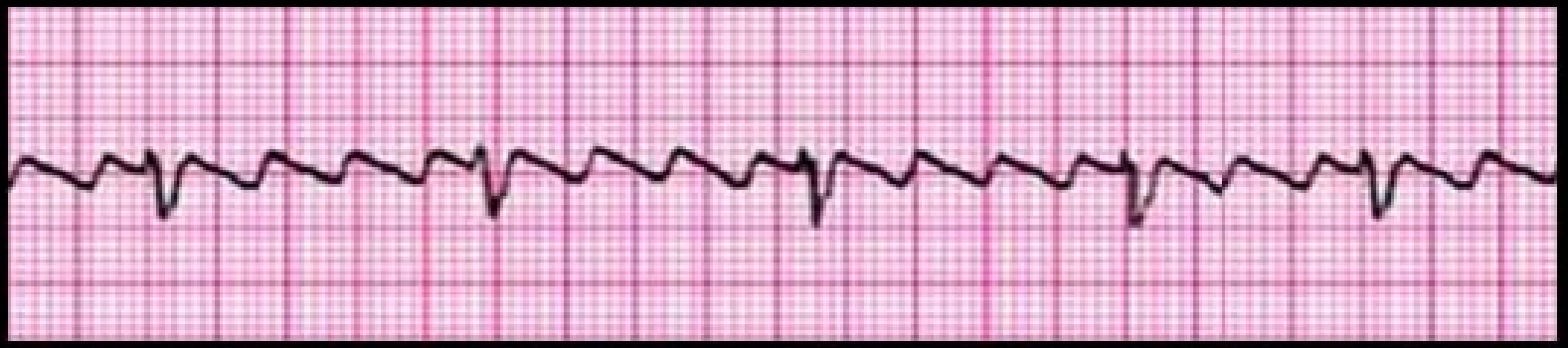
THIS RHYTHM IS: ATRIAL FLUTTER



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

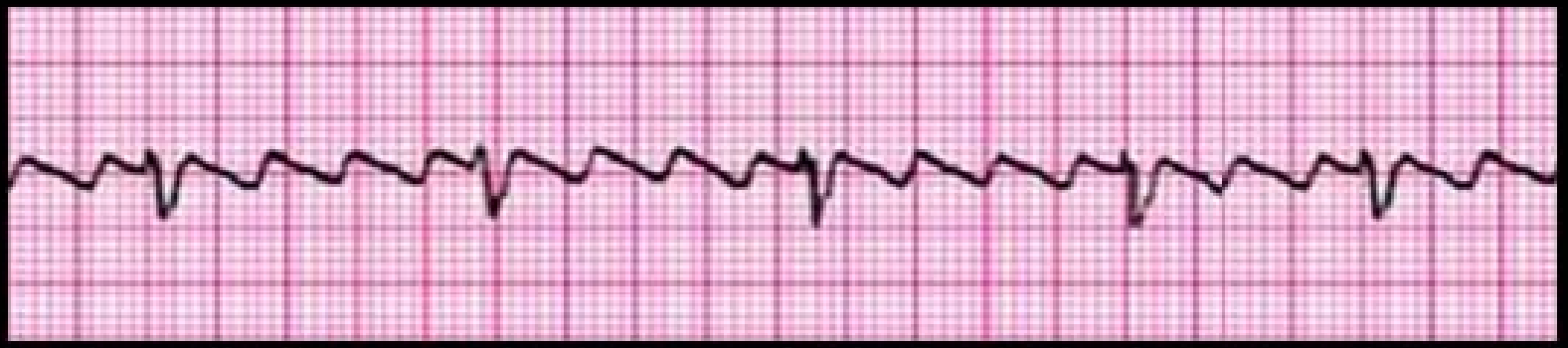


MAIN IDENTIFICATION CHARACTERISTIC(S): RAPID RATE " SAW-TOOTHED " FLUTTER WAVES (F-WAVES)

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

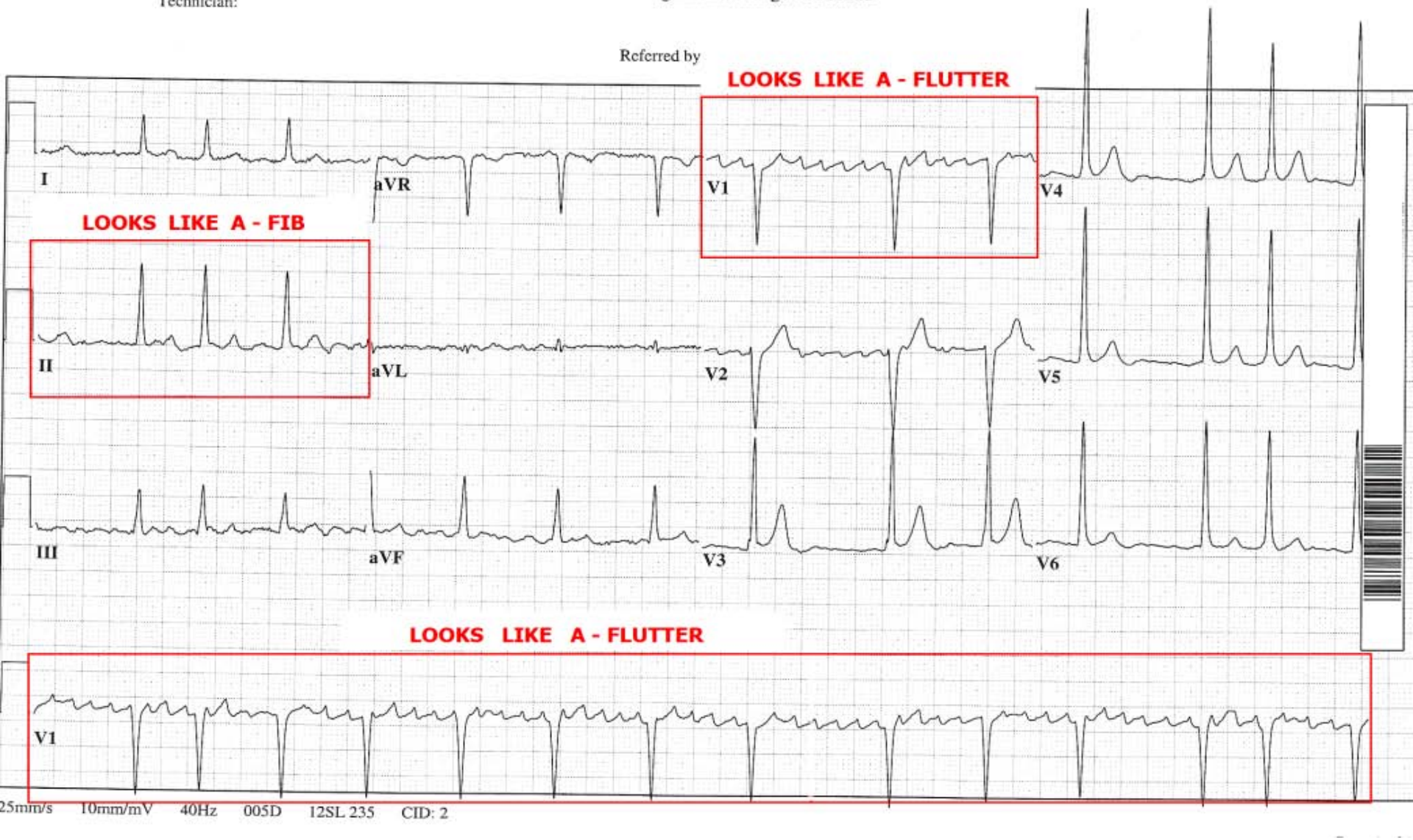
Room:VAM
Loc:3 Option:23

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

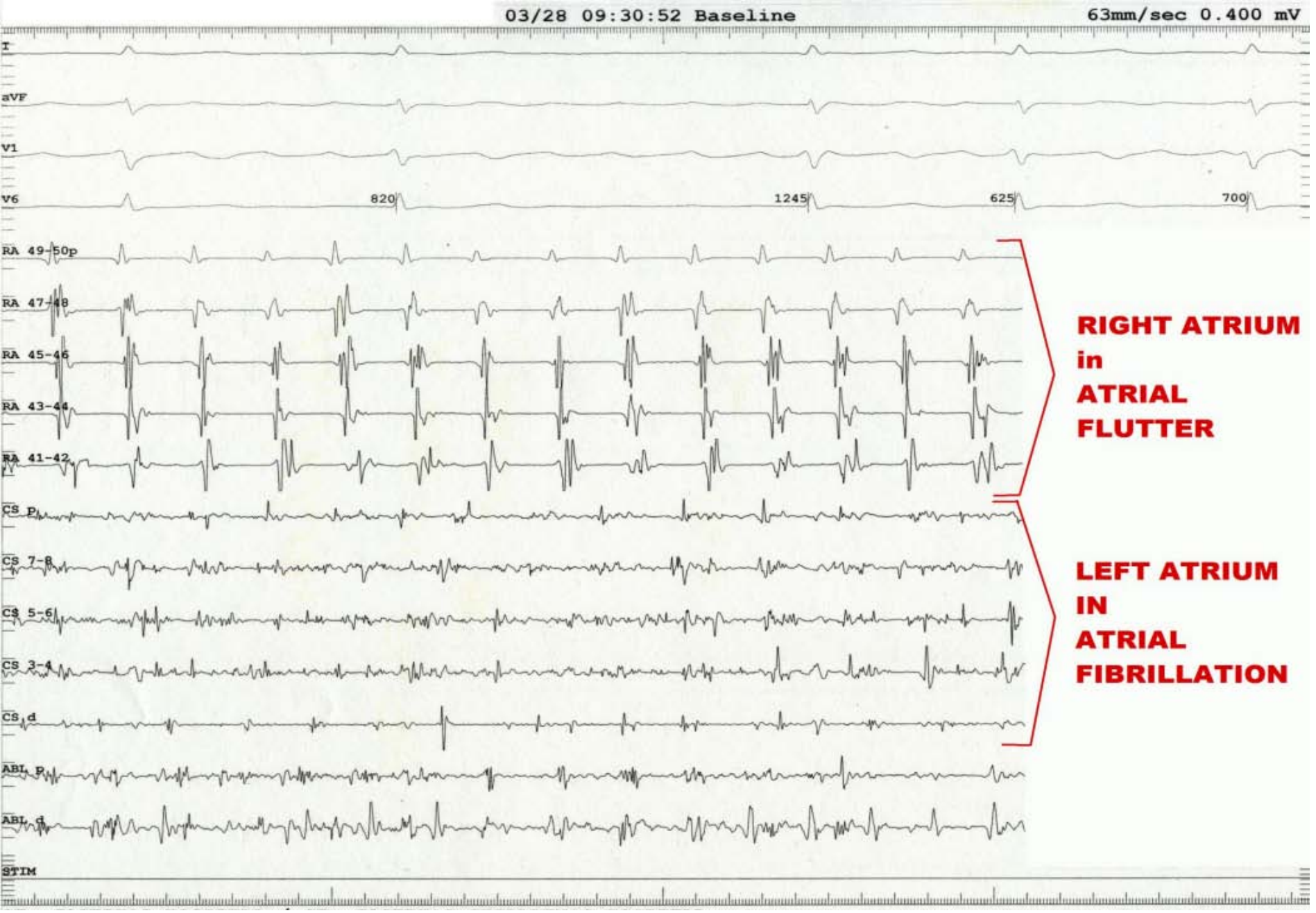
"**UNEDITED COPY: REPORT IS COMPUTER GENERATED ONLY, WITHOUT PHYSICIAN INTERPRETATION".
Atrial fibrillation
Voltage criteria for left ventricular hypertrophy
Abnormal ECG
When compared with ECG of 19-NOV-2006 07:39,
No significant change was found

Technician:

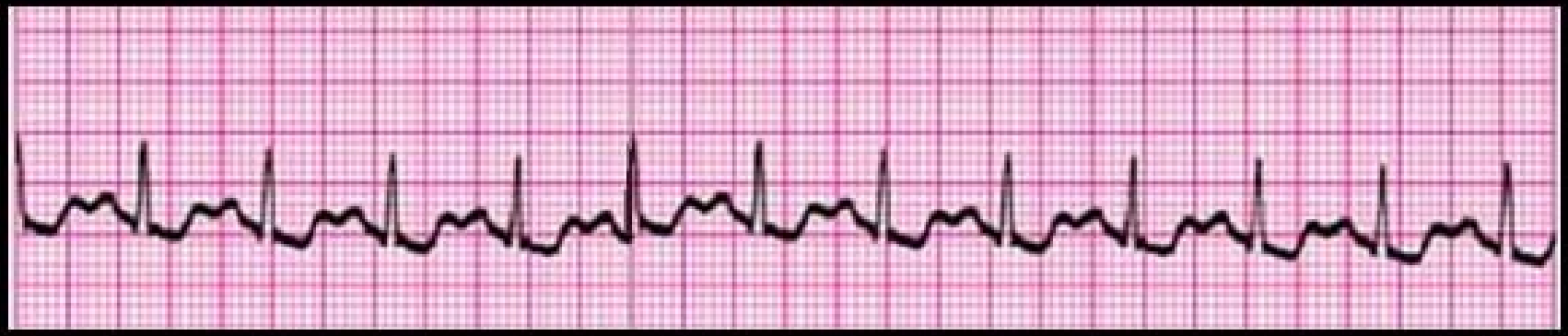
Referred by



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


03/28 09:30:52 Baseline
63mm/sec 0.400 mV
I
aVF
V1
V6
820
1245
625
700
RA 49-50p
RA 47-48
RA 45-46
RA 43-44
RA 41-42
CS p
CS 7-8
CS 5-6
CS 3-4
CS d
ABL p
ABL d
STIM
RIGHT ATRIUM
in
ATRIAL
FLUTTER
LEFT ATRIUM
IN
ATRIAL
FIBRILLATION

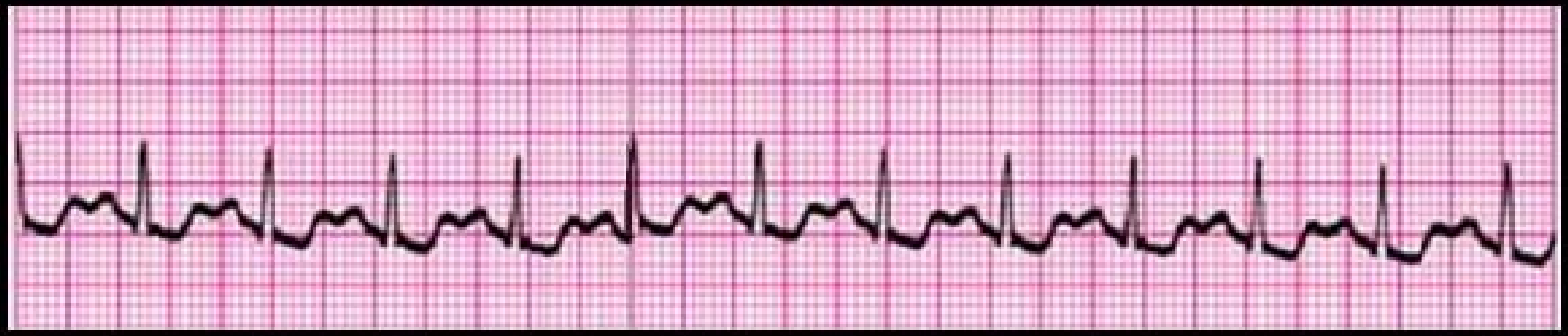
THIS RHYTHM IS:



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

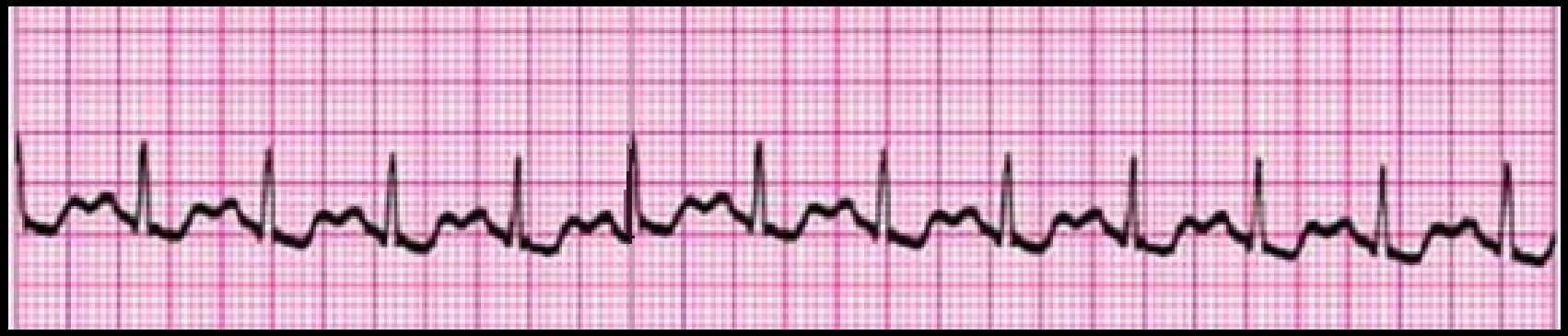
THIS RHYTHM IS: SINUS TACHYCARDIA



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

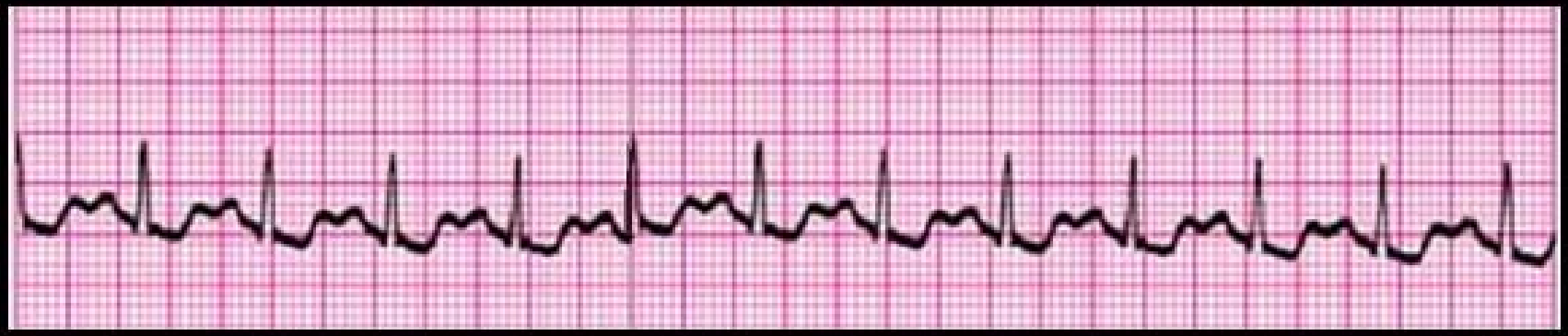
THIS RHYTHM IS: SINUS TACHYCARDIA



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

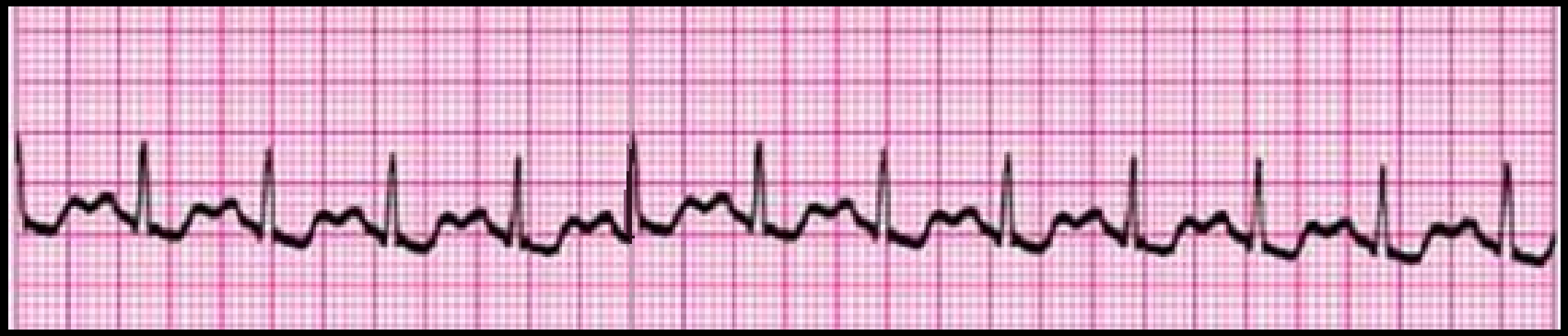


MAIN IDENTIFICATION CHARACTERISTIC(S): SINUS RHYTHM, RATE HIGHER THAN 100. (ACLS guidelines: heart rate 100 - 150)

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

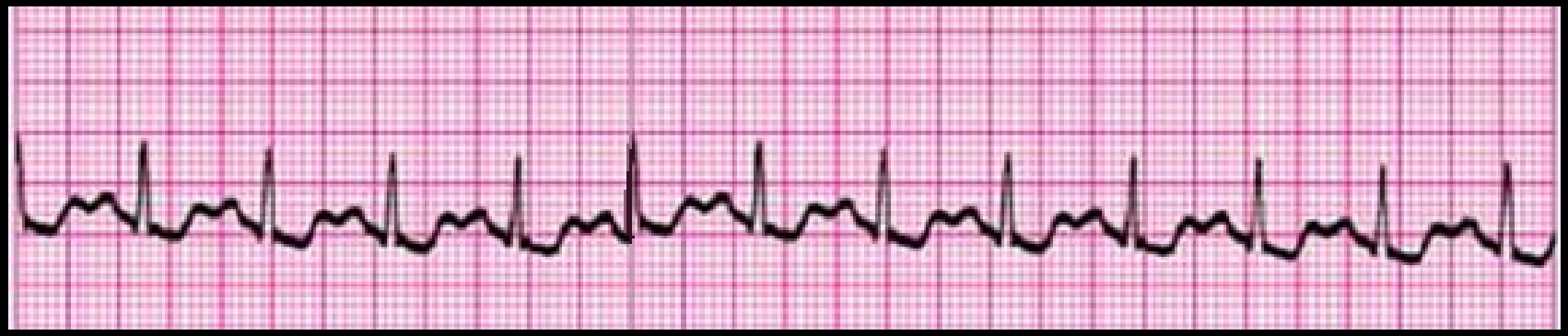


MAIN IDENTIFICATION CHARACTERISTIC(S): SINUS RHYTHM, RATE HIGHER THAN 100. (ACLS guidelines: heart rate 100 - 150)

TREATMENT / INTERVENTIONS :

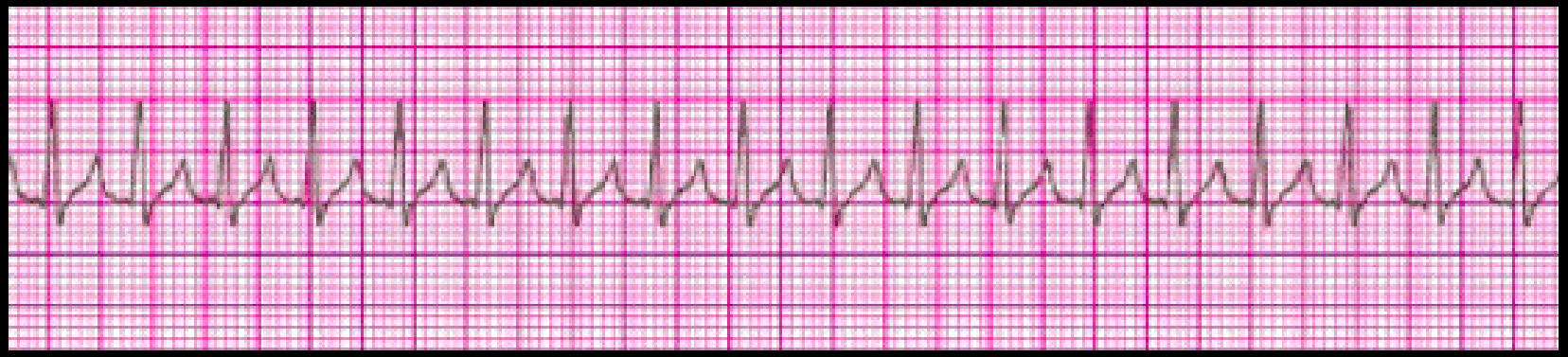
☞ IN MOST CASES, YOU TREAT THE UNDERLYING CAUSE!

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

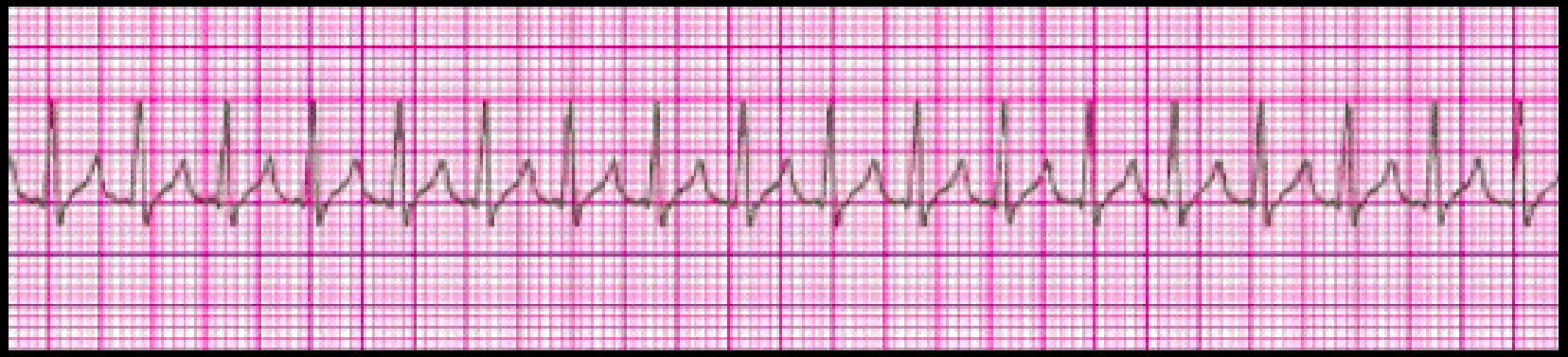
THIS RHYTHM IS:



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

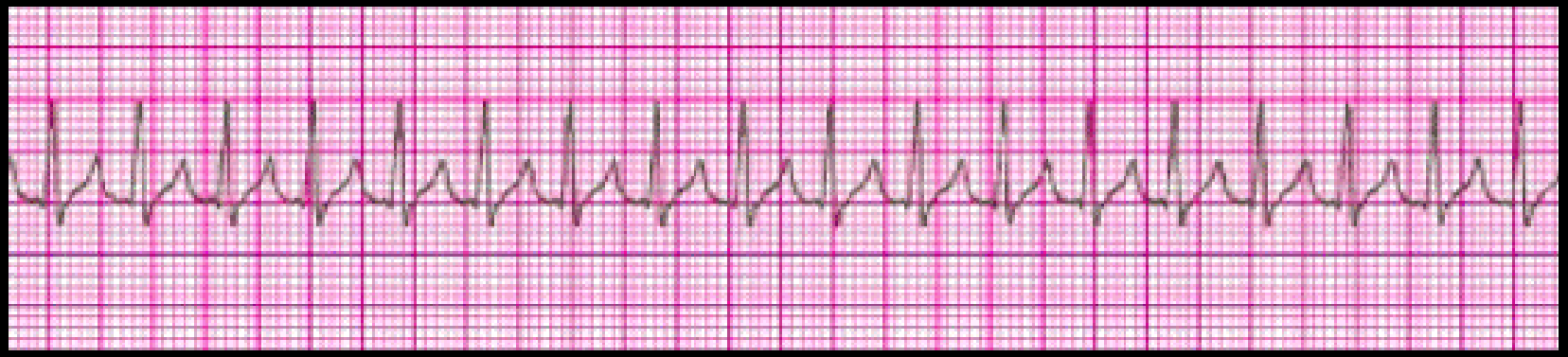
THIS RHYTHM IS: SUPRAVENTRICULAR TACHYCARDIA (SVT)



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."

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

ACLS TACHYCARDIA GUIDELINES

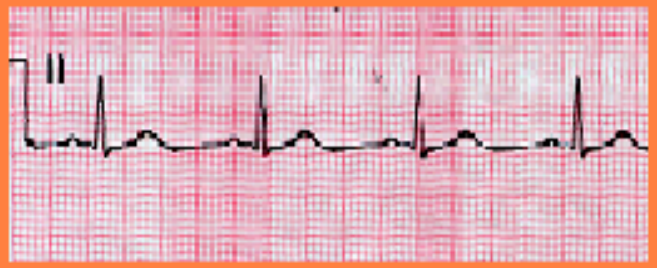
150

100

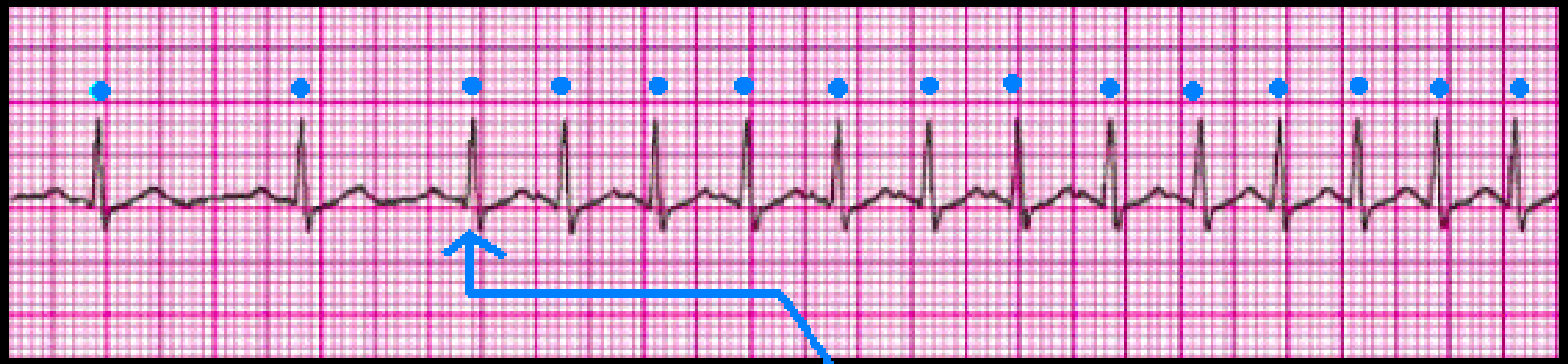
SVT

SINUS TACH

NSR



RHTHYM CLUES . . . .

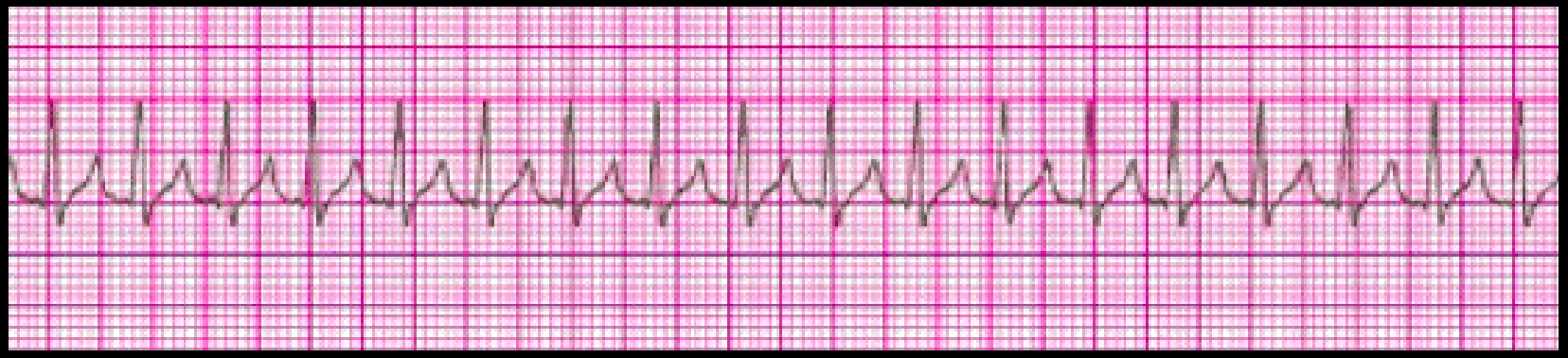


SUPRAVENTRICULAR TACHYCARDIA

SVT is usually PAROXSYMAL -- 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)

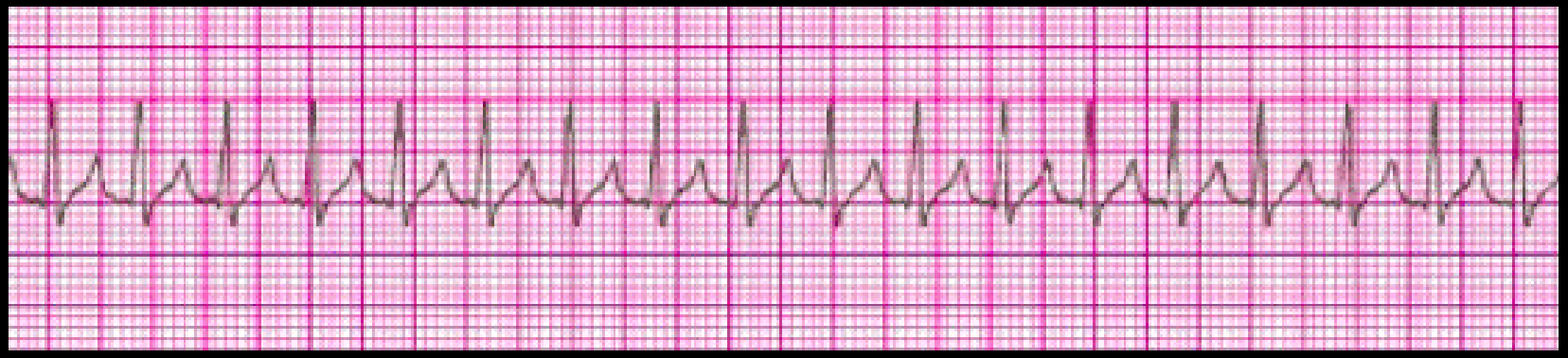


MAIN IDENTIFICATION CHARACTERISTIC(S): HEART RATE TOO FAST, USUALLY > 150. P WAVES MAY BE "BURIED" IN THE PRECEDING T WAVES. Pt USUALLY C/O "SUDDEN ONSET of HEART RACING," or "PALPITATIONS."

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-T seg) or JUST BEFORE QRS (short P-R). WHEN P wave seen, it is INVERTED (upside-down).

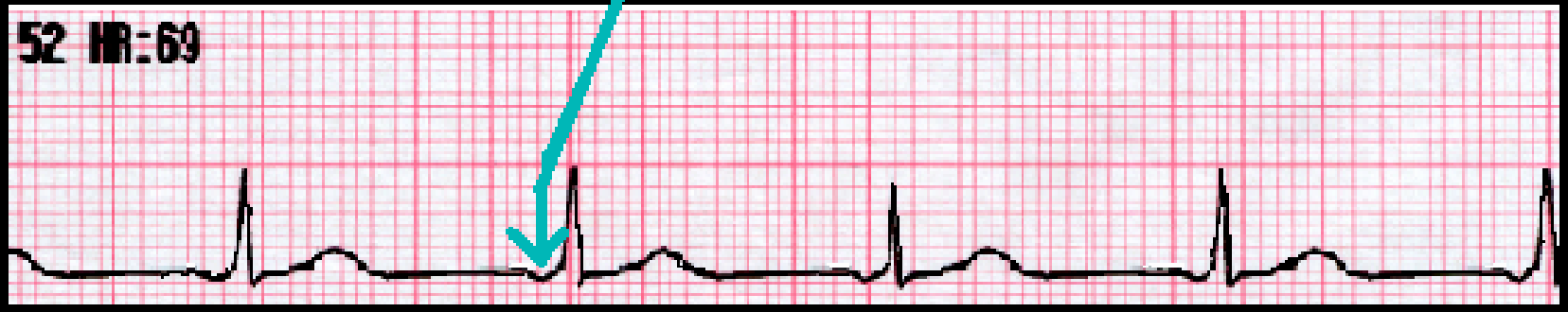
- HR USUALLY 40-60

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-T seg) or JUST BEFORE QRS (short P-R). WHEN P wave seen, it is INVERTED (upside-down).

- HR USUALLY 40 - 60



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- 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-T seg) 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-T seg) 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:		AND TREAT THEM:
INCREASED VAGAL TONE	→	ATROPINE
BLOCKED SA NODAL ARTERY (ACUTE INFERIOR MI ?)	→	CARDIAC CATH - PTCA / STENT THROMBOLYTICS
ELECTROLYTE IMBAL. (K+)	→	CORRECT ELECTROLYTES

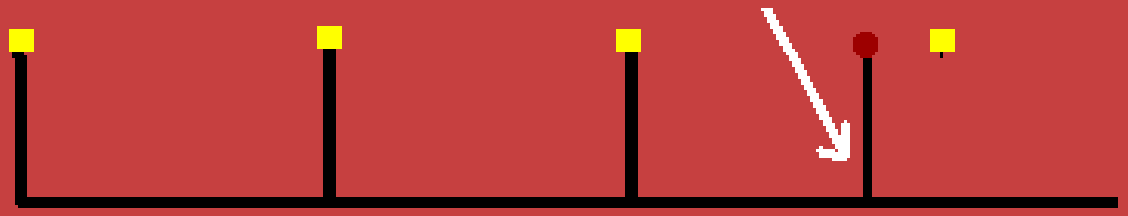
ECTOPY

- ATRIAL
- JUNCTIONAL
- VENTRICULAR

CLASSIFICATIONS OF ECTOPY

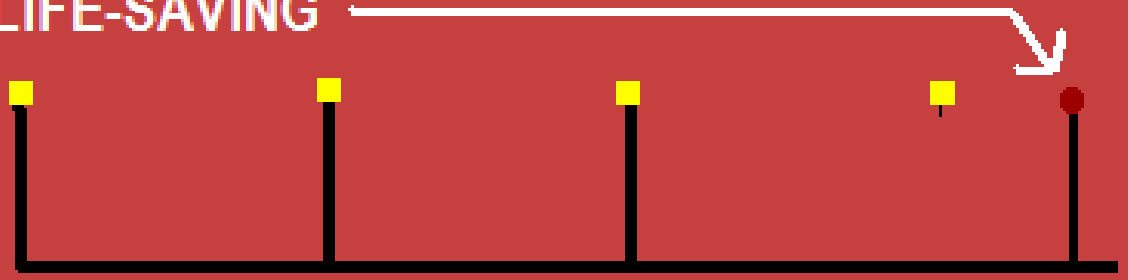
1. PREMATURE

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 IS 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

- FAILUARE 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,

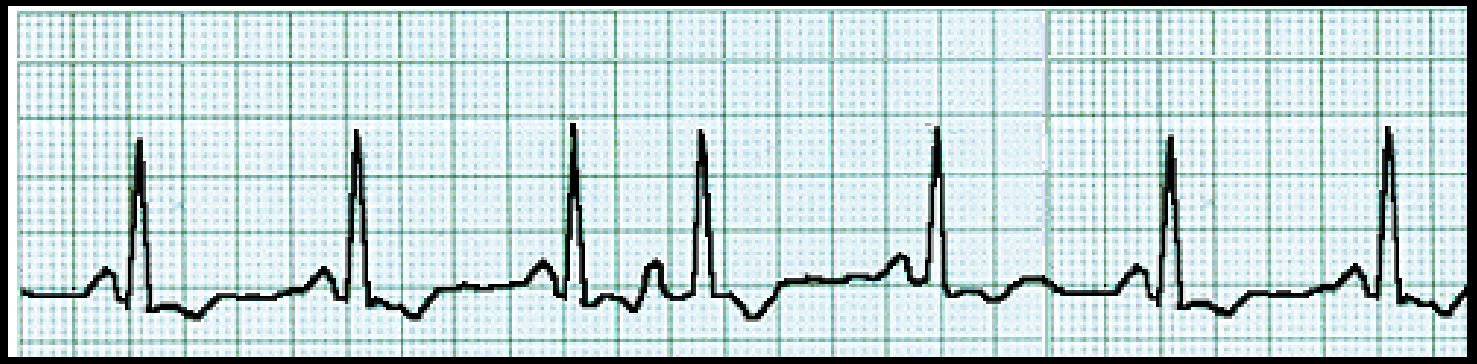
1. PREMATURE BEATS ---- **BAD**

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

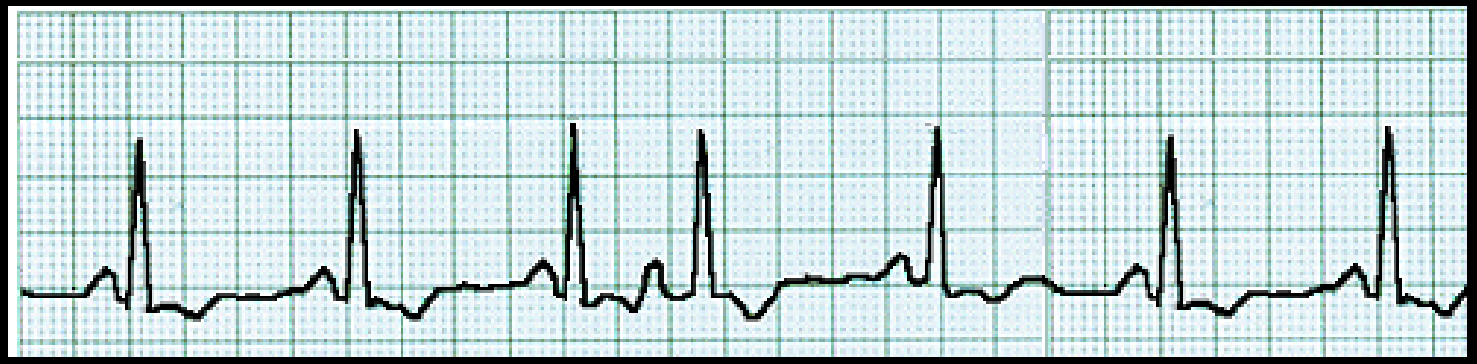
THIS RHYTHM IS:



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

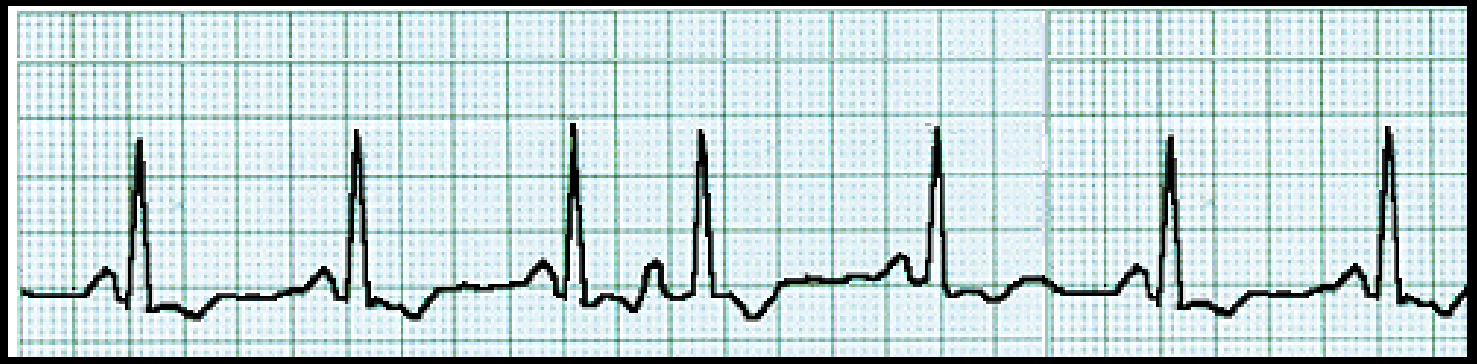
THIS RHYTHM IS: NSR with PAC



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

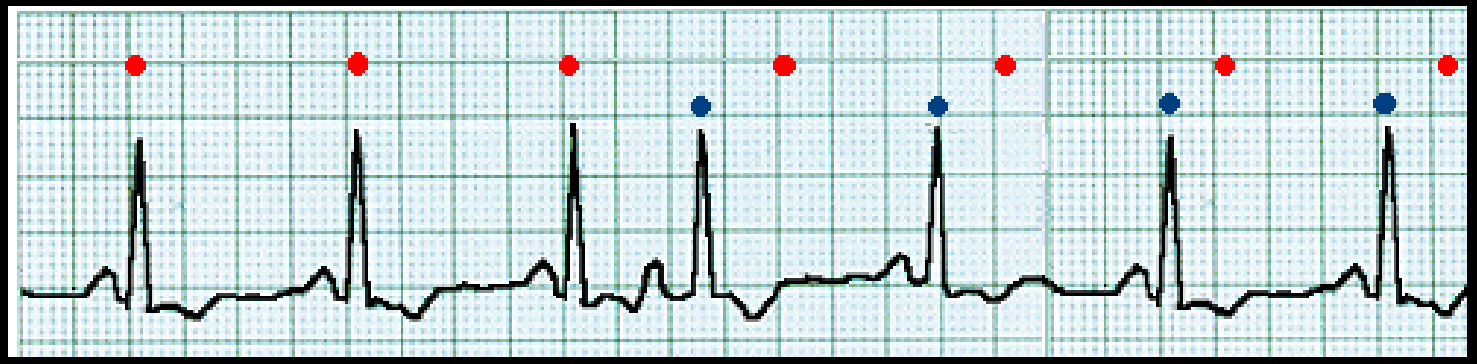
THIS RHYTHM IS: NSR with PAC



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



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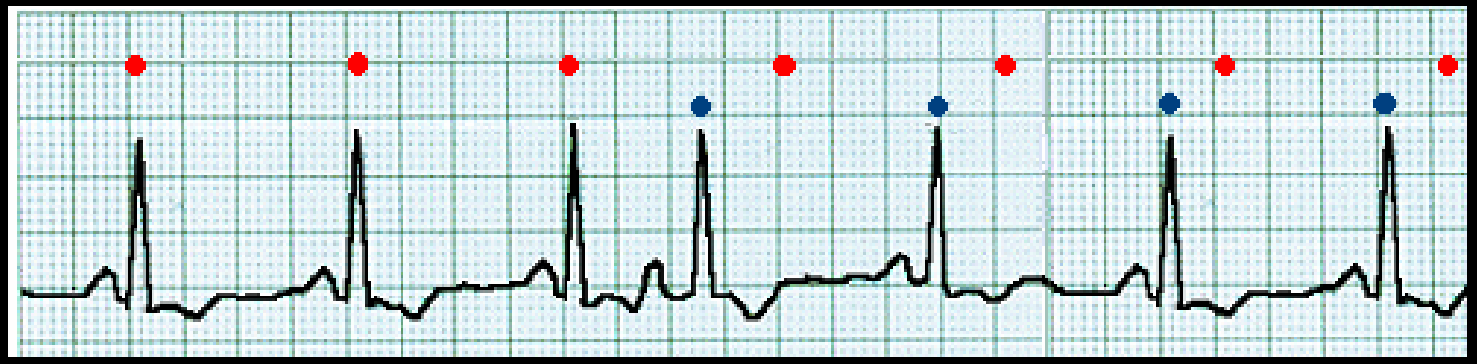
RATE ---------- NORMAL
RHYTHM ---------- IRREGULAR
P-R INTERVAL ------ NORMAL (except PAC may be LONGER or SHORTER)
P:QRS RATIO ------- 1:1
QRS INTERVAL ----- NORMAL (unless BBB present)

THIS RHYTHM IS: NSR with PAC



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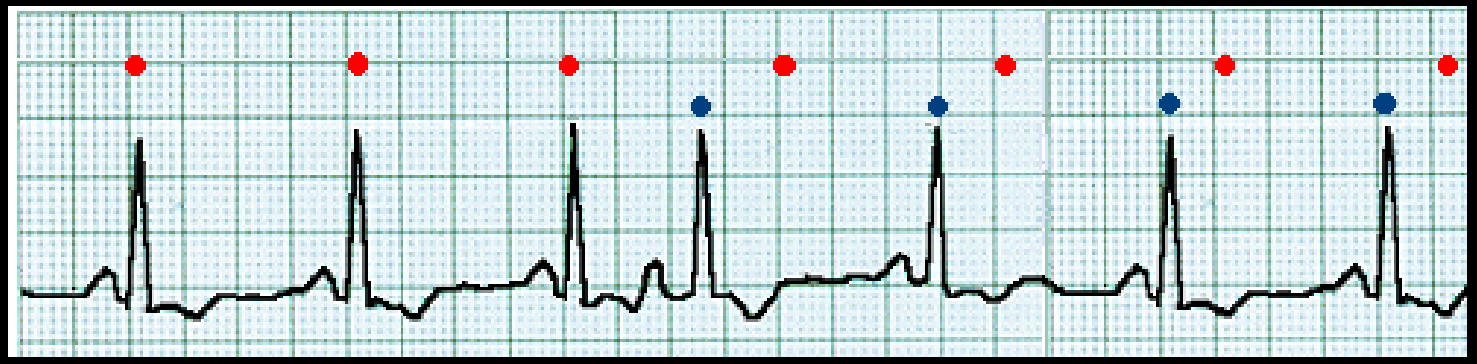
POTENTIAL PROBLEMS(S):

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)

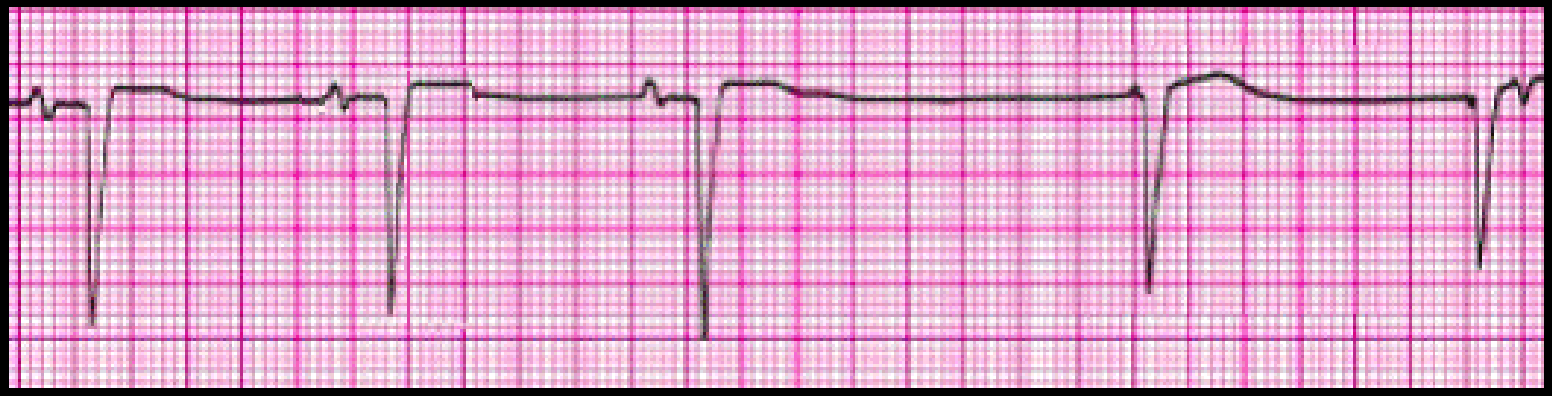
CAUSES OF ECTOPY

1. **PREMATURE**
   - HYPOXIA
   - IRRITABILITY
   - CHANGES IS 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**
   - FAILUARE 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

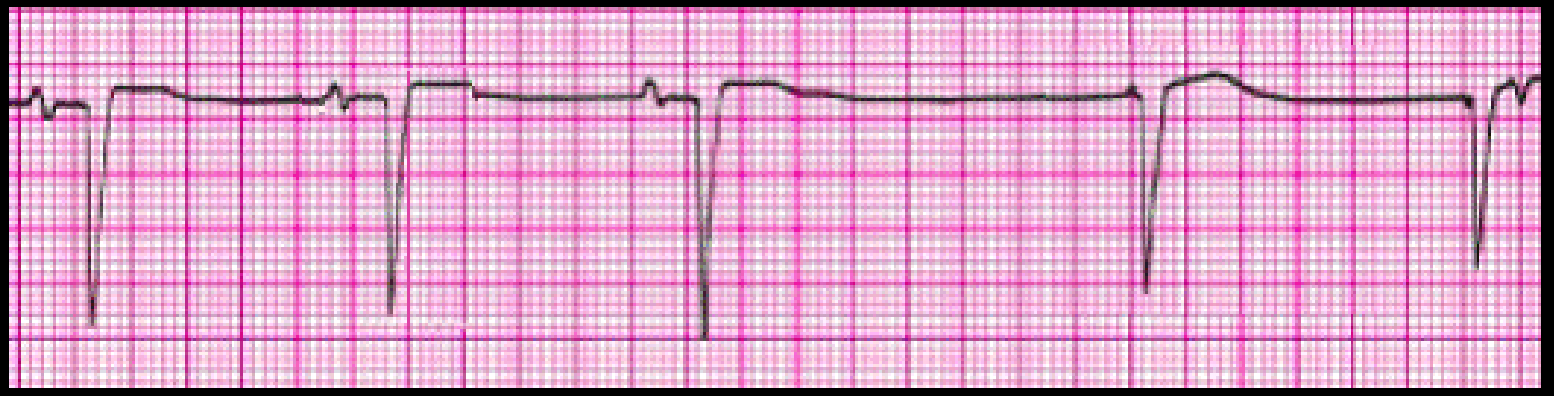
THIS RHYTHM IS:



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

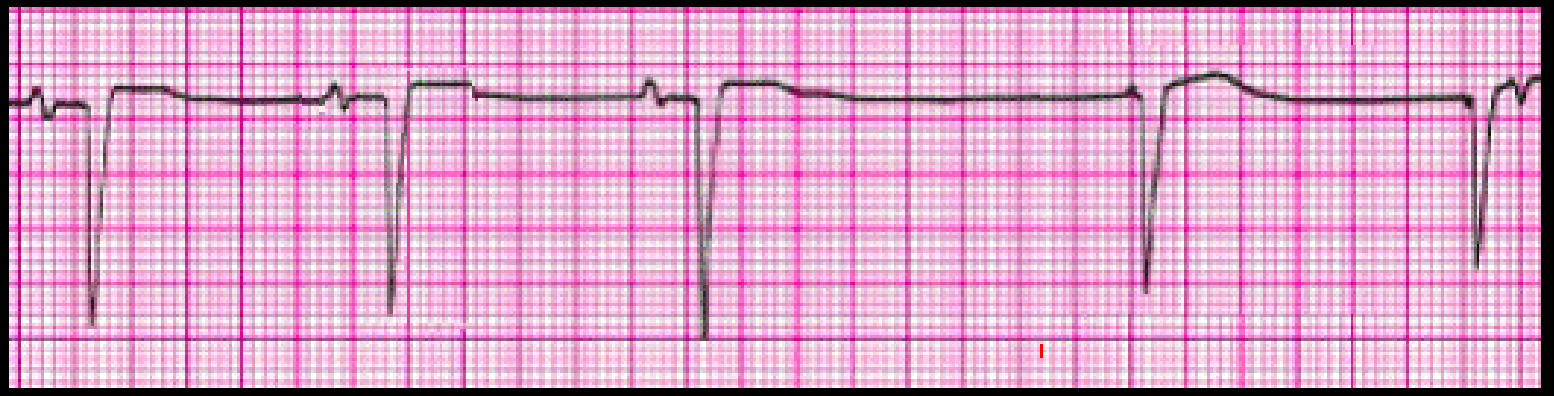
THIS RHYTHM IS: NSR with JUNCTIONAL ESCAPE BEAT



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

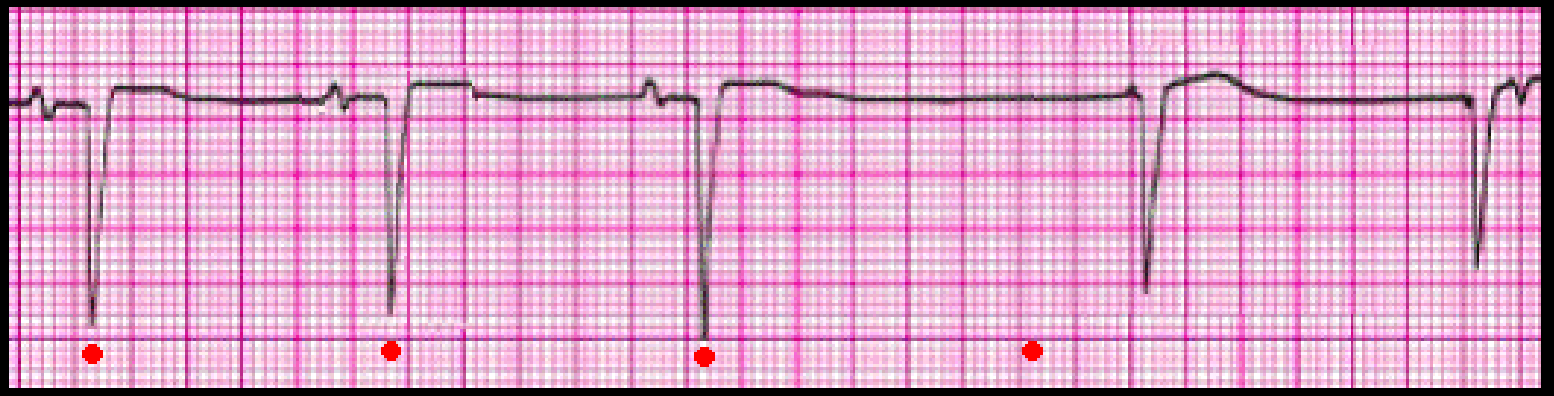
THIS RHYTHM IS: NSR with JUNCTIONAL ESCAPE BEAT



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)

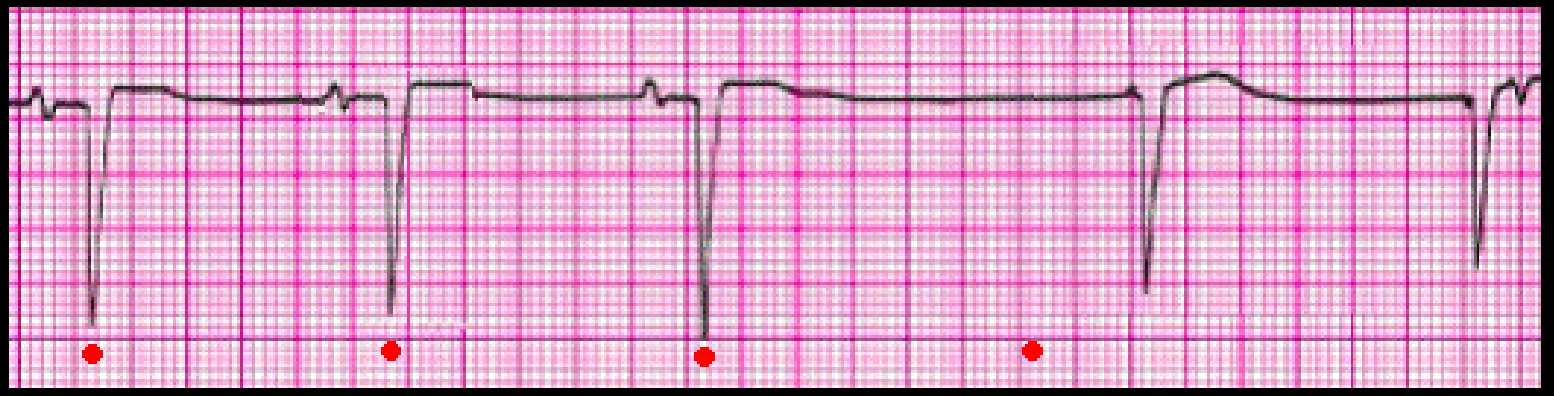
THIS RHYTHM IS: NSR with JUNCTIONAL ESCAPE BEAT



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

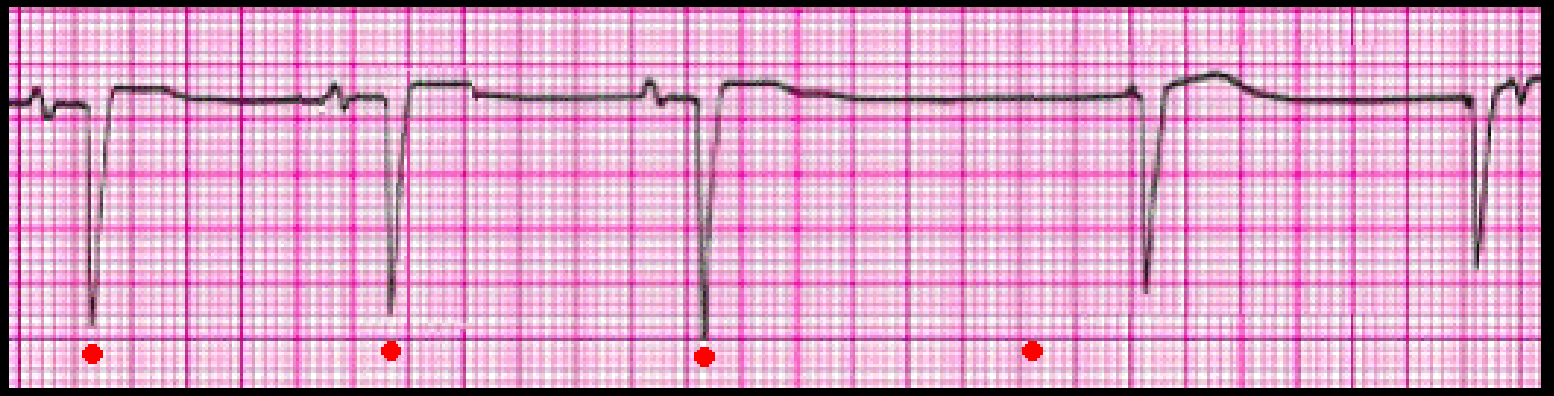


MAIN IDENTIFICATION CHARACTERISTIC(S): BEAT OCCURS LATER THAN NEXT EXPECTED BEAT; QRS IS NORMAL; P WAVE ABSENT or JUST IN FRONT OF or JUST AFTER QRS and is USUALLY INVERTED.

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):

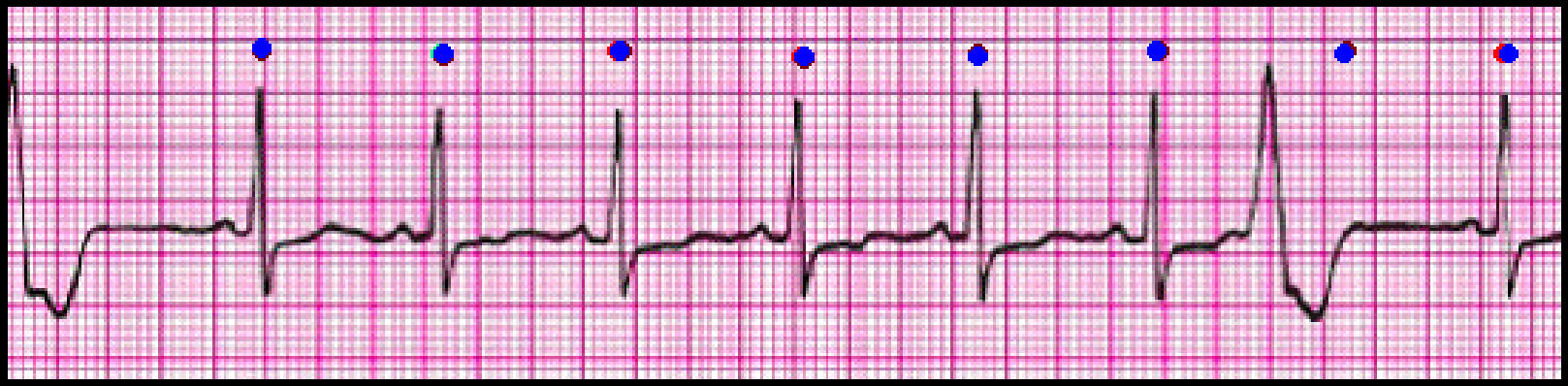
RATE ----------
RHYTHM ----------
P-R INTERVAL ------
P: QRS RATIO -------
QRS INTERVAL -----

THIS RHYTHM IS: NSR with UNIFOCAL PVCs

MAIN IDENTIFICATION CHARACTERISTIC(S):

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

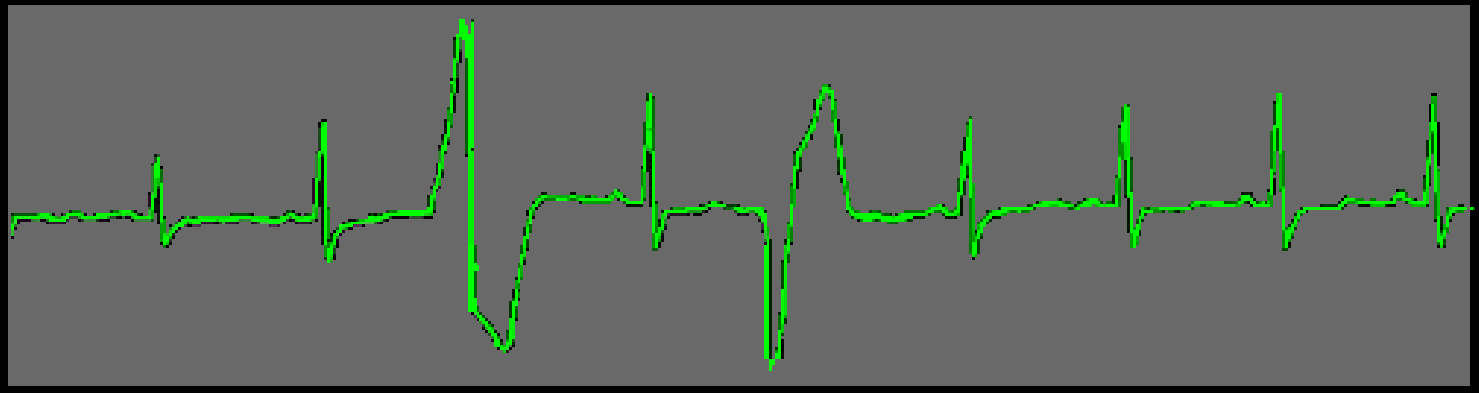
THIS RHYTHM IS: NSR with UNIFOCAL PVCs



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

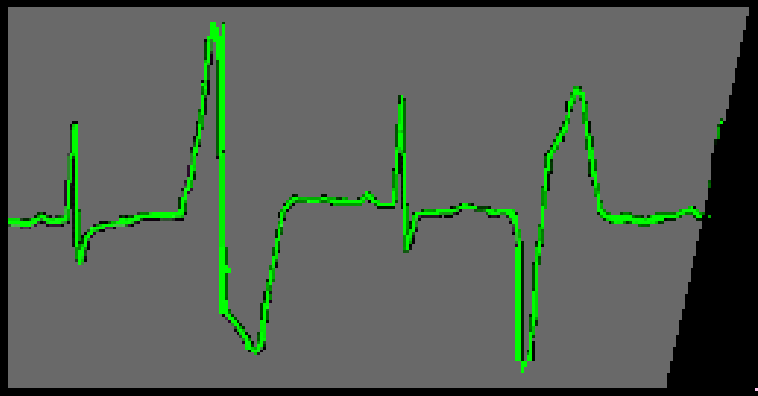
THIS RHYTHM IS: NSR with MULTIFOCAL PVCs

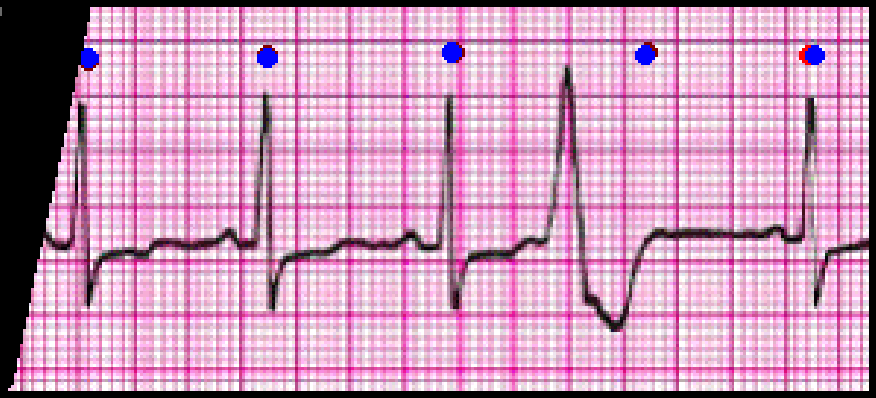


MAIN IDENTIFICATION CHARACTERISTIC(S): ECTOPIC BEATS ARE PREMATURE AND WIDE (> 120 ms); THEY VARY IN SHAPE and DEFLECTION; THERE IS A COMPENSATORY PAUSE

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

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

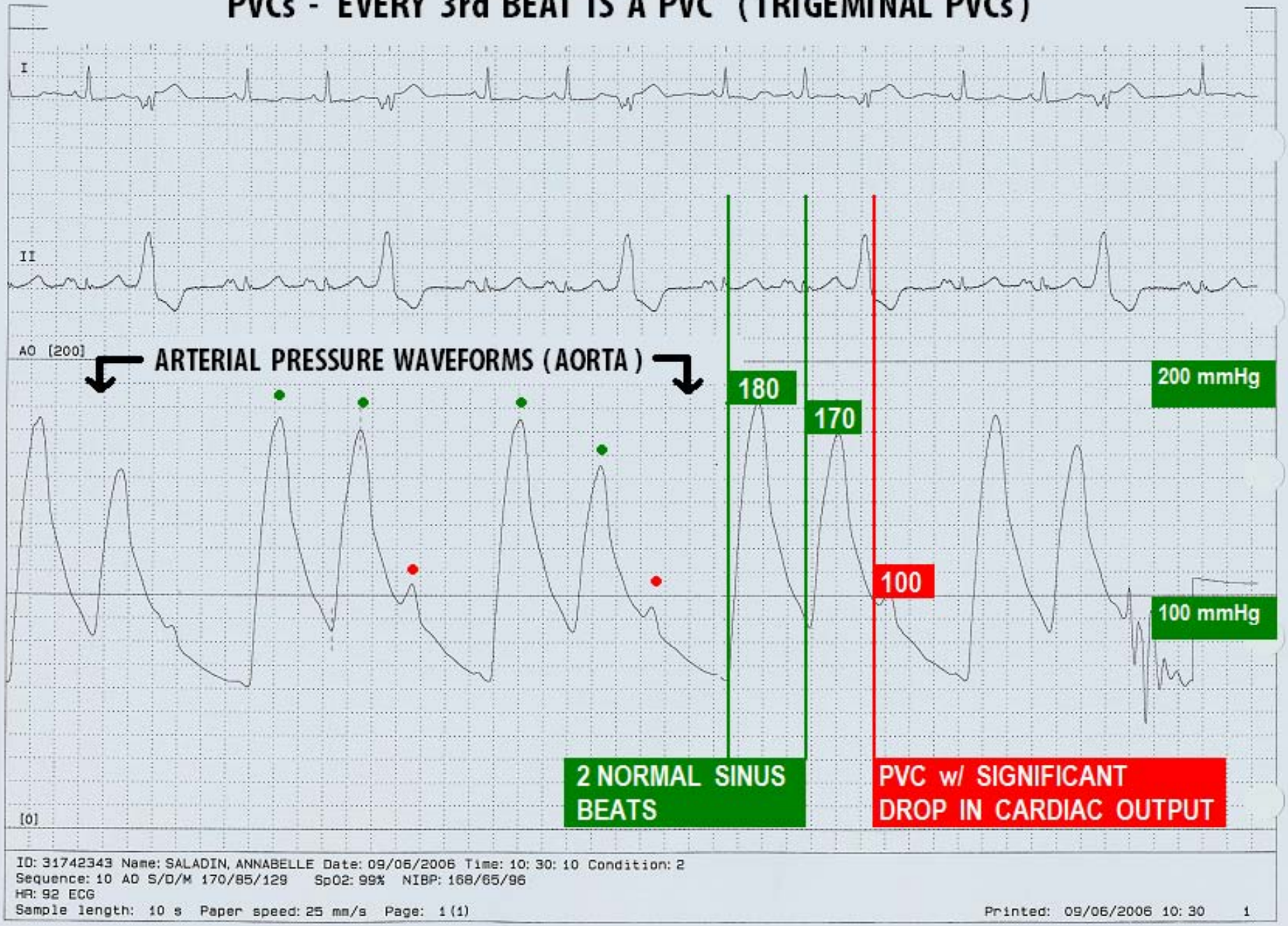
CAUSES OF ECTOPY

1. **PREMATURE**
   - HYPOXIA
   - IRRITABILITY
   - CHANGES IS 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**
   - FAILUARE OF SA NODE
   - FAILURE OF AV NODE

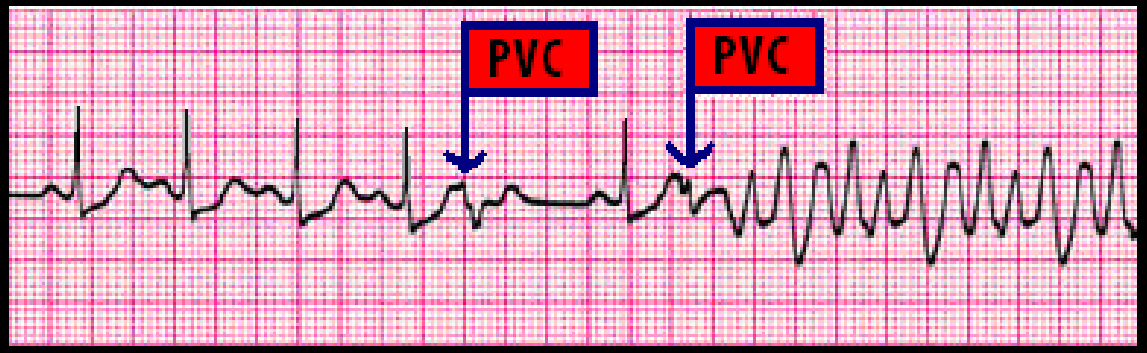
WHEN THESE FAIL TO PRODUCE OR PROPOGATE AN IMPULSE, ESCAPE FOCI MAY TAKE OVER PACING THE HEART BY PRODUCING END-DIASTOLIC BEATS

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



ID: 31742343 Name: SALADIN, ANNABELLE Date: 09/06/2006 Time: 10: 30: 10 Condition: 2
Sequence: 10 AO S/D/M 170/85/129 SpO2: 99% NIBP: 168/65/96
HR: 92 ECG
Sample length: 10 s Paper speed: 25 mm/s Page: 1 (1)
Printed: 09/06/2006 10: 30 1

THIS RHYTHM IS: NSR with R on T PHENONEMON

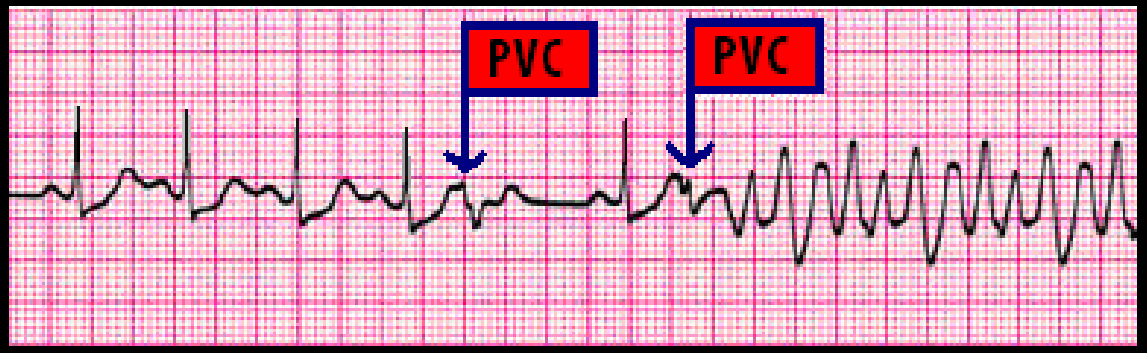


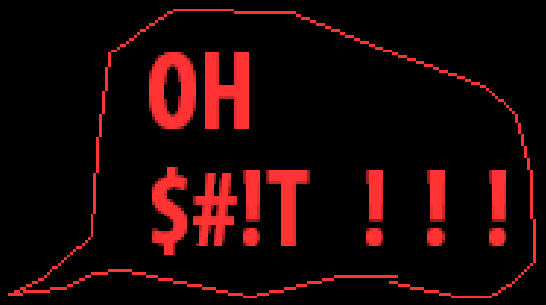
MAIN IDENTIFICATION CHARACTERISTIC(S): ECTOPIC BEATS ARE WIDE (> 120 ms); ALL APPEAR TO HAVE SAME SHAPE and DEFLECTION ; THERE IS A COMPENSATORY PAUSE

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 PHENONEMON





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POTENTIAL PROBLEMS (S):

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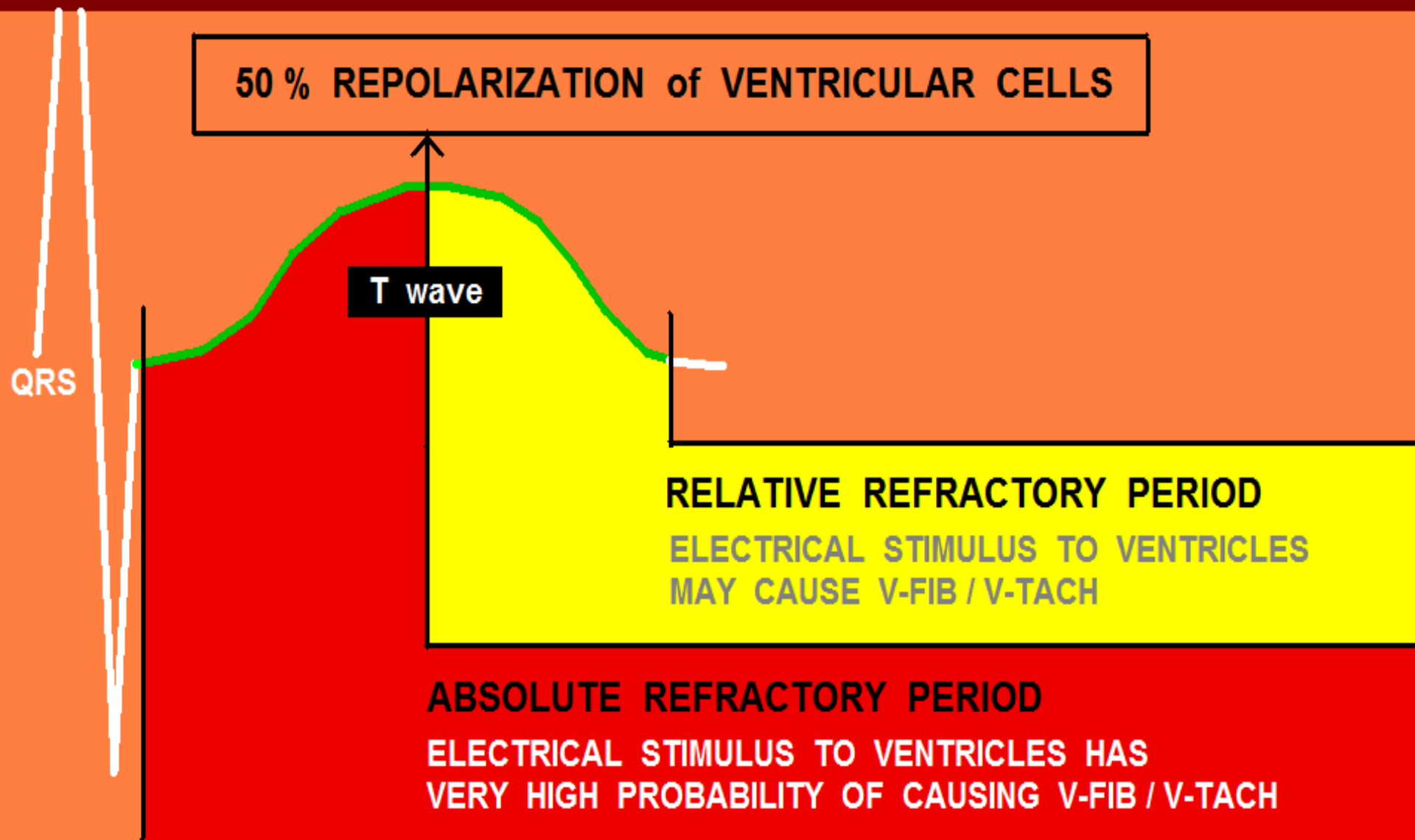
- PVCs COUPLED TOGETHER COULD PRECIPITATE V-TACH

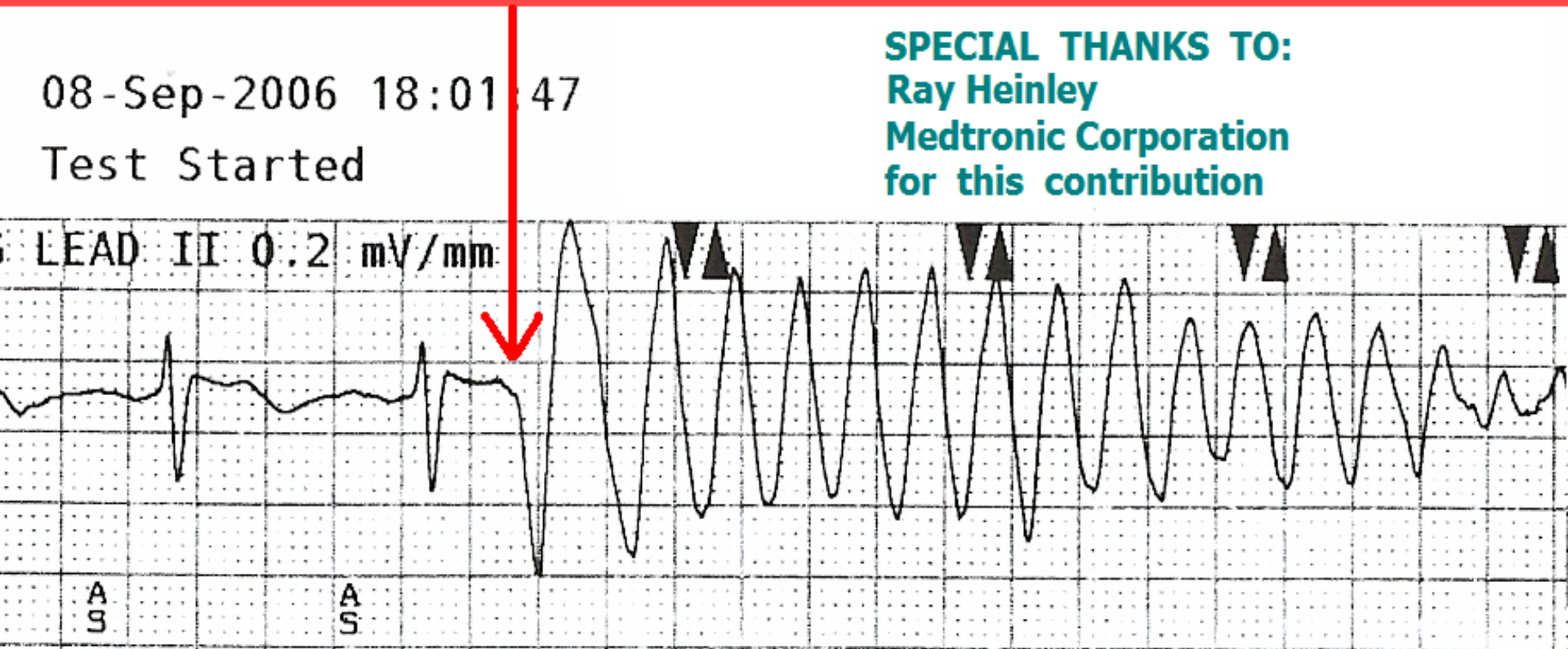
CARDIAC ANATOMY and PHYSIOLOGY "101"



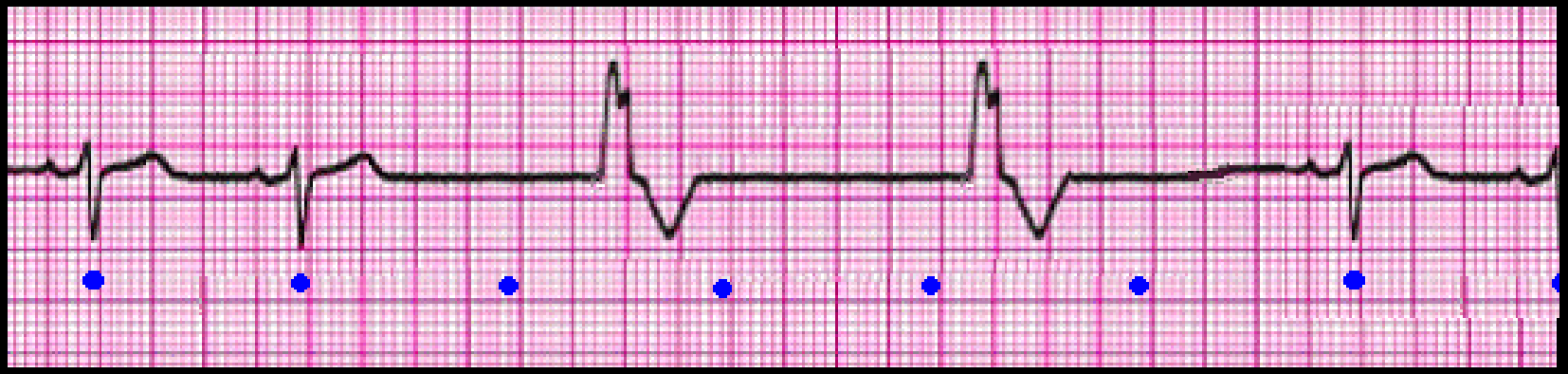
ROUTINE TEST OF ICD

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

SPECIAL THANKS TO:
Ray Heinley
Medtronic Corporation
for this contribution



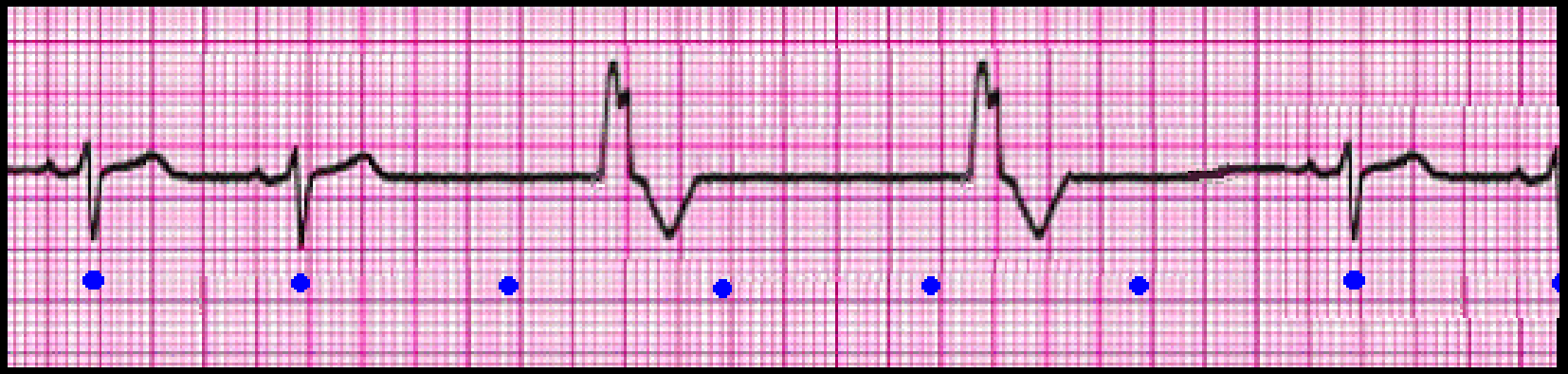
THIS RHYTHM IS:



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

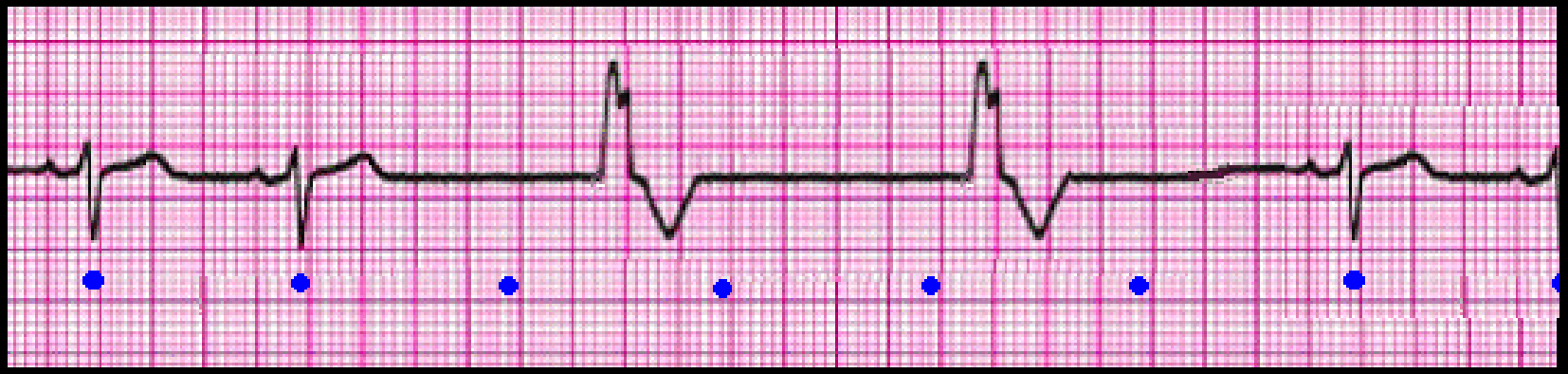
THIS RHYTHM IS: SINUS ARREST w/ VENT. ESCAPE



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

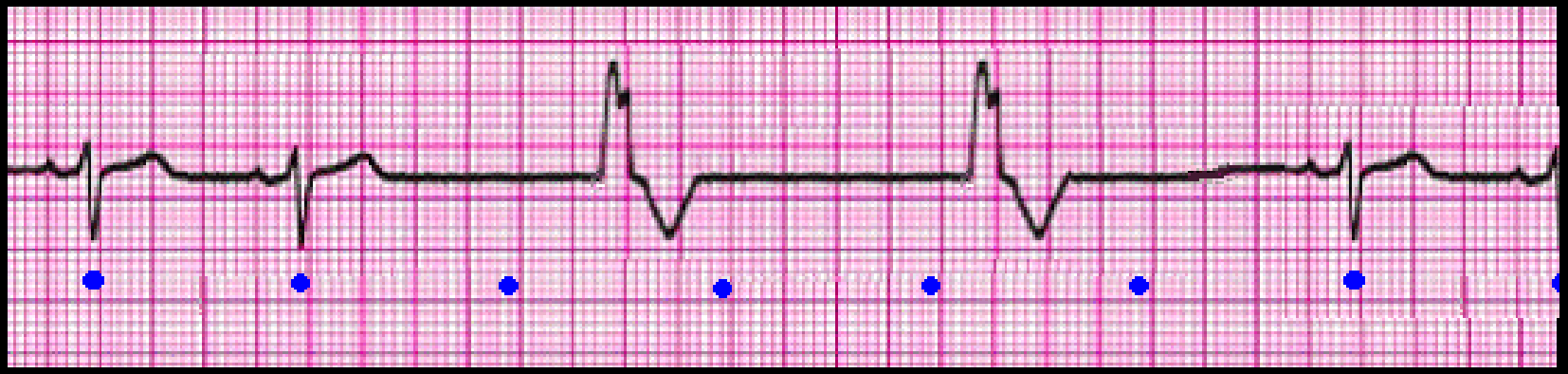
THIS RHYTHM IS: SINUS ARREST w/ VENT. ESCAPE



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

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

THIS RHYTHM IS: SINUS ARREST w/ VENT. ESCAPE

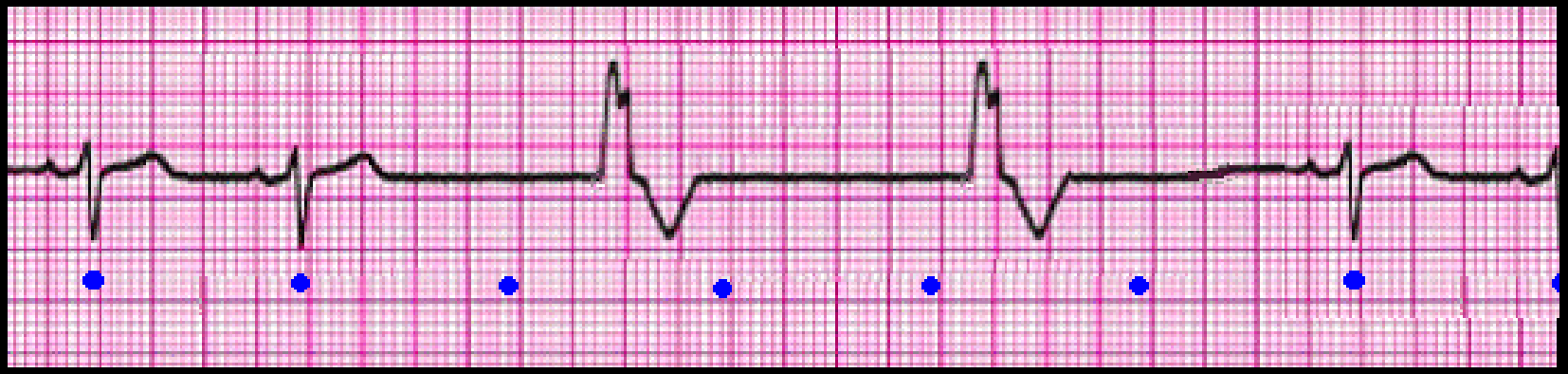


MAIN IDENTIFICATION CHARACTERISTIC(S): END DIASTOLIC (ESCAPE) BEAT(S); COMPLEXES WIDER THAN 120 ms ; MAY BE UNIFOCAL or MULTIFOCAL; MAY or MAY NOT HAVE GOOD PULSE w/ COMPLEXES

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.

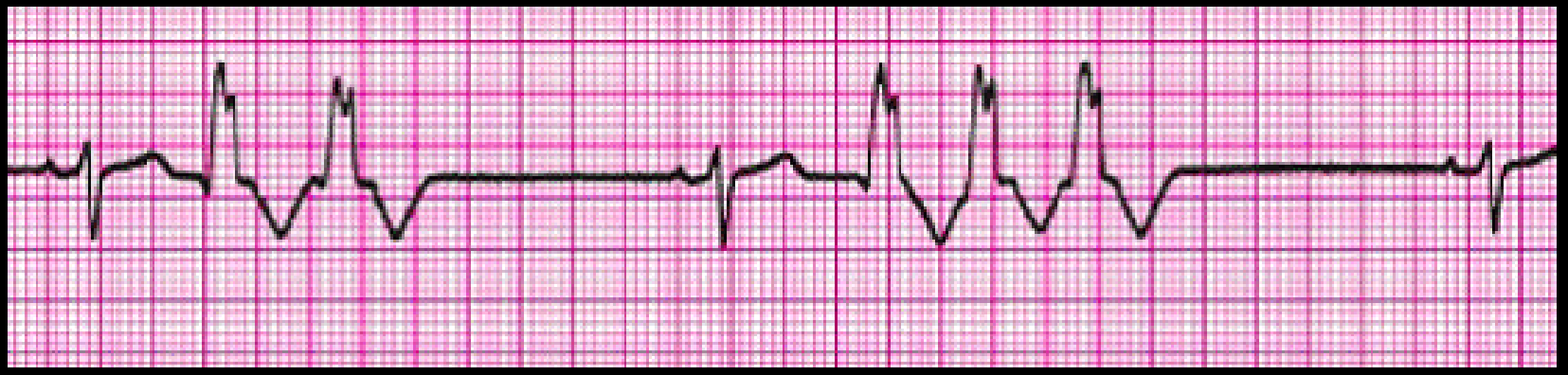
THIS RHYTHM IS: SINUS ARREST w/ VENT. ESCAPE



TREATMENT / INTERVENTION (S):

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

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

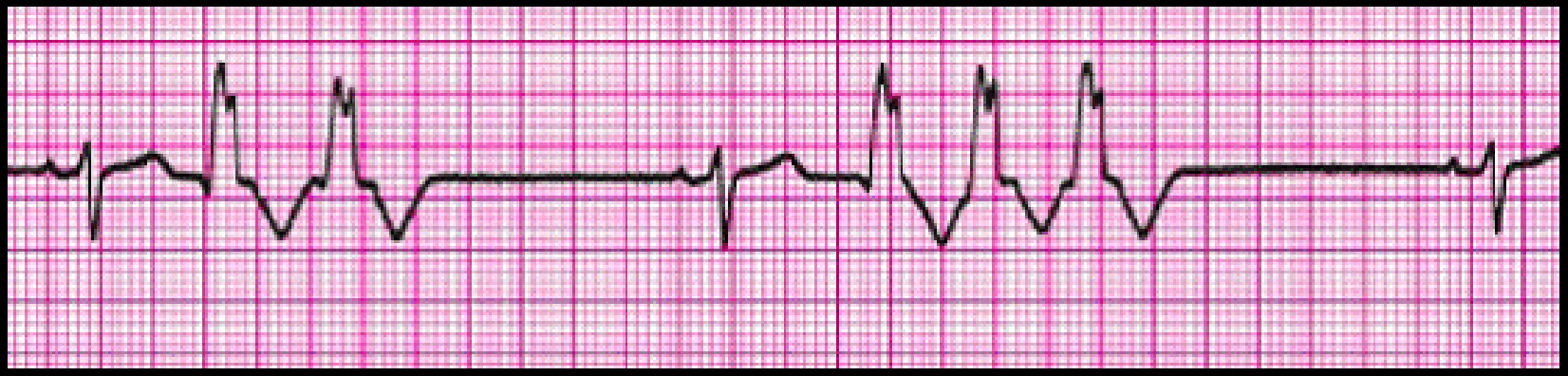


MAIN IDENTIFICATION CHARACTERISTIC(S): ECTOPIC BEATS ARE WIDE (> 120 ms); PVCs ARE COUPLED TOGETHER (2 = "COUPLET"), (3 or more = RUN OF V-TACH)

POTENTIAL PROBLEMS (S):

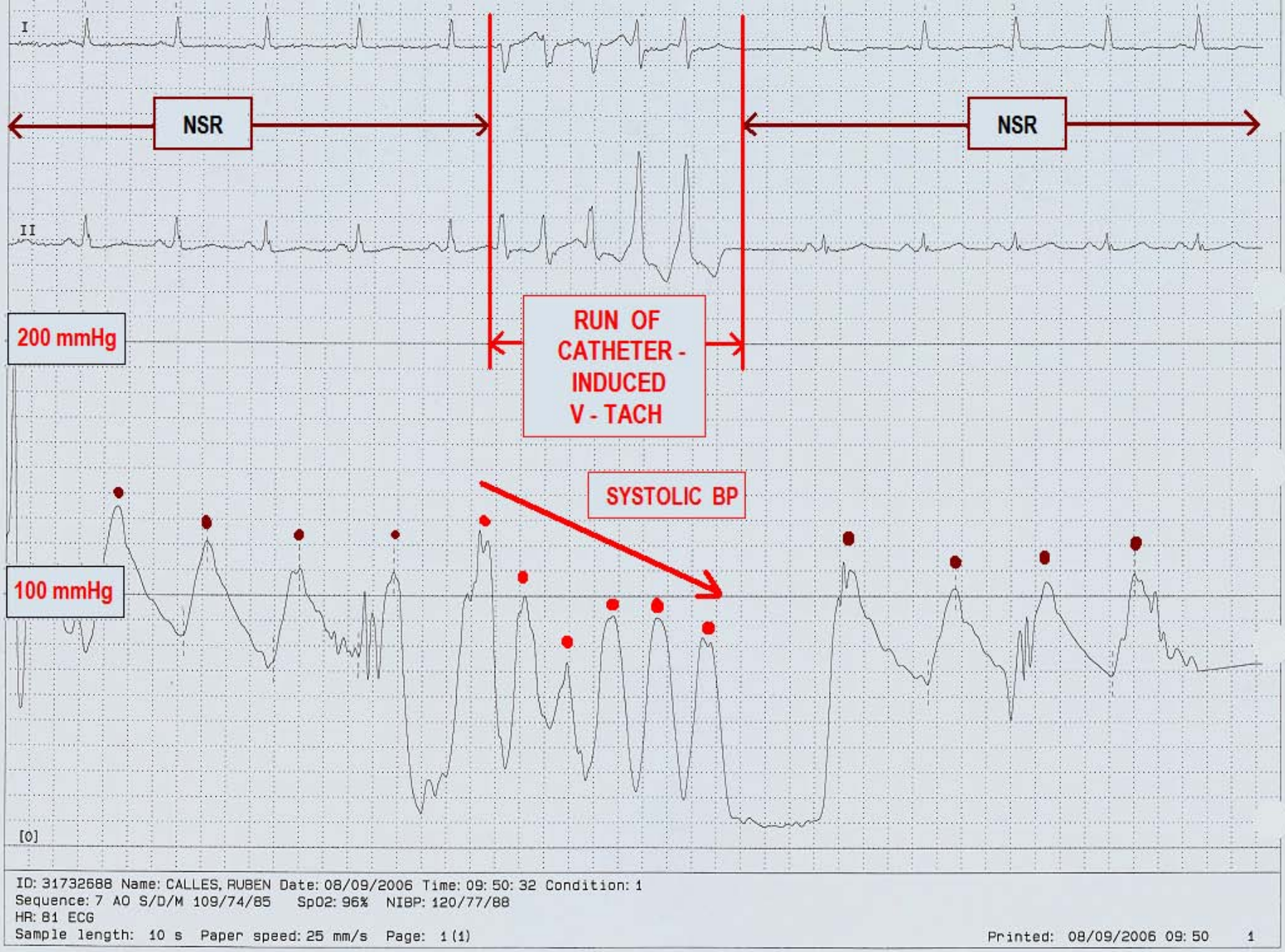
- THE UNDERLYING REASON PVCs ARE PRESENT COULD BE A CRITICAL ISSUE . . .
- PVCs MAY HAVE A WEAKER PULSE, or NO PULSE
- PVCs DURING REFRACTORY PERIOD COULD CAUSE V-FIB
- PVCs COUPLED TOGETHER COULD PRECIPITATE V-TACH

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



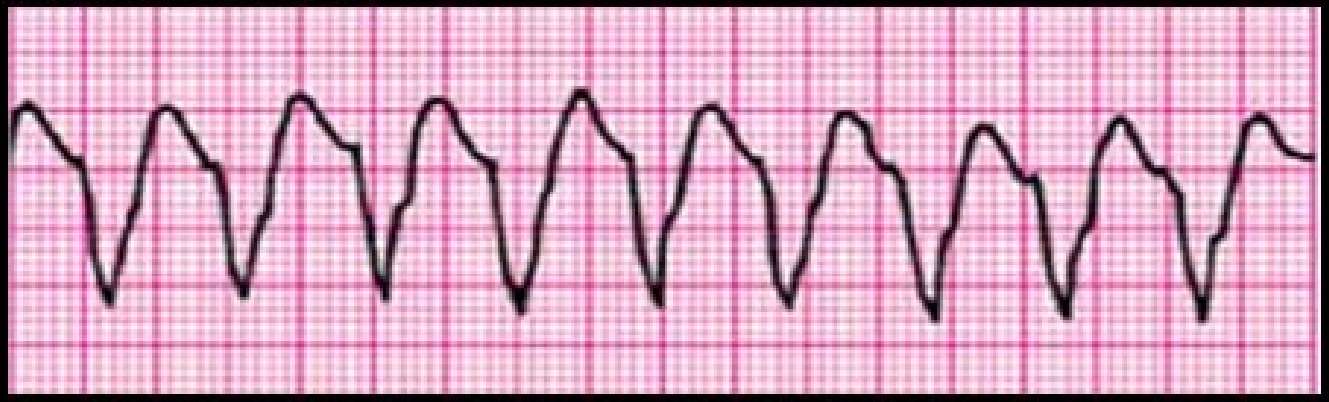
TEXTBOOK STANDARDS:

- 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) Printed: 08/09/2006 09: 50 1

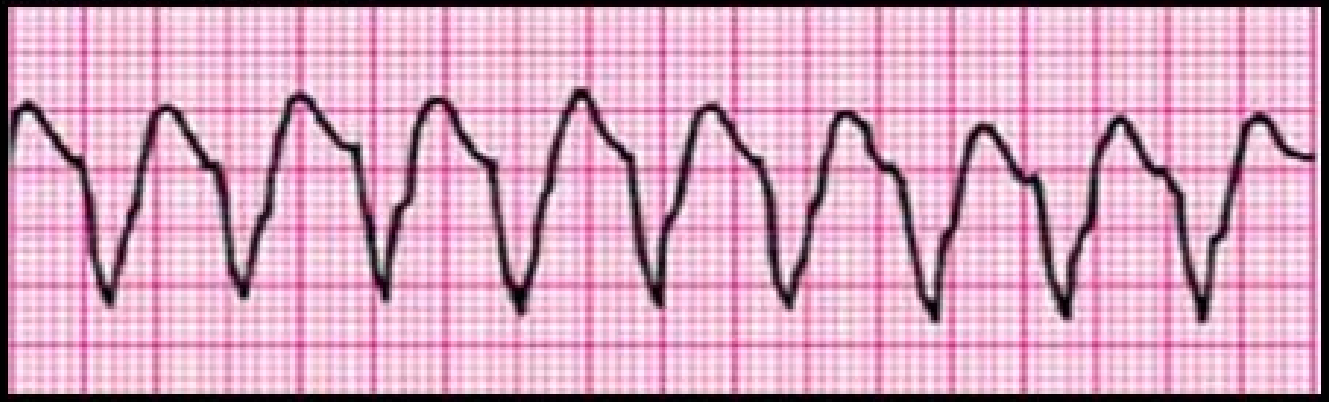
THIS RHYTHM IS:



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

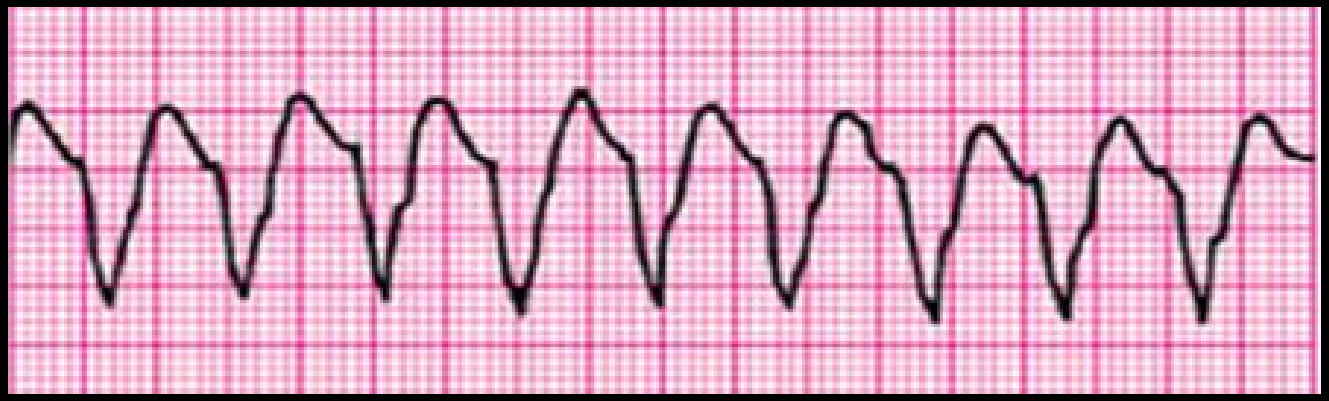
THIS RHYTHM IS: MONOMORPHIC V-TACH



MAIN IDENTIFICATION CHARACTERISTIC(S):

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

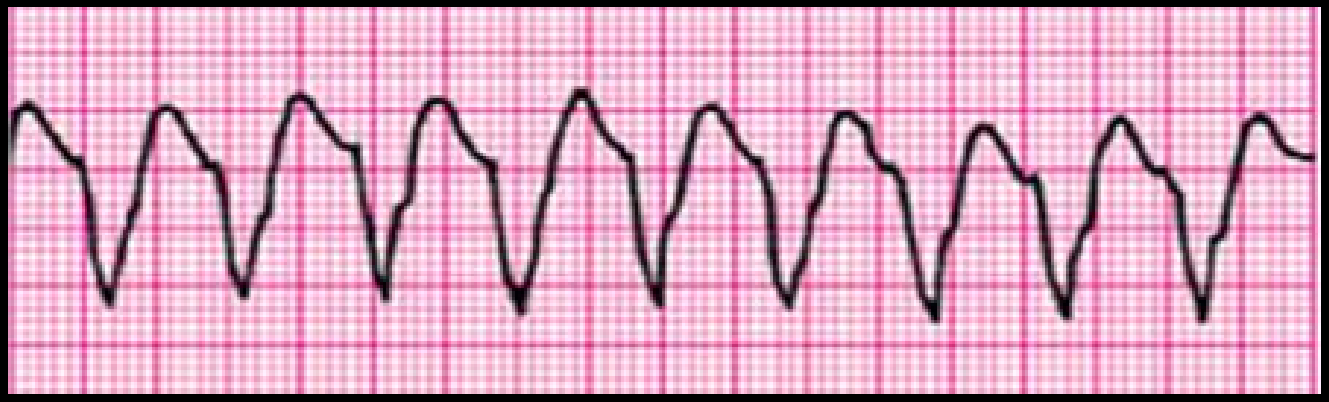
THIS RHYTHM IS: MONOMORPHIC V-TACH



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



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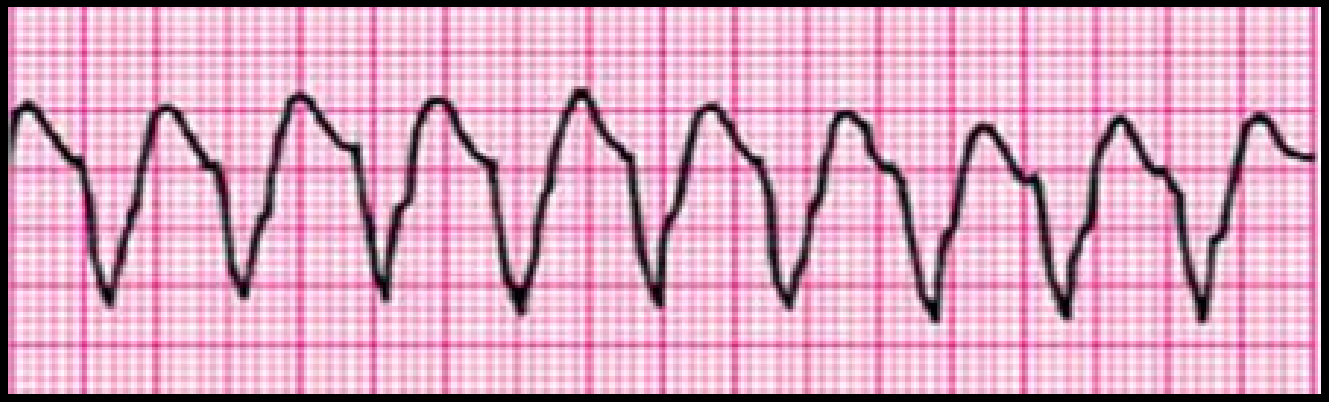
HR USUALLY BETWEEN 150 - 200; ALL QRS COMPLEXES APPEAR SAME IN SHAPE and DEFELCTION; IF P WAVES SEEN, DISASSOTIATED w/ QRS

POTENTIAL PROBLEM(S):

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

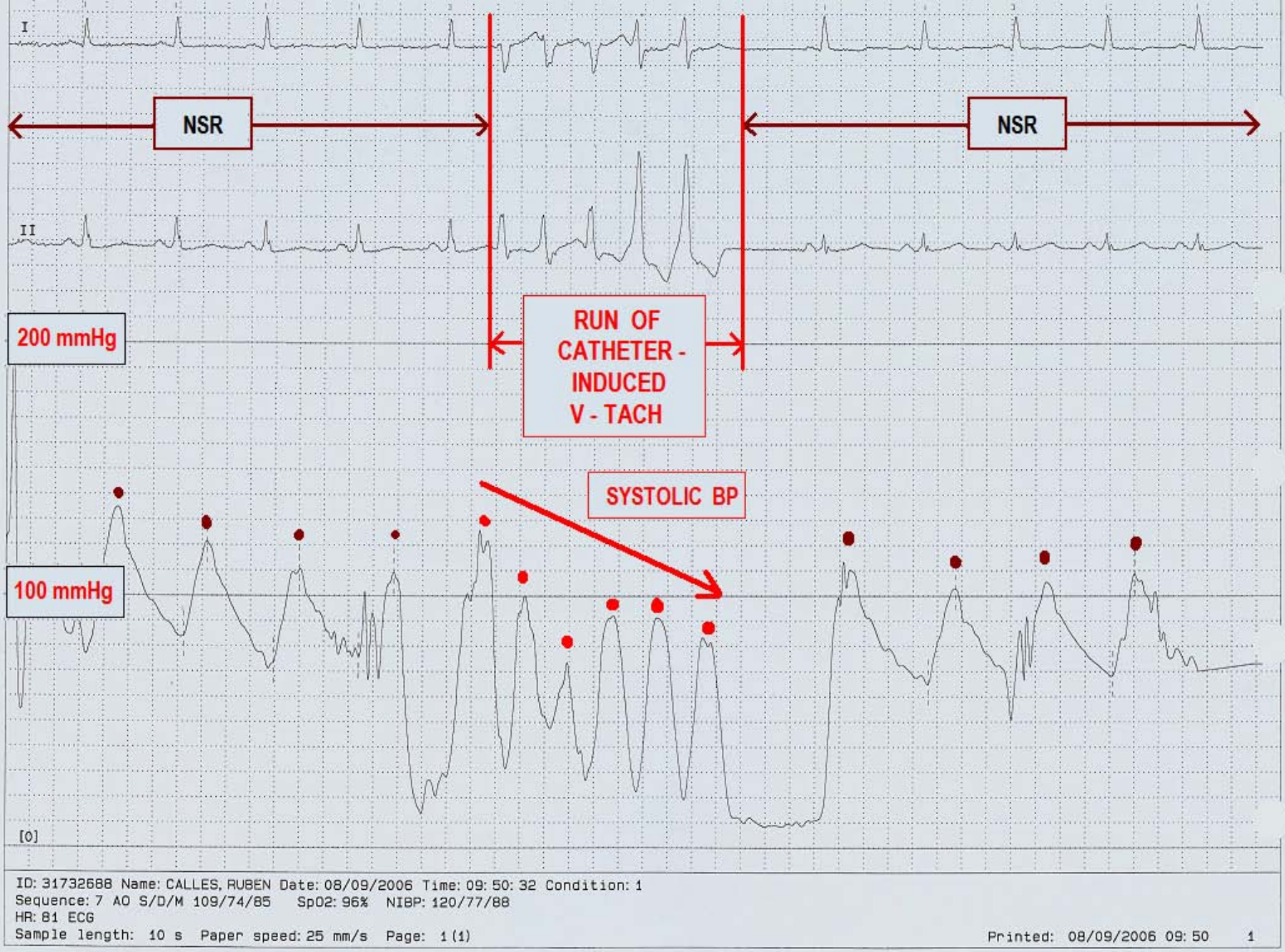
THIS RHYTHM IS: MONOMORPHIC V-TACH



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



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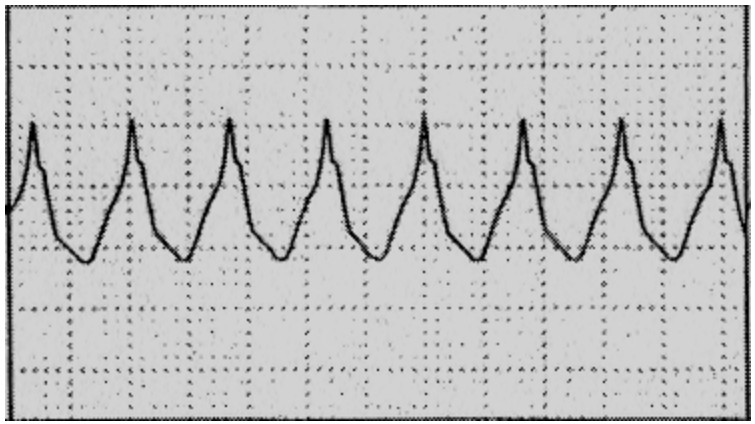
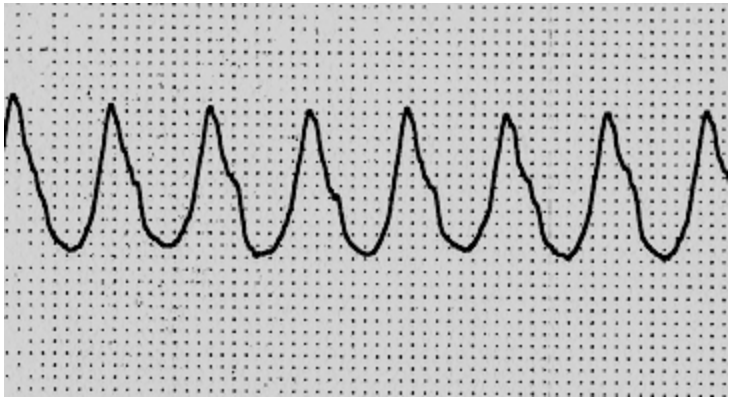
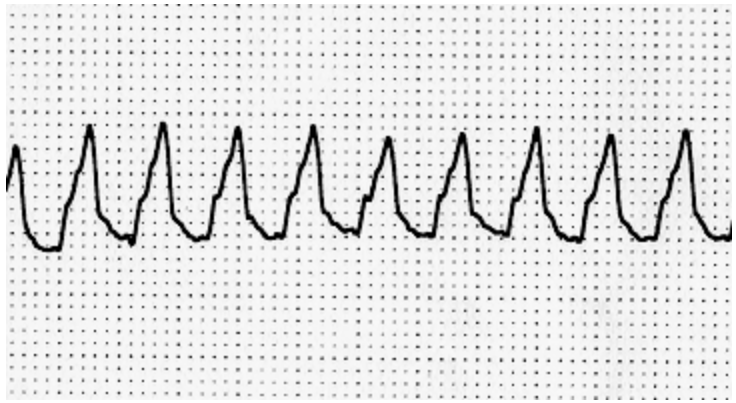
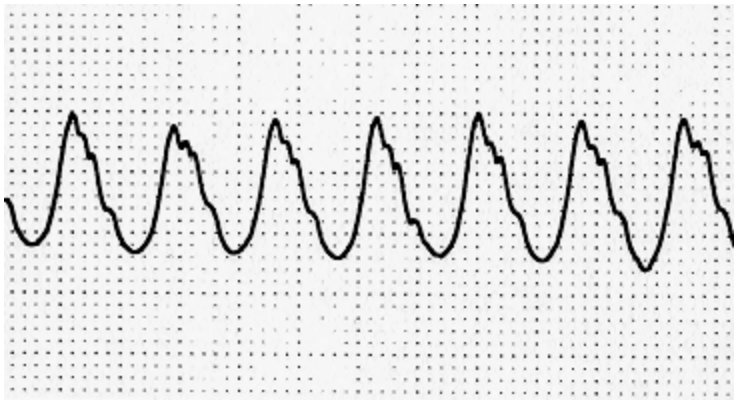
Sequence: 7 AO S/D/M 109/74/85 SpO2: 96% NIBP: 120/77/88
HR: 81 ECG
Sample length: 10 s Paper speed: 25 mm/s Page: 1 (1) Printed: 08/09/2006 09: 50 1

? WIDE COMPLEX TACHYCARDIA ?

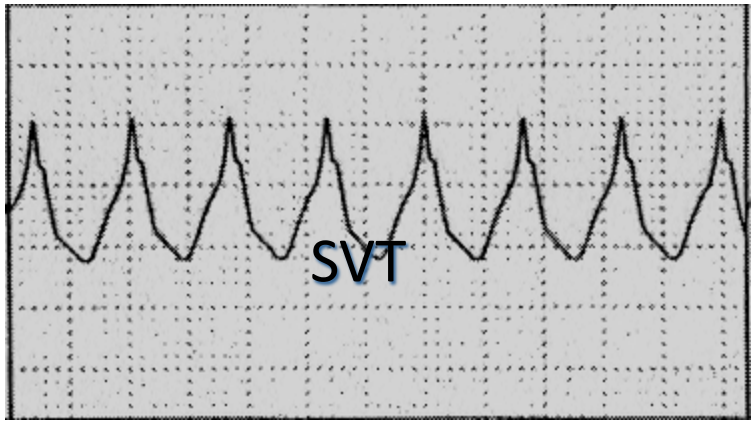


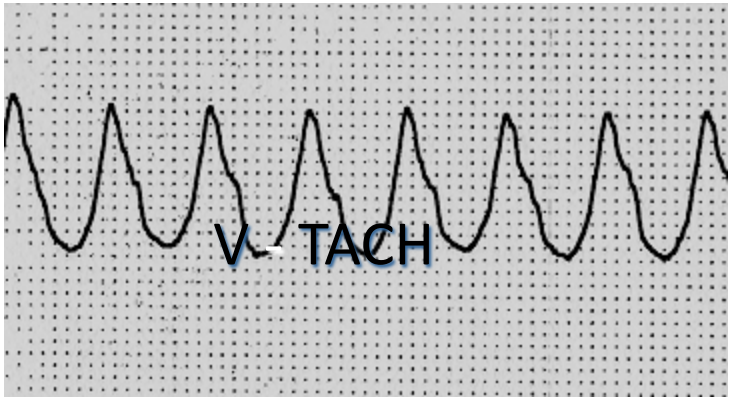


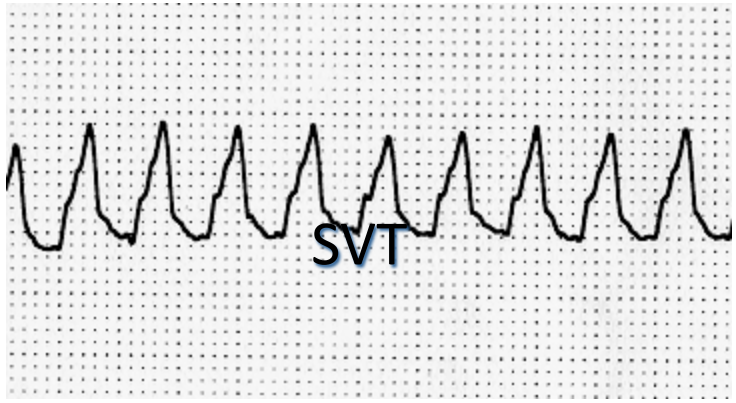


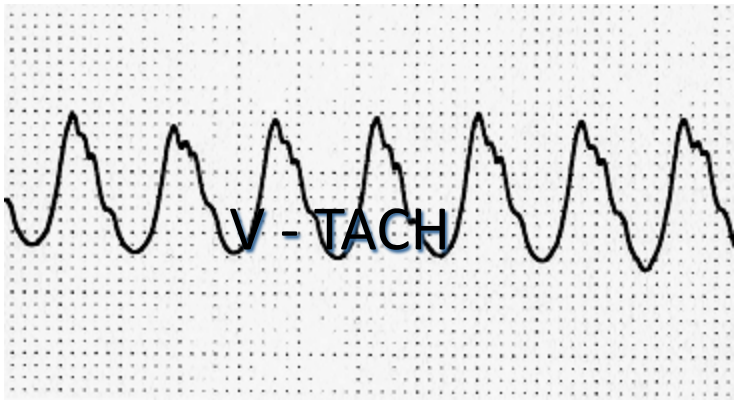


? WIDE COMPLEX TACHYCARDIA ?









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):

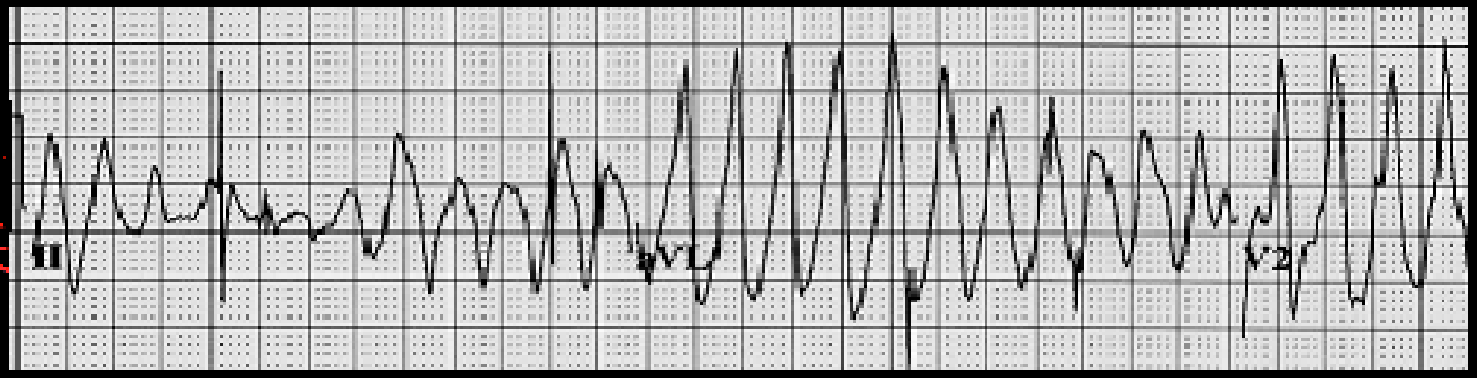
RATE ----------
RHYTHM ----------
P-R INTERVAL ------
P: QRS RATIO -------
QRS INTERVAL -----

THIS RHYTHM IS: POLYMORPHIC V - TACH

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

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

THIS RHYTHM IS: POLYMORPHIC V - TACH

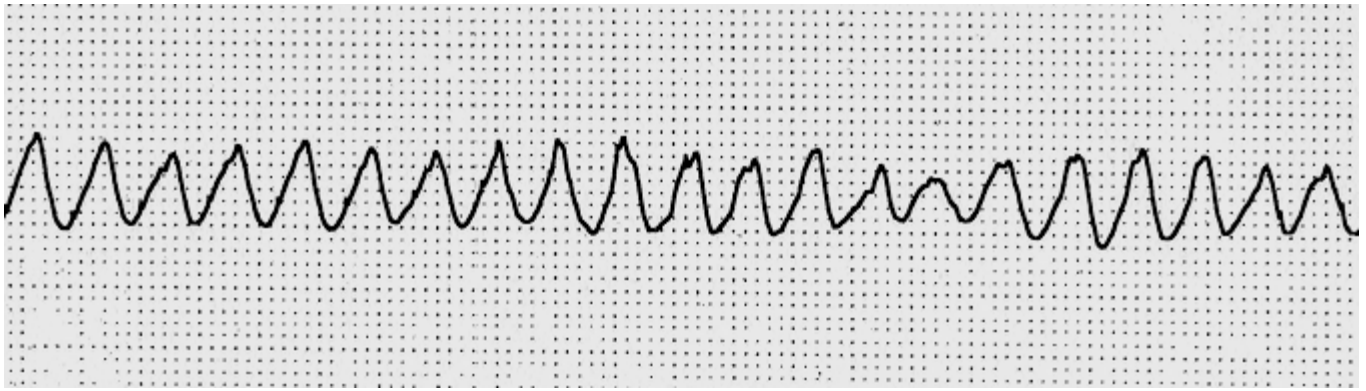


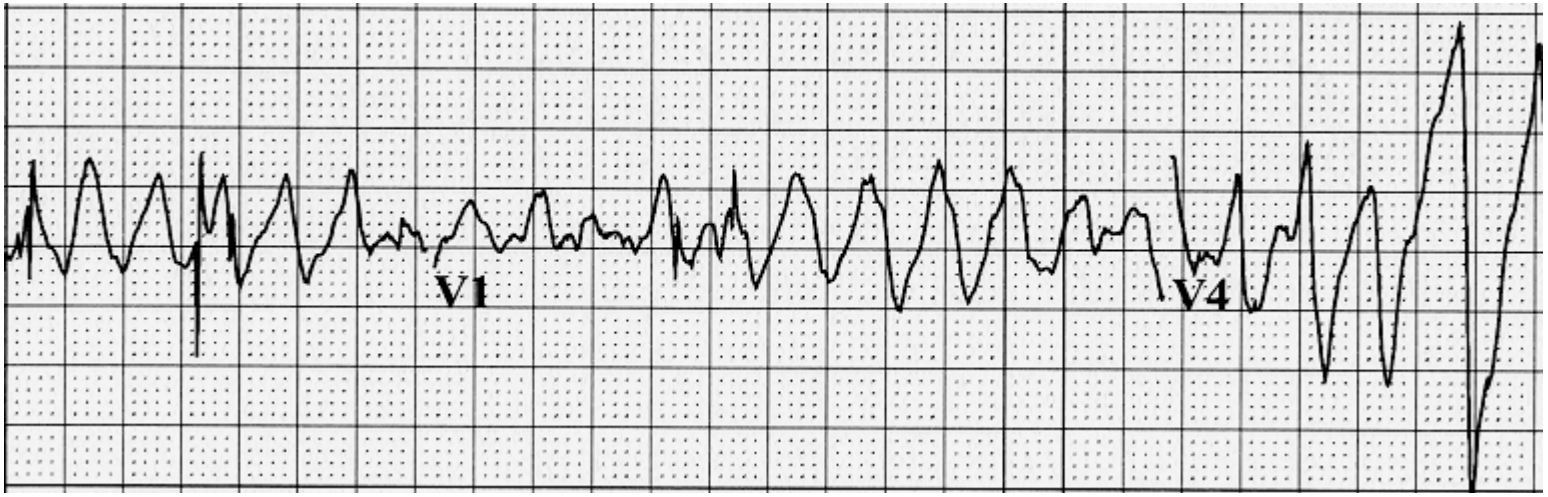
MAIN IDENTIFICATION CHARACTERISTIC(S): WIDE QRS COMPLEXES, MULTIPLE SHAPES AND FORMS, POSITVE AND NEGATIVE DEFLECTIONS, APPEARS TO ROTATE BETWEEN NEGATIVE AND POSITIVE (TWISTING OF POINTS)

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. . . . .

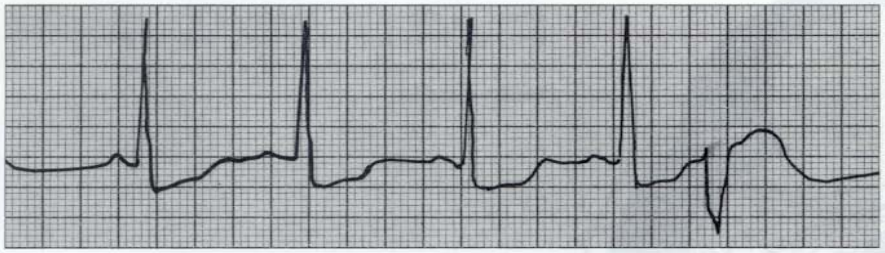




If a rhythm presents to you like it “may possibly be Torsades” – it will most likely benefit the patient if you TREAT IT as TORSADES. . . .

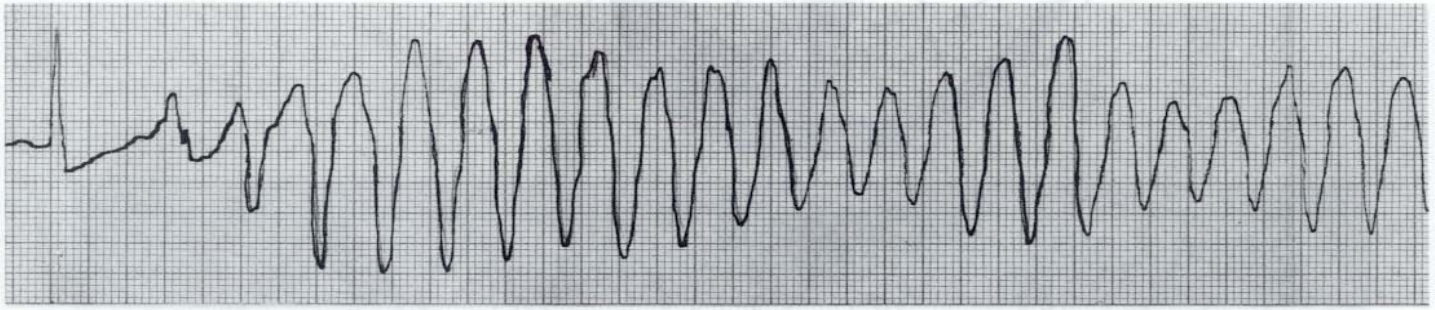
Torsades de pointes

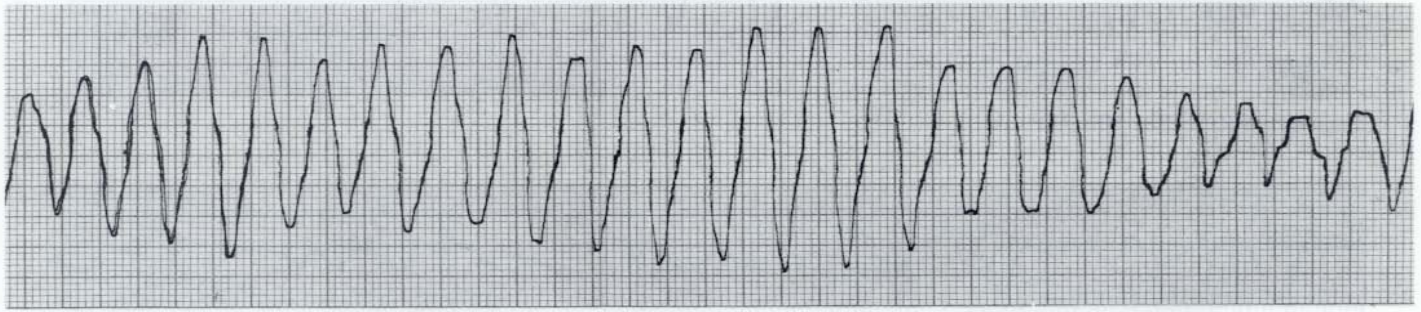
II



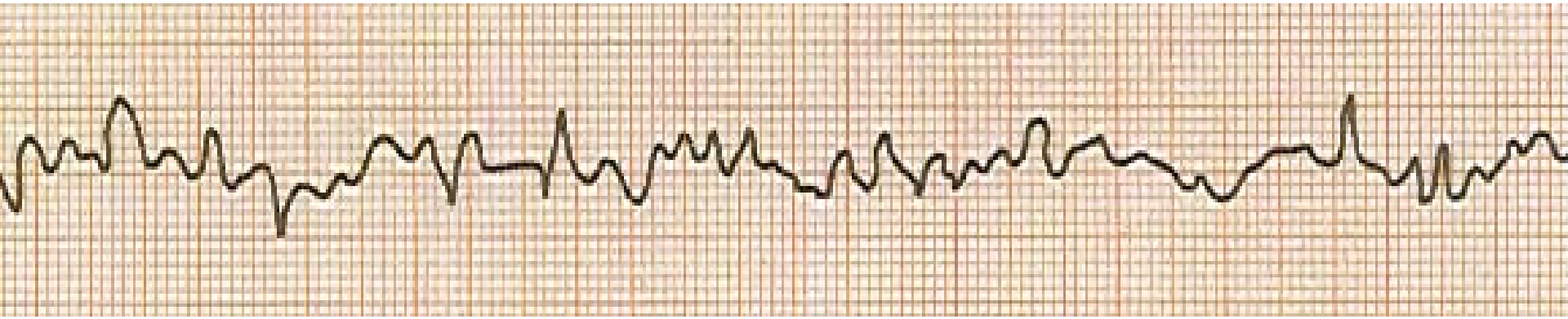
Torsades de pointes (twists of points) is a type of ventricular tachycardia that is often paroxysmal and that occurs in the setting of a long QT interval, which is commonly secondary to therapy with quinidine or quinidine-like drugs (procainamide and disopyramide) but which may also be the result of 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.

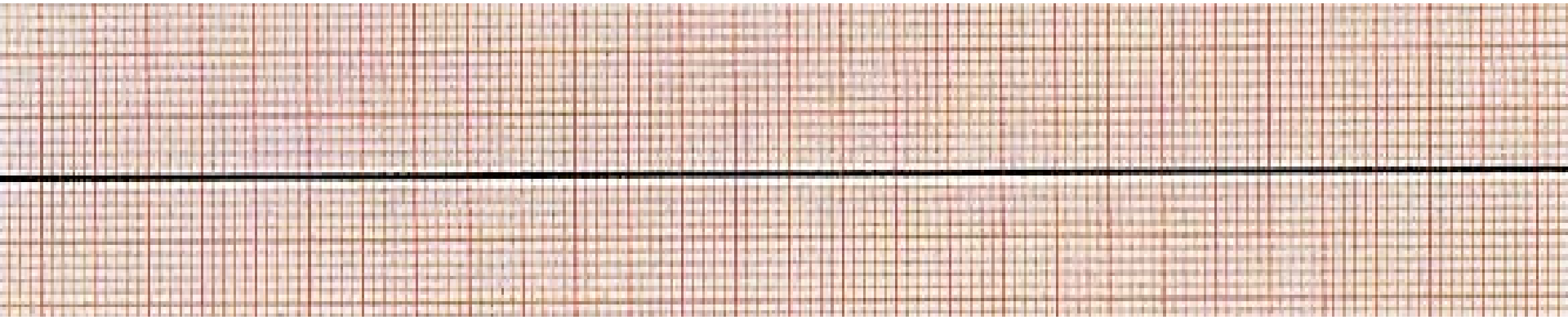




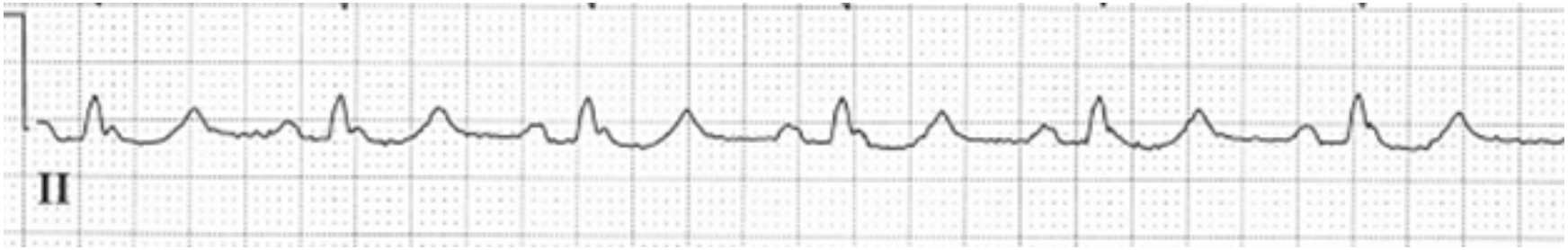
Ventricular Fibrillation



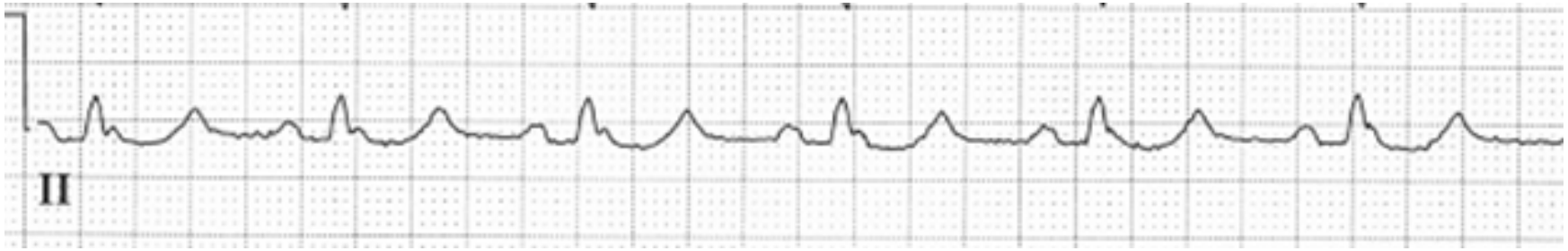
Ventricular Asystole



What's this rhythm?



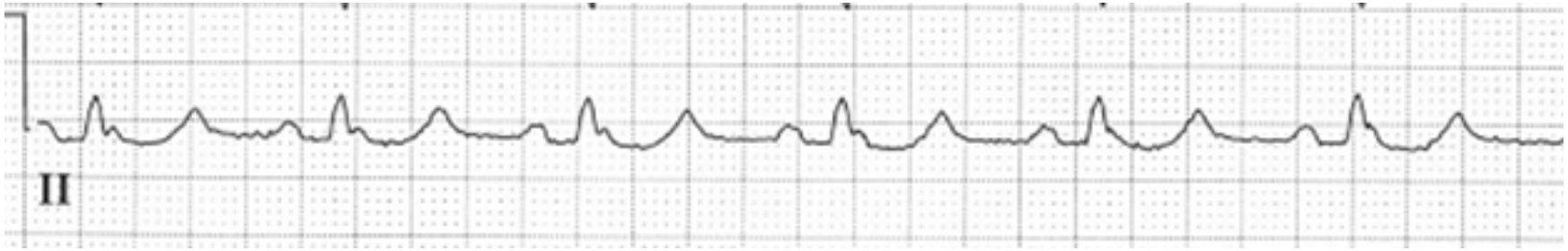
What's this rhythm?



It' "Normal Sinus Rhythm" . . . .

But the QRS it too wide!

What's this rhythm?



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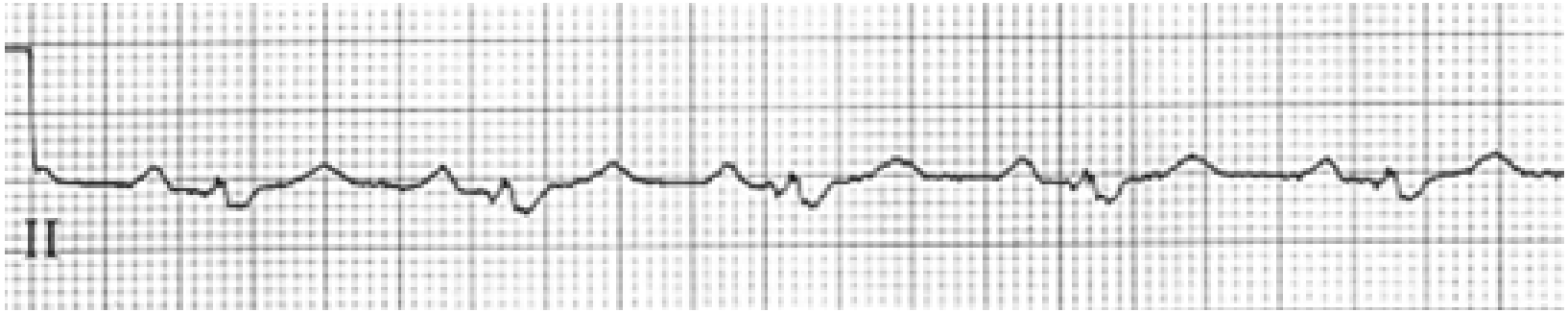
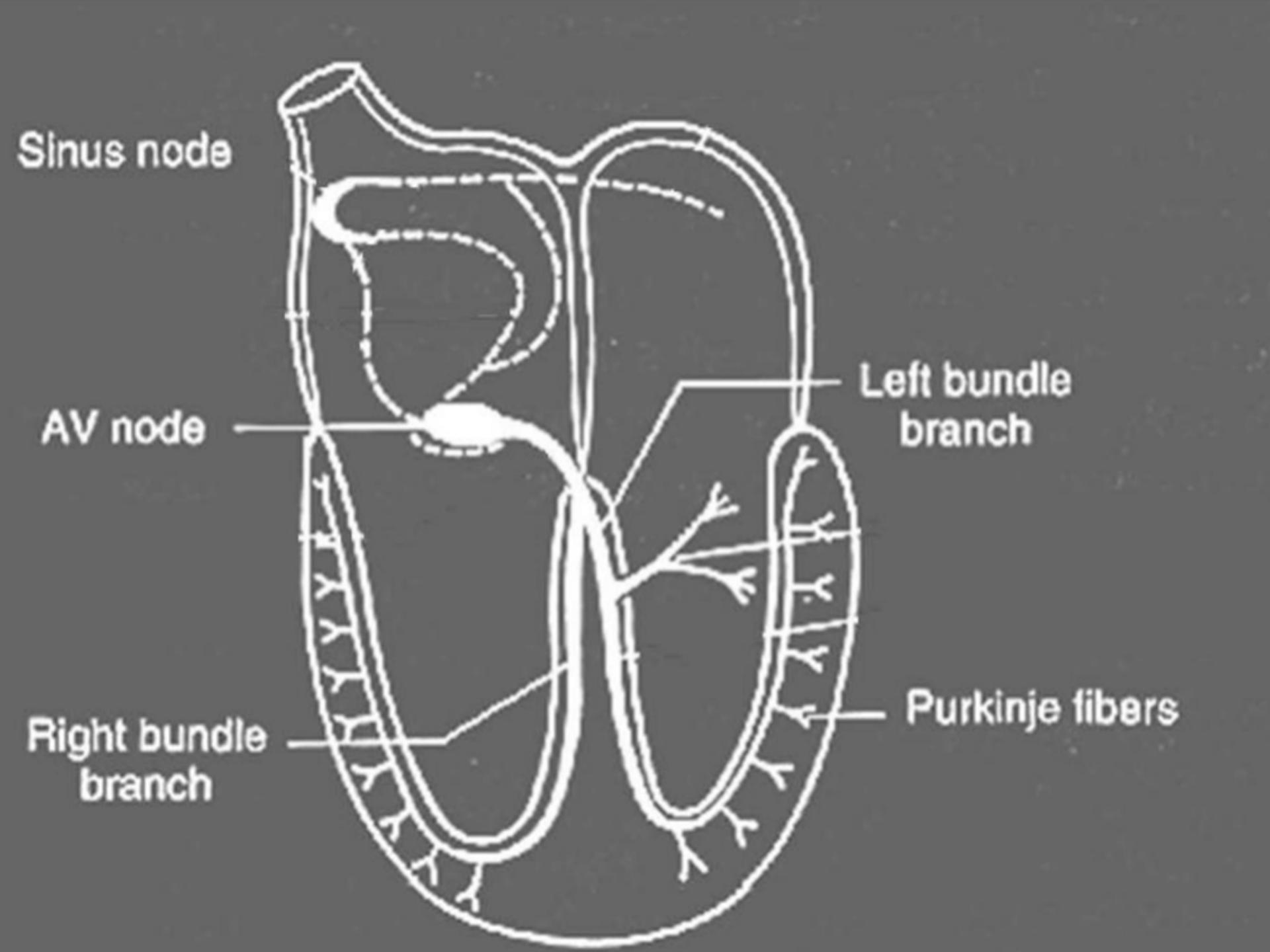


SAME WITH THE ABOVE RHYTHM

When the QRS is TOO WIDE (>3mm -or- 120ms) …..

IT USUALLY INDICATES "BUNDLE BRANCH BLOCK"


Sinus node
AV node
Left bundle branch
Right bundle branch
Purkinje fibers

When the QRS is TOO WIDE (>3mm -or- 120ms) …..

…..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

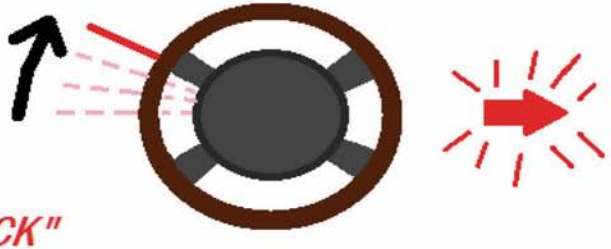
USE LEAD V1 for this technique

To make a **RIGHT TURN**

you push the turn signal lever **UP** . . . . .

THINK:

"QRS points UP = RIGHT BUNDLE BRANCH BLOCK"



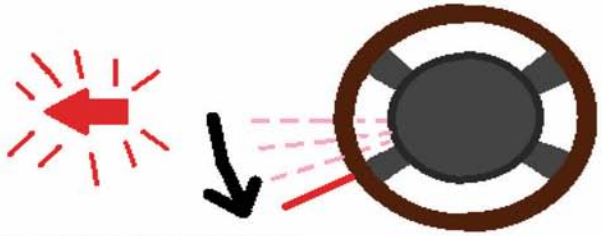
V1

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:

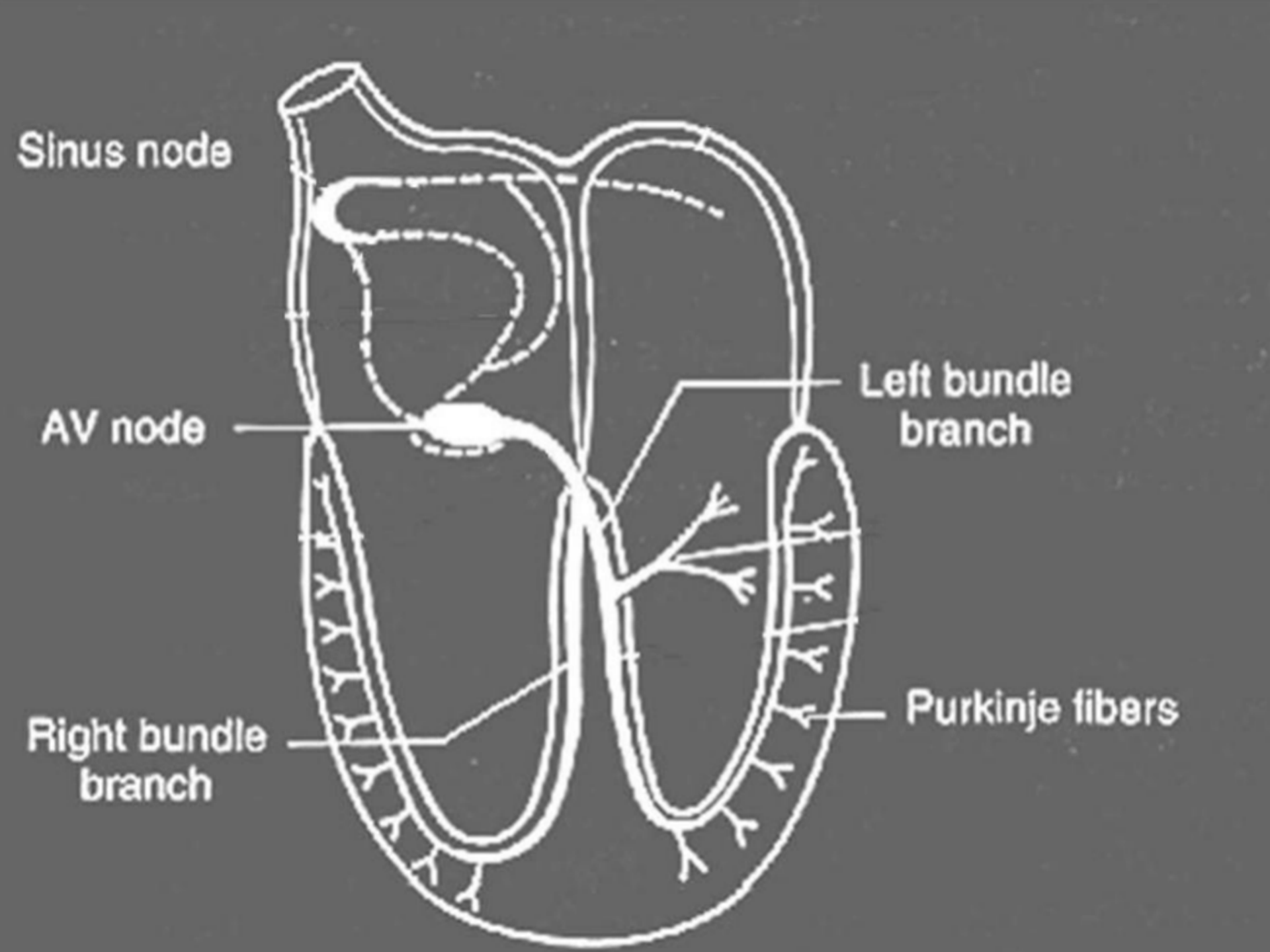
- **QRS is ABNORMALLY WIDE (>120 ms),**
  - **indicates DEPOLARIZATION ABNORMALITY (e.g. "bundle branch block, Wolff-Parkinson-White Syndrome, etc).**

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
Left bundle branch
Right bundle branch
Purkinje fibers

09:16:40

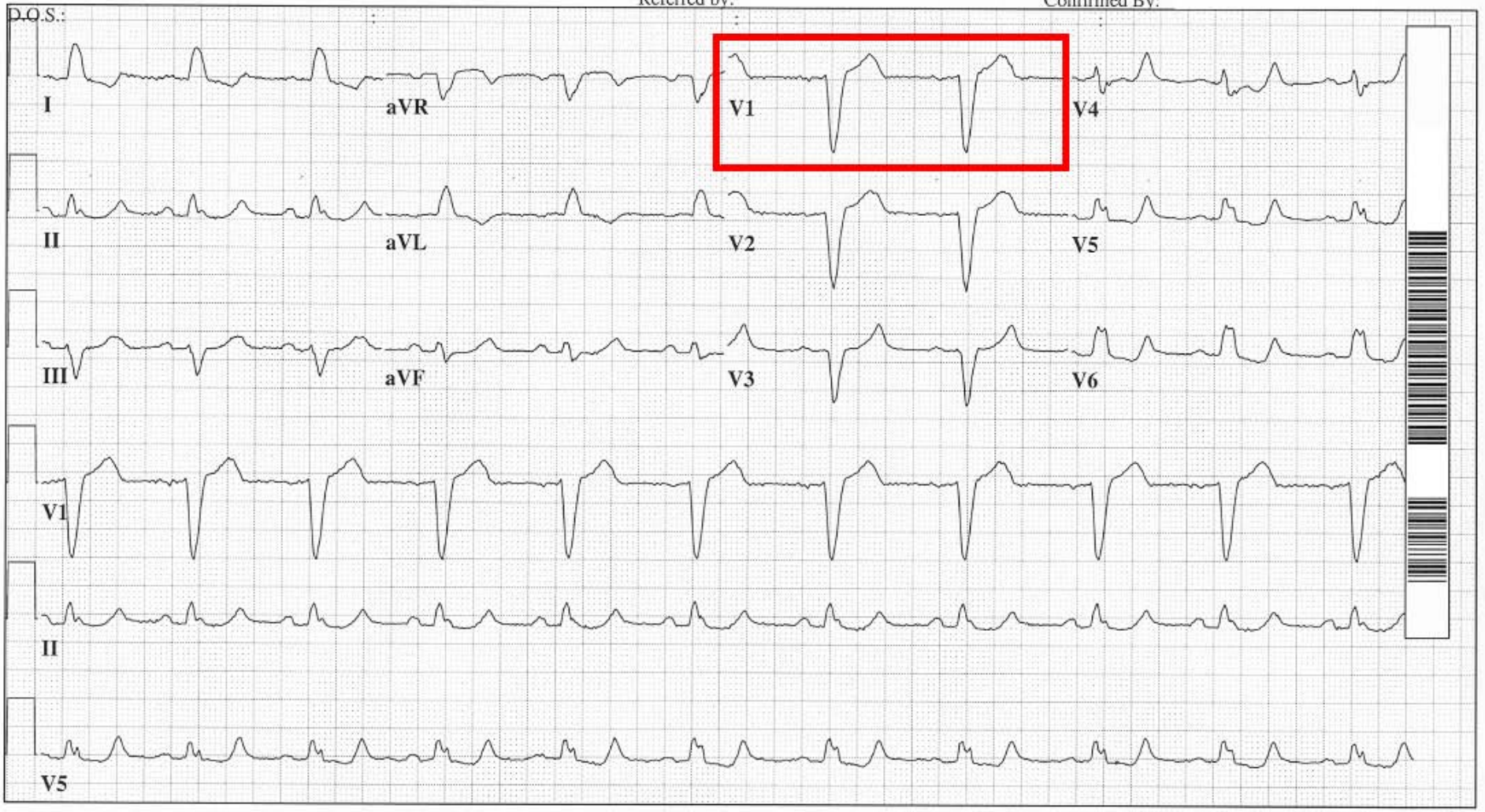
74 yr		Vent. rate	64	BPM	Normal sinus rhythm
Female	Caucasian	PR interval	188	ms	Left bundle branch block
		QRS duration	152	ms	Abnormal ECG
		QT/QTc	472/486	ms	When compared with ECG of 28-MAY-2003 06:36,
Loc:7	Option:35	P-R-T axes	78 3	106	

EKG #WR03029959

Technician: WW

Referred by: Confirmed By:

D.O.S.:



25mm/s 10mm/mV 40Hz 005C 12SL 229 CID: 0

EID:5 EDT:

09:16:40

74 yr		Vent. rate	64	BPM	Normal sinus rhythm
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EKG #WR03029959

Technician: WW

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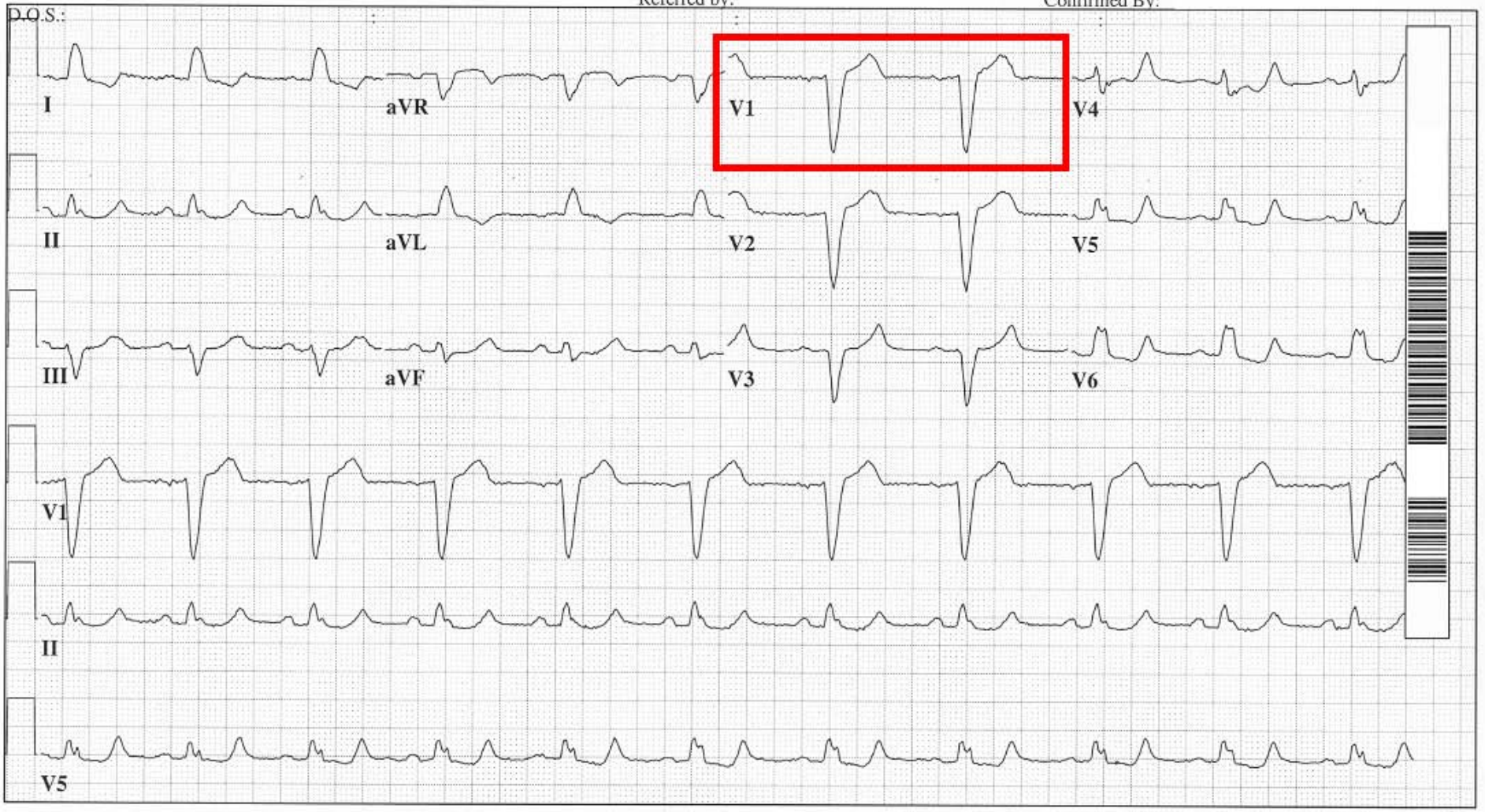
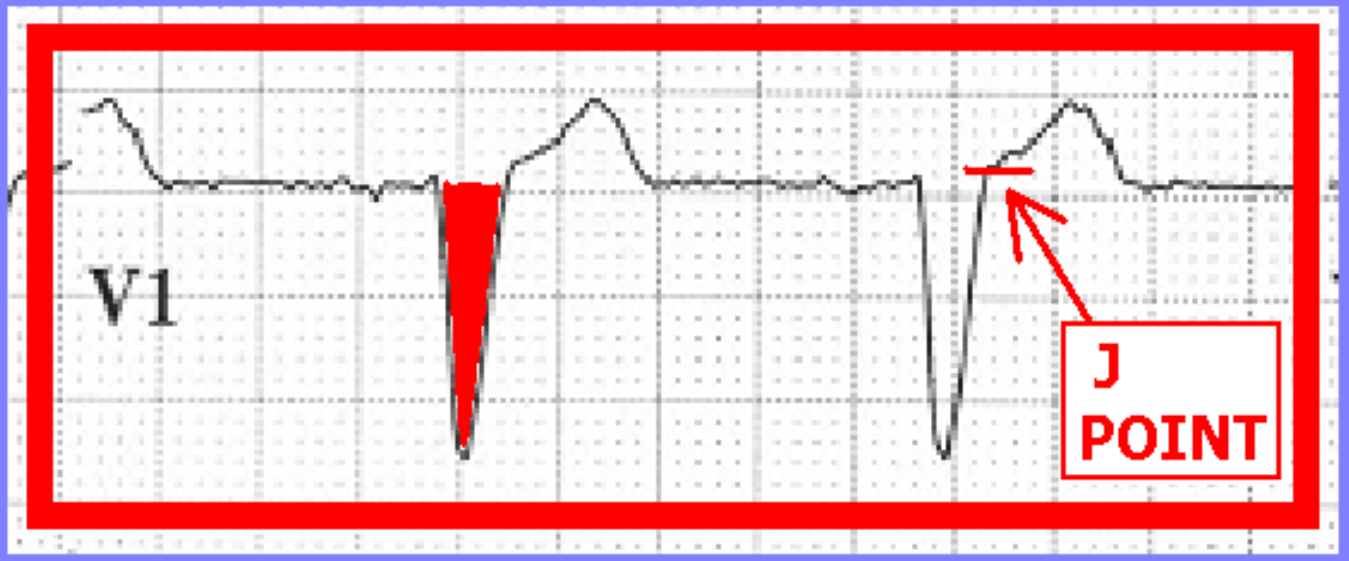


25mm/s 10mm/mV 40Hz 005C 12SL 229 CID: 0

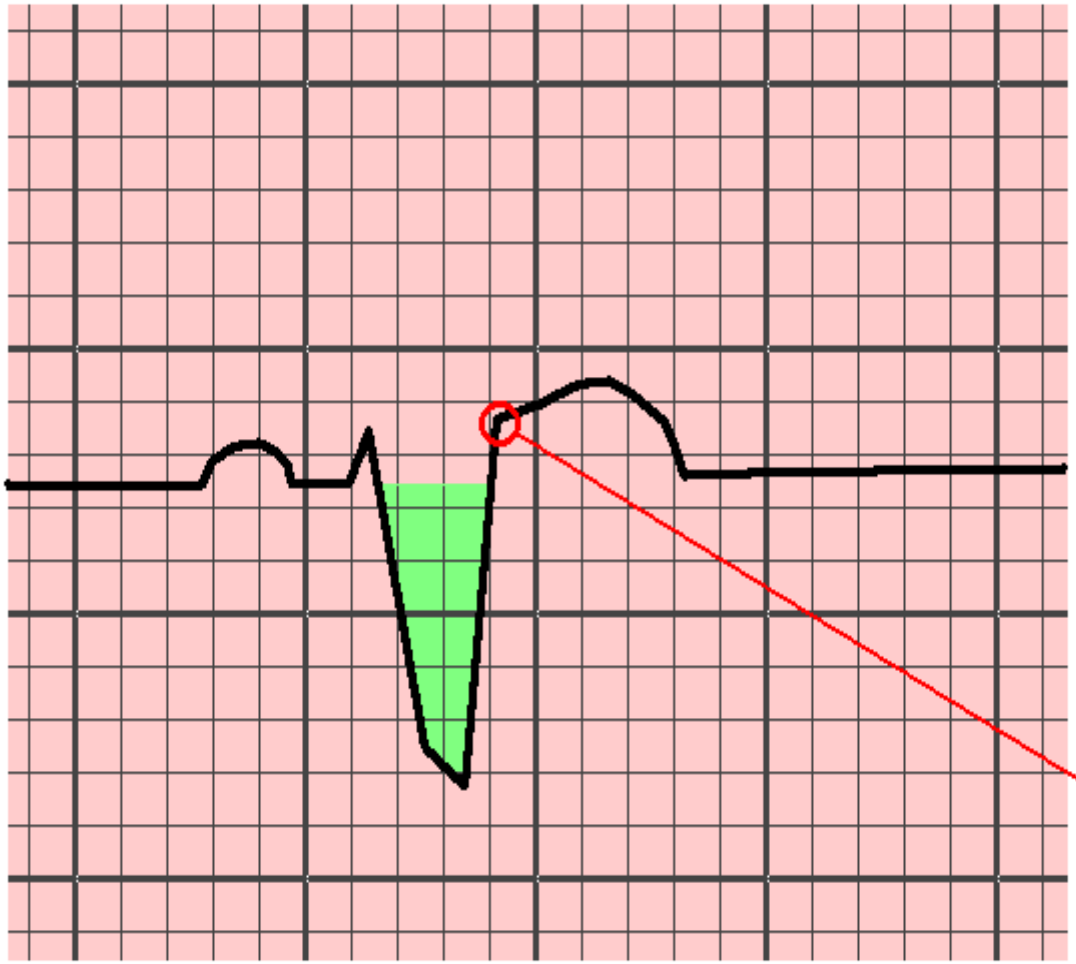
EID:5 EDT:

TERMINAL PHASE OF QRS IS NEGATIVE

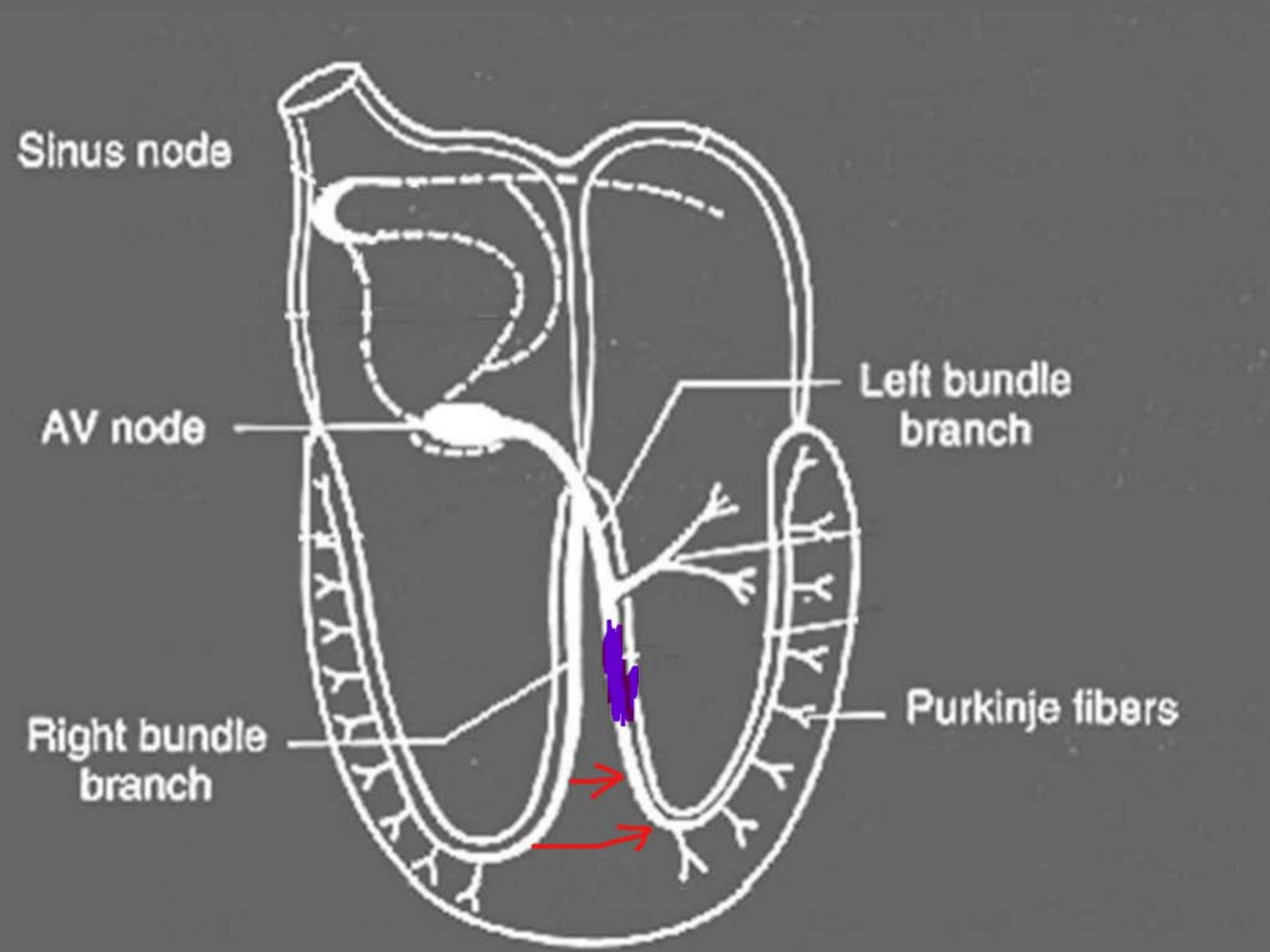


= LEFT BUNDLE BRANCH BLOCK

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
Left bundle branch
Right bundle branch
Purkinje fibers

RUPPERT, WAYNE ID: 099999999 4-Mar-2001

74years
Male Caucasian

Room:
Loc: 0 Opt:

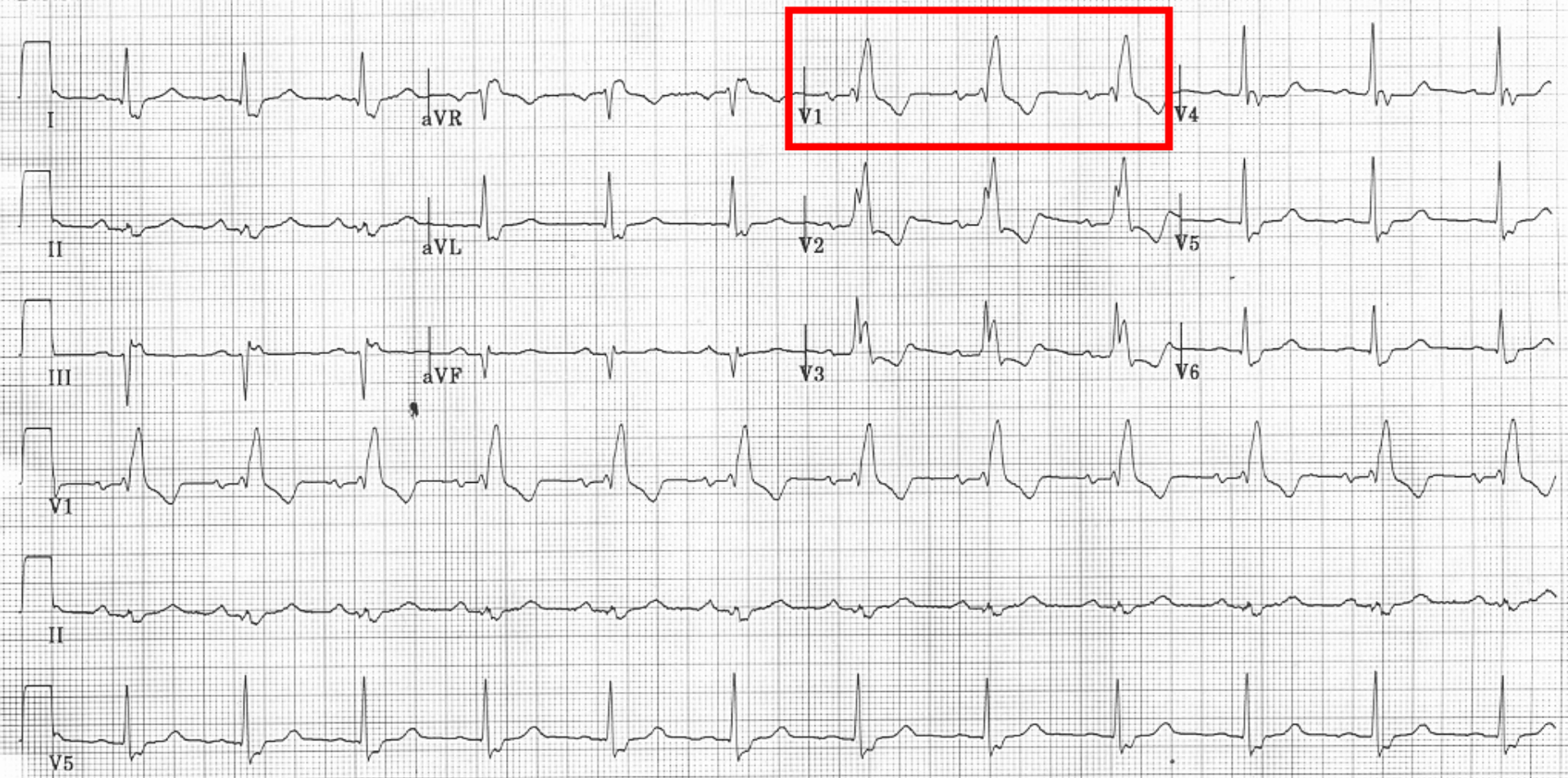
Vent. rate	72	bpm
PR interval	186	ms
QRS duration	166	ms
QT/QTc	436/477	ms
P-R-T axes	57 -32 32	

Normal sinus rhythm
Left axis deviation
Right bundle branch block
Inferior infarct, age undetermined
Abnormal ECG

Technician: WR

Referred by: Unconfirmed

D.O.S.:

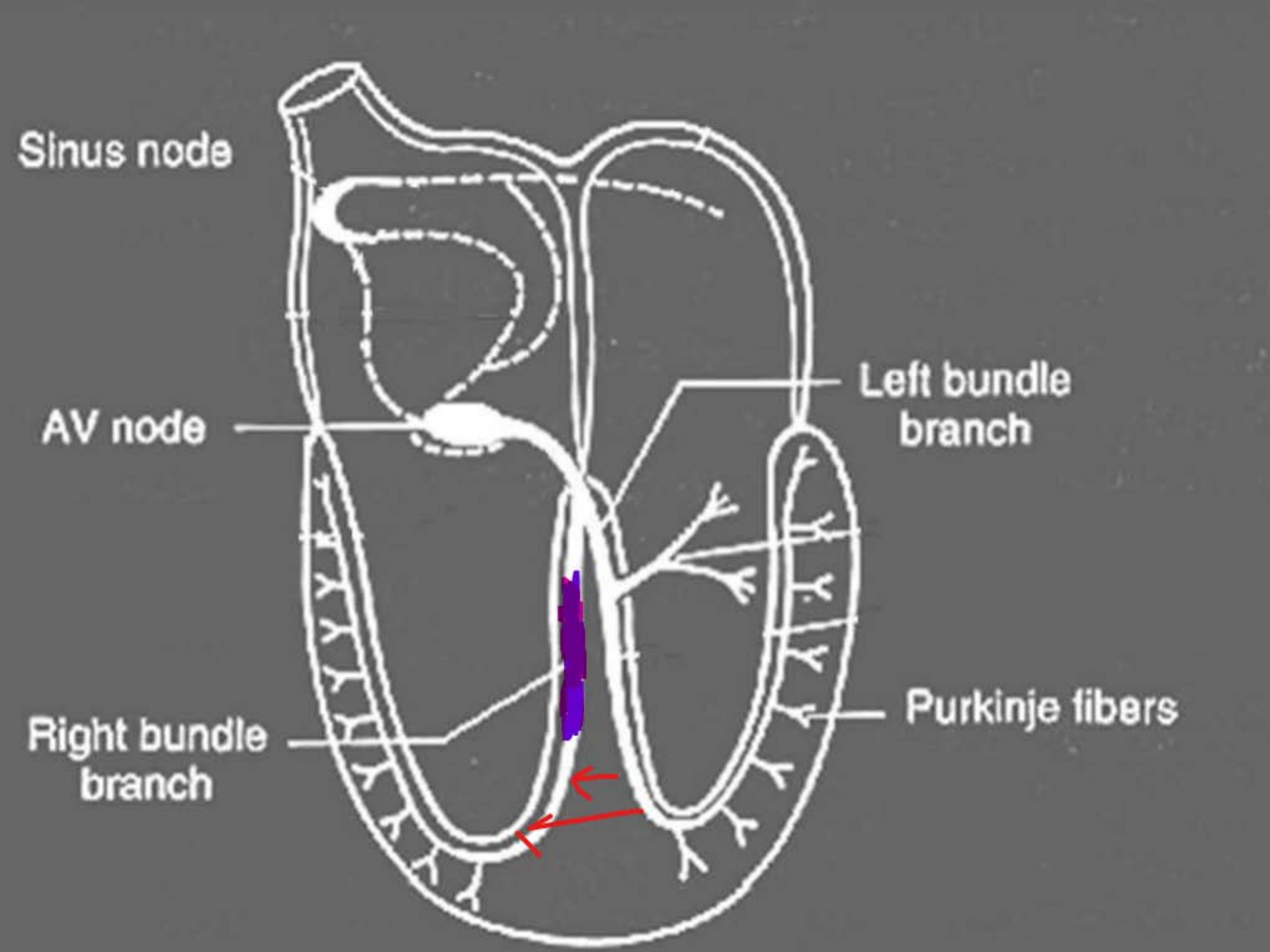


40 Hz 25.0 mm/s 10.0 mm/mV 4 by 2.5s + 3 rhythm lds MACVU 003C 12SL^{tm} v250

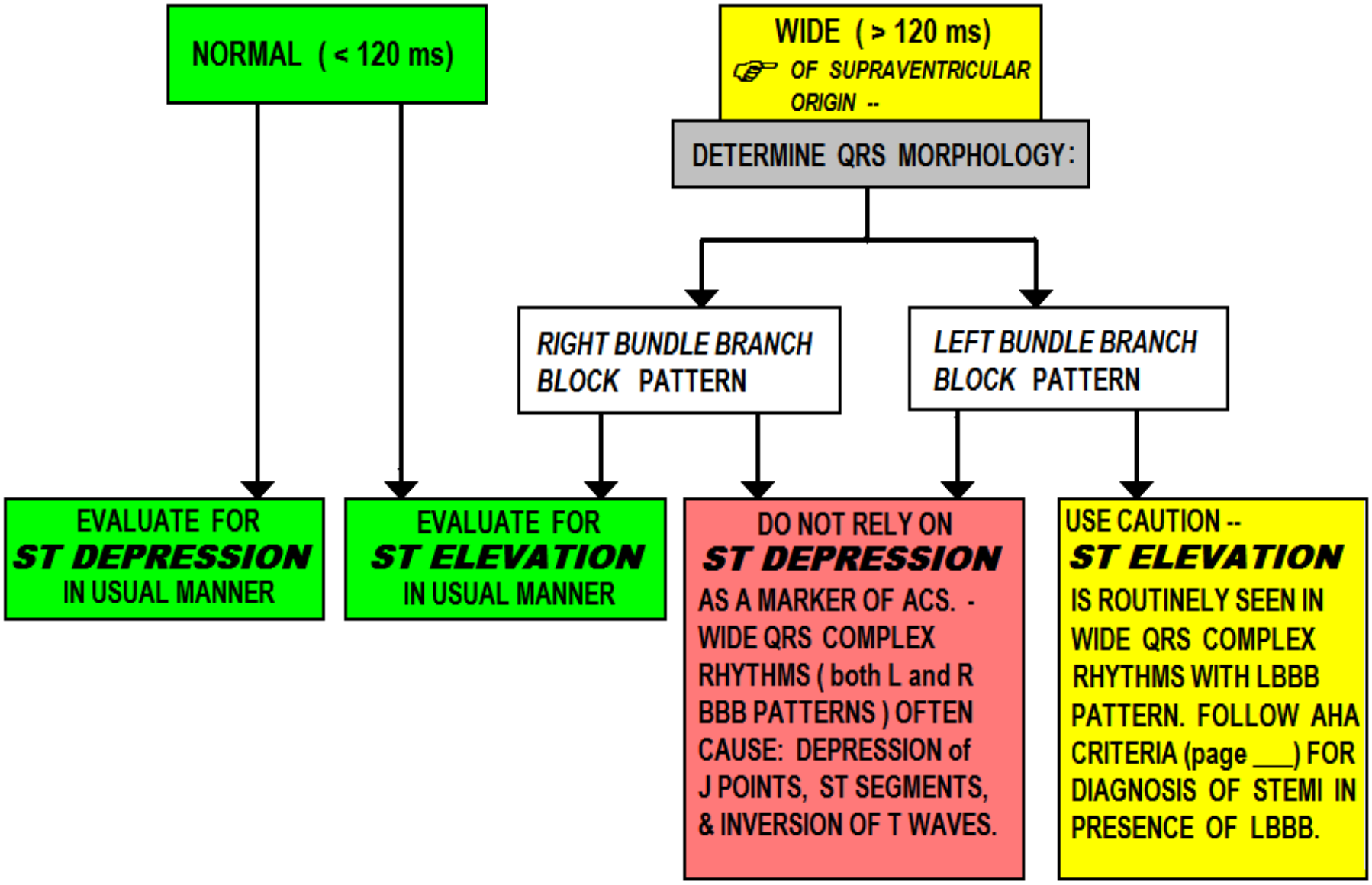
TERMINAL PHASE OF QRS IS

POSITIVE

= RIGHT BUNDLE BRANCH BLOCK


Sinus node
AV node
Left bundle branch
Right bundle branch
Purkinje fibers

STEP 1 - EVALUATE WIDTH OF QRS:



YOU SURVIVED !!!